Manual No. 168
61-00-68
Revision 11
October 2024

Propeller Owner's Manual
and Logbook

Steel Hub Reciprocating Propellers with Aluminum Blades

Two Blade	Three Blade
(B)HC-A2(MV,V)(F,K,L)-1( )	**(E,P)HC-A3(MV,V)F-2( )**
HC-A2(MV,V)(F,K,L)-2( )	**HC-A3(MV,V)K-2( )( )**
BHC-A2(MV,V)F-3	**HC-A3(MV,V)F-3L**
HC-A2(MV,V)L-6F	**(E,P)HC-A3(MV,V)(F,K)-4( )**
HA-A2(MV,V)20-1B	**HC-A3(MV,V)F-5A( )**
HC-A2(MV,V)20-1A	**(P)HC-A3(MV,V)F-5R**
HC-A2(MV,V)20-2	**HC-A3(MV,V)20-1( )**
HC-A2(MV,V)20-3L	**HC-A3(MV,V)20-2( )**
HC-A2(MV,V)20-5L	**HC-A3(MV,V)20-3L**

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

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

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

JJ Frigge
President, Hartzell Propeller LLC

WARNING (Rev. 5)

People who fly should recognize that various types of risks are involved; and they should take all precautions to minimize them, since they cannot be eliminated entirely. The propeller is a vital component of the aircraft. A mechanical failure of the propeller could cause a forced landing or create vibrations sufficiently severe to damage the aircraft, possibly causing it to become uncontrollable.

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

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

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

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

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

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

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

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REVISION 11 HIGHLIGHTS

Revision 11, dated October 2024, incorporates the following:

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

Removed references to “Hartzell Propeller Inc.”. Revised to “Hartzell Propeller LLC” where applicable.

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

- INSPECTION AND CHECK
  - Revised the section, "Pre-Flight Checks"
- RECORDS
  - Revised the section, "Record Keeping"

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REVISION 11 HIGHLIGHTS

1. Introduction
   A. General
      (1) This is a list of current revisions that have been issued against this manual. Please compare it to the RECORD OF REVISIONS page to ensure that all revisions have been added to the manual.
   B. Components
      (1) Revision No. indicates the revisions incorporated in this manual.
      (2) Issue Date is the date of the revision.
      (3) Comments indicates the level of the revision.
         (a) New Issue is a new manual distribution. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.
         (b) Reissue is a revision to an existing manual that includes major content and/or major format changes. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.
         (c) Major Revision is a revision to an existing manual that includes major content or minor content changes over a large portion of the manual. The manual is distributed in its entirety. All the page revision dates are the same, but change bars are used to indicate the changes incorporated in the latest revision of the manual.
         (d) Minor Revision is a revision to an existing manual that includes minor content changes to the manual. Only the revised pages of the manual are distributed. Each page retains the date and the change bars associated with the last revision to that page.

Revision No.	Issue Date	Comments
Original	July/01	New Issue
Rev. 1	Oct/04	Minor Revision
Rev. 2	July/08	Minor Revision
Rev. 3	Mar/11	Minor Revision
Rev. 4	Oct/13	Minor Revision
Rev. 5	Aug/15	Minor Revision
Rev. 6	Apr/17	Minor Revision
Rev. 7	Mar/21	Major Revision
Rev. 8	Oct/21	Minor Revision
Rev. 9	Aug/23	Major Revision
Rev. 10	Mar/24	Minor Revision
Rev. 11	Oct/24	Minor Revision

RECORD OF REVISIONS

This is a record of revisions inserted into this manual.
Revision 9 includes all prior revisions.

Rev. No.	Issue Date	Date Inserted	Inserted By
9	Aug/23		
10	Mar/24		
11	Oct/24		

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RECORD OF TEMPORARY REVISIONS

Update this page to show all Temporary Revisions inserted into this manual. Revision 9 includes all prior temporary revisions, up to and including TR-003.

TR No.	Section/ Page	Issue Date	Date Inserted	Inserted By	Date Removed	Removed By

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SERVICE DOCUMENTS LIST

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

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

Service Document Number	Incorporation Rev/Date
Service Bulletins:	
HC-ASB-61-292	Rev. 7 Mar/21

SERVICE DOCUMENTS LIST

Service Document Number	Incorporation Rev/Date
Service Letters:	
HC-SL-61-176	Original Jul/01
HC-SL-61-324	Rev. 4 Oct/13
HC-SL-61-256	Rev. 5 Aug/15
HC-SL-61-364	Rev. 7 Mar/21

AIRWORTHINESS LIMITATIONS

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

FAA APPROVED

by: Michael Dawson date: 3/15/11

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

Rev. No.	Description of Revision
7	Revised the wording of the initial paragraph

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.

   B. There are no new (or additional) Airworthiness Limitations associated with this equipment and/or installation.

FAA APPROVED

by: ______________________ date: 3/15/11

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

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INTRODUCTION - CONTENTS

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1. General (Rev. 2)

A. Statement of Purpose

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

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

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

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

(3) This manual may include multiple design types.

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

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

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

B. Maintenance Practices

(1) The propeller and its components are highly vulnerable to damage while they are removed from the engine. Properly protect all components until they are reinstalled on the engine.

(2) Never attempt to move the aircraft by pulling on the propeller.

(3) Avoid the use of blade paddles. If blade paddles must be used, use at least two paddles. Do not put the blade paddle in the area of the de-ice or anti-icing boot when applying torque to a blade assembly. Put the blade paddle in the thickest area of the blade, just outside of the de-ice or anti-icing boot. Use one blade paddle per blade.

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

(5) Observe applicable torque values during maintenance.

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

(a) Hartzell Propeller statically balances all new propellers.

(b) Overhauled propellers must be statically balanced by a certified propeller repair station with the appropriate rating before return to service.

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

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

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

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

(9) As applicable, follow military standard NASM33540 for safety wire, safety cable, and cotter pin general practices. Use 0.032 inch (0.81 mm) diameter stainless steel safety wire unless otherwise indicated.

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

(11) The airframe manufacturer's manuals should be used in addition to the information in this manual due to possible special requirements for specific aircraft applications.

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

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

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

(a) For information about the application of corrosion protection and paint, refer to the Maintenance Practices chapter of this manual. Operation of blades without the specified coatings and finishes, i.e., "polished blades", is not permitted.

2. Airframe or Engine Modifications (Rev. 2)

A. Propeller Stress Levels

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

B. Engine Modifications

(1) Engine modifications can 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.

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

(b) Examples of reciprocating engine modifications include, but are not limited to: the addition or alteration of a turbocharger or turbonormalizer, increased compression ratio, increased RPM, altered ignition timing, electronic ignition, full authority digital electronic controls (FADEC), or tuned induction or exhaust.

(2) All such modifications must be reviewed and approved by the propeller manufacturer prior to obtaining approval on the aircraft.

3. Restrictions and Placards (Rev. 1)

A. Important Information

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

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

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

4. Reference Publications (Rev. 8)

A. Hartzell Propeller Publications

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

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

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

Manual No. (ATA No.)	Hartzell Propeller Manual Title
n/a	Active Hartzell Propeller Service Bulletins, Service Letters, Service Instructions, and Service Advisories
Manual 114C (61-10-14)	-3 and -5 Steel "A" Hub Propeller Maintenance Manual
Manual 127 (61-16-27)	Metal Spinner Maintenance Manual
Manual 130B (61-23-30)	Mechanically Actuated Governors and Accessories Maintenance Manual

Manual No. (ATA No.)	Hartzell Propeller Manual Title
Manual 133C (61-13-33)	Aluminum Blade Overhaul Manual
Manual 148 (61-16-48)	Composite Spinner Maintenance Manual
Manual 159 (61-02-59)	Application Guide
Manual 165A (61-00-65)	Illustrated Tool and Equipment Manual
Manual 171 (61-10-71)	-1, -4, -6 Series Steel "A" Hub Propeller Maintenance Manual
Manual 172 (61-10-72)	-2 Series Steel "A" Hub Propeller Maintenance Manual
Manual 180 (30-61-80)	Propeller Ice Protection System Manual
Manual 202A (61-01-02)	Standard Practices Manual, Volumes 1 through 11

B. Vendor Publications

None.

5. <u>Personnel Requirements</u> (Rev. 3)

A. Service and Maintenance Procedures in this Manual

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

(2) Compliance to the applicable regulatory requirements established by the Federal Aviation Administration (FAA) or international equivalent is mandatory for anyone performing or accepting responsibility for the inspection and/or repair of any Hartzell Propeller product.

(a) Maintenance records must be kept in accordance with the requirements established by the Federal Aviation Administration (FAA) or international equivalent.

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

6. <u>Special Tooling and Consumable Materials</u> (Rev. 2)

A. Special Tooling

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

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

B. Consumable Materials

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

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

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

A. Instructions for Use

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

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

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

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

A. Calendar Limits

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

(2) A calendar limit between overhauls is specified in Hartzell Propeller Service Letter HC-SL-61-61Y.

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

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

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

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

B. Long Term Storage

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

9. Component Life and Overhaul (Rev. 3)

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

A. Component Life

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

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

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

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

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

(b) Refer to the Airworthiness Limitations chapter in the applicable Hartzell Propeller owner's manual for a list of life limited components.

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

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

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

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

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

(b) Hub replacement

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

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

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

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

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

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

B. Overhaul

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

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

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

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

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

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

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

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

10. Damage/Repair Types (Rev. 2)

A. Airworthy/Unairworthy Damage

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

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

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

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

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

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

B. Minor/Major Repair

(1) Minor Repair

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

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

(2) Major Repair

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

(b) Major repair work must be accepted by an individual that is certified by the Federal Aviation Administration (FAA) or international equivalent.

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

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

11. Propeller Critical Parts (Rev. 2)

A. Propeller Critical Parts

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

(a) These procedures have been substantiated based on Engineering analysis that expects this product will be operated and maintained using the procedures and inspections provided in the Instructions for Continued Airworthiness (ICA) for this product.

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

(2) Numerous propeller system parts can produce a propeller Major or Hazardous effect, even though those parts may not be considered as Propeller Critical Parts.

(a) The operating and maintenance procedures and inspections provided in the ICA for this product are, therefore, expected to be accomplished for all propeller system parts.

12. Warranty Service (Rev. 2)

A. Warranty Claims

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

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

13. Hartzell Propeller Contact Information (Rev. 3)

A. Product Support Department

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

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

(a) The Product Support Department may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4379 or at (800) 942-7767, toll free from the United States and Canada.

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

(c) After business hours, you may leave a message on our 24 hour product support line at (937) 778-4376 or at (800) 942-7767, toll free from the United States and Canada.

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

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

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

B. Technical Publications Department

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

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

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

C. Recommended Facilities

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

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

14. Definitions (Rev. 5)

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

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

Term	Definition
Blade Centerline	An imaginary reference line through the length of a blade around which the blade rotates
Blade Station	Refers to a location on an individual blade for blade inspection purposes. It is a measurement from the blade "zero" station to a location on a blade, used to apply blade specification data in blade overhaul manuals. Note: Do not confuse *blade station* with *reference blade radius*; they may not originate at the same location.
Blemish	An imperfection with visible attributes, but having no impact on safety or utility
Brinelling	A depression caused by failure of the material in compression
Bulge	An outward curve or bend
Camber	The surface of the blade that is directed toward the front of the aircraft. It is the low pressure, or suction, side of the blade. The camber side is convex in shape over the entire length of the blade.
Chord	A straight line distance between the leading and trailing edges of an airfoil
Chordwise	A direction that is generally from the leading edge to the trailing edge of an airfoil
Co-bonded	The act of bonding a composite laminate and simultaneously curing it to some other prepared surface

Term	Definition
Composite Material	Kevlar®, carbon, or fiberglass fibers bound together with, or encapsulated within an epoxy resin
Compression Rolling	A process that provides improved strength and resistance to fatigue
Constant Force	A force that is always present in some degree when the propeller is operating
Constant Speed	A propeller system that employs a governing device to maintain a selected engine RPM
Corrosion (Aluminum)	The chemical or electrochemical attack by an acid or alkaline that reacts with the protective oxide layer and results in damage of the base aluminum. Part failure can occur from corrosion due to loss of structural aluminum converted to corrosion product, pitting, a rough etched surface finish, and other strength reduction damage caused by corrosion.
Corrosion (Steel)	Typically, an electrochemical process that requires the simultaneous presence of iron (component of steel), moisture and oxygen. The iron is the reducing agent (gives up electrons) while the oxygen is the oxidizing agent (gains electrons). Iron or an iron alloy such as steel is oxidized in the presence of moisture and oxygen to produce rust. Corrosion is accelerated in the presence of salty water or acid rain. Part failure can occur from corrosion due to loss of structural steel converted to corrosion product, pitting, a rough etched surface finish and other strength reduction damage caused by corrosion.

Term	Definition
Corrosion Product (Aluminum)	A white or dull gray powdery material that has an increased volume appearance (compared to non-corroded aluminum). Corrosion product is not to be confused with damage left in the base aluminum such as pits, worm holes, and etched surface finish.
Corrosion Product (Steel)	When iron or an iron alloy such as steel corrodes, a corrosion product known as rust is formed. Rust is an iron oxide which is reddish in appearance and occupies approximately six times the volume of the original material. Rust is flakey and crumbly and has no structural integrity. Rust is permeable to air and water, therefore the interior metallic iron (steel) beneath a rust layer continues to corrode. Corrosion product is not to be confused with damage left in the base steel such as pits and etched surface finish.
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface
Debond	Separation of two materials that were originally bonded together in a separate operation
Defect	An imperfection that affects safety or utility
Delamination	Internal separation of the layers of composite material

Term	Definition
Dent	The permanent deflection of the cross section that is visible on both sides with no visible change in cross sectional thickness
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component
Edge Alignment	Distance from the blade centerline to the leading edge of the blade
Erosion	Gradual wearing away or deterioration due to action of the elements
Exposure	Leaving material open to action of the elements
Face	The surface of the blade that is directed toward the rear of the aircraft. The face side is the high pressure, or thrusting, side of the blade. The blade airfoil sections are normally cambered or curved such that the face side of the blade may be flat or even concave in the midblade and tip region.
Face Alignment	Distance from the blade centerline to the highest point on the face side perpendicular to the chord line
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag
Fraying	A raveling or shredding of material

Term	Definition
Fretting	Damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface
Galling	To fret or wear away by friction
Gouge	Surface area where material has been removed
Hazardous Propeller Effect	The hazardous propeller effects are defined in Title 14 CFR section 35.15(g)(1)
Horizontal Balance	Balance between the blade tip and the center of the hub
Impact Damage	Damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object while in flight or on the ground
Inboard	Toward the butt of the blade
Intergranular Corrosion	Corrosion that attacks along the grain boundaries of metal alloys
Jog	A term used to describe movement up/down, left/right, or on/off in short incremental motions
Laminate	To unite composite material by using a bonding material, usually with pressure and heat
Lengthwise	A direction that is generally parallel to the pitch axis

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

Term	Definition
Open Circuit	Connection of high or infinite resistance between points in a circuit which are normally lower
Outboard	Toward the tip of the blade
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain airworthiness
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control/ condition lever
Pitch	Same as "Blade Angle"
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear
Pitting (Linear)	The configuration of the majority of pits forming a pattern in the shape of a line
Porosity	An aggregation of microvoids. See "voids".
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15

Term	Definition
Reference Blade Radius	Refers to the propeller reference blade radius in an assembled propeller, e.g., 30-inch radius. A measurement from the propeller hub centerline to a point on a blade, used for blade angle measurement in an assembled propeller. An adhesive stripe (blade angle reference tape CM160) is usually located at the reference blade radius location. Note: Do not confuse *reference blade radius* with *blade station*; they may not originate at the same point.
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up
Scratch	Same as "Nick"
Short Circuit	Connection of low resistance between points on a circuit between which the resistance is normally much greater
Shot Peening	Process where steel shot is impinged on a surface to create compressive surface stress, that provides improved strength and resistance to fatigue
Single Acting	Hydraulically actuated propeller that utilizes a single oil supply for pitch control
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip
Station Line	See "Blade Station"

Term	Definition
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM
Synchrophasing	A form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other
Ticking	A series of parallel marks or scratches running circumferentially around the diameter of the blade
Track	In an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly
Trailing Edge	The aft edge of an airfoil over which the air passes last
Trimline	Factory terminology referring to where the part was trimmed to length
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control/condition lever
Unidirectional Material	A composite material in which the fibers are substantially oriented in the same direction
Variable Force	A force that may be applied or removed during propeller operation

Term	Definition
Vertical Balance	Balance between the leading and trailing edges of a two-blade propeller with the blades positioned vertically
Voids	Air or gas that has been trapped and cured into a laminate
Windmilling	The rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power
Woven Fabric	A material constructed by interlacing fiber to form a fabric pattern
Wrinkle (aluminum blade)	A wavy appearance caused by high and low material displacement
Wrinkle (composite blade)	Overlap or fold within the material

15. Abbreviations (Rev. 2)

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

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

Abbreviation	Term
RPM	Revolutions per Minute
SAE	Society of Automotive Engineers
STC	Supplemental Type Certificate
TBO	Time Between Overhaul
TC	Type Certificate
TSI	Time Since Inspection
TSN	Time Since New
TSO	Time Since Overhaul
UID	Unique Identification
WIG	Wing-In-Ground-Effect

DESCRIPTION AND OPERATION - CONTENTS

LIST OF FIGURES

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1. Description of Propellers and Systems

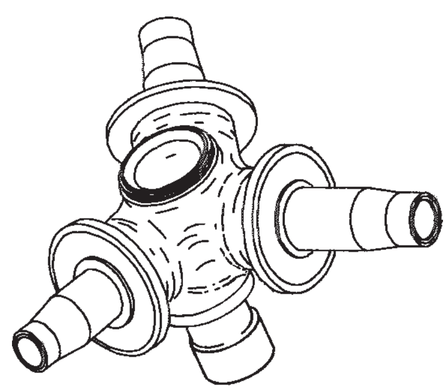
A. System Overview

Hartzell steel hub propellers are either ground adjustable or constant speed assemblies that use a steel hub as a central component (Figure 2-1).

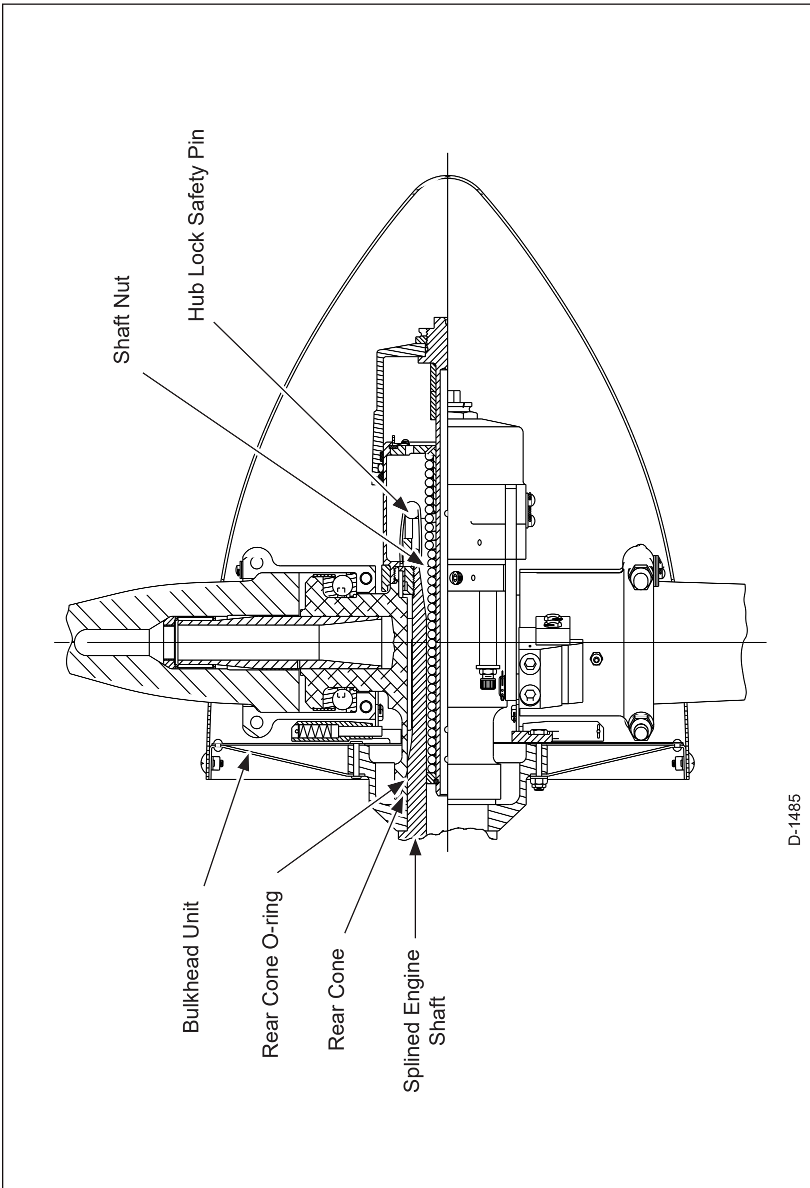
The propeller attaches to the engine through either a splined shaft or one of several flanged designs. A spline shaft attachment uses either a Society of Automotive Engineers (SAE) Number 20 or Number 30 spline (Figure 2-2).

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.

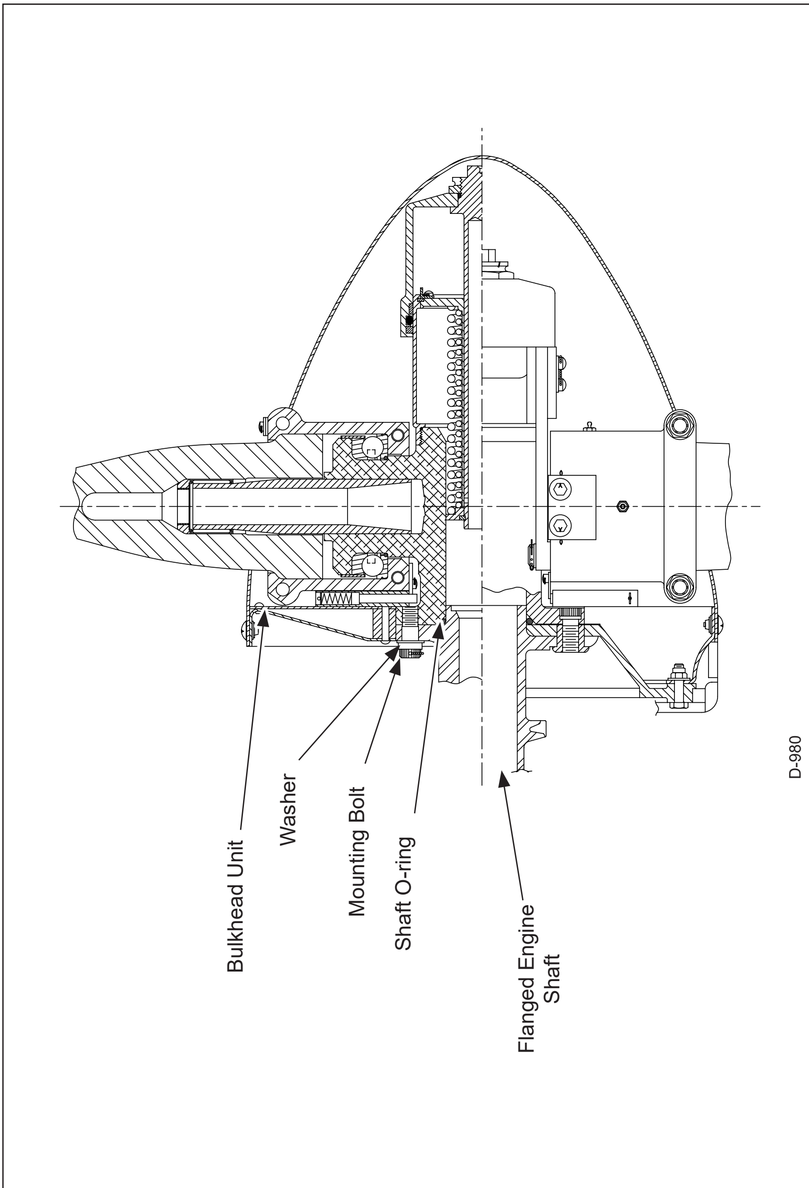
A flanged shaft attachment uses a six-bolt and two dowel pin interface or a six bolt and four bushing interface between the engine and the propeller flange (Figure 2-3).



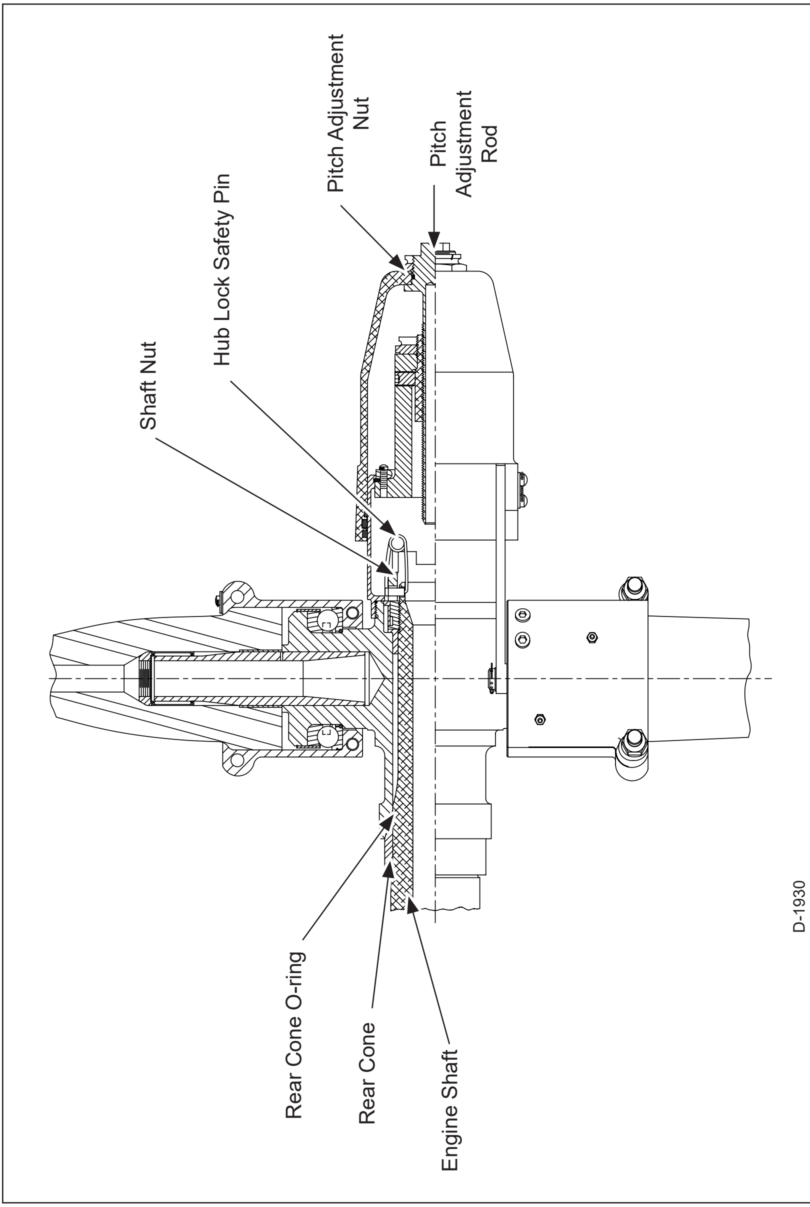
Steel Hub Unit (For Splined Shaft Mounting)
Figure 2-1



Spline Shaft Attachment
Figure 2-2



Flanged Attachment
Figure 2-3



Ground Adjustable Propeller Assembly
Figure 2-4

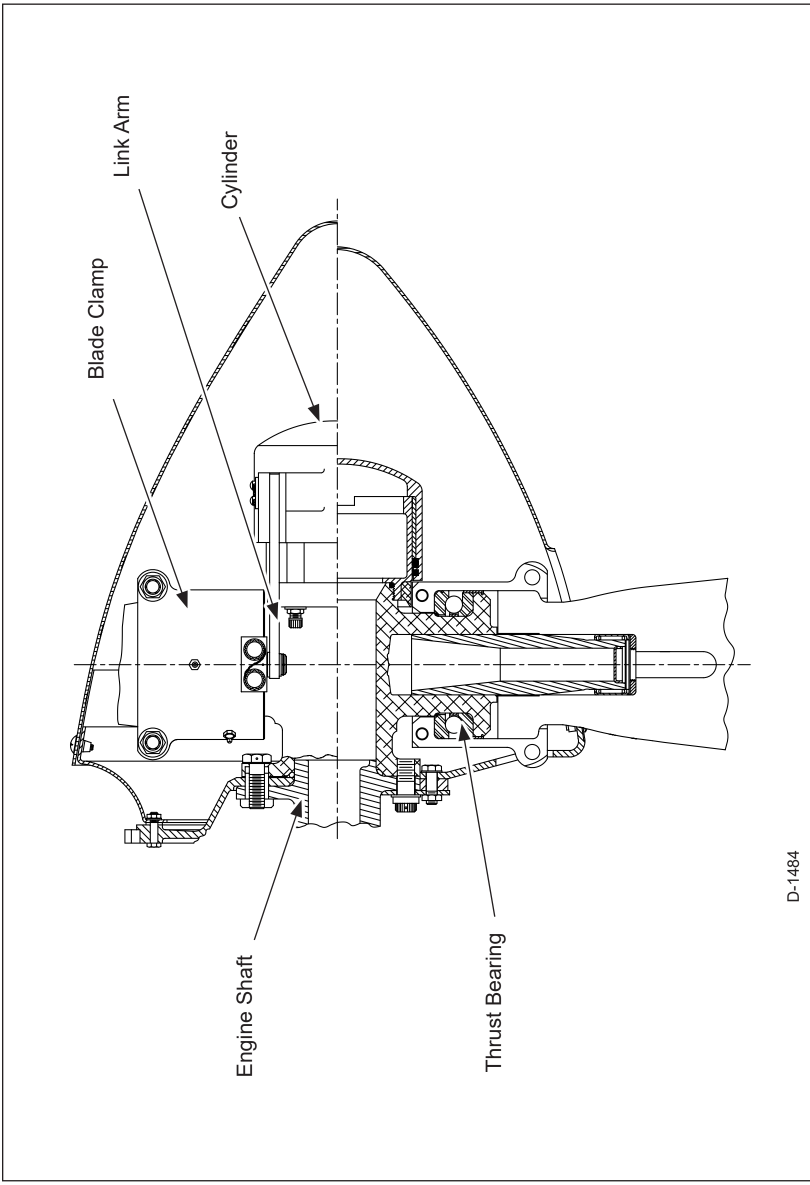
B. Ground Adjustable Pitch Propellers

Propeller models HA-A2(MV,V)20-1B
Refer to Figure 2-4.

Ground adjustable pitch propellers are typically used on single engine aircraft equipped with an engine that does not support governing capability nor is able to supply oil through a hollow shaft to the propeller.

Ground adjustable pitch propellers may be set to a desired blade pitch by manually adjusting the propeller when the aircraft is static on the ground. This allows an optimal blade pitch to be selected for different flight conditions, such as climb or cruise. A propeller adjusted for climb will not fly very fast (unless engine RPM's are excessively high). A propeller adjusted for cruise will need more runway for takeoff and will climb more slowly (engine RPM will be less than optimum).

Ground adjustable propellers do not require a governor or any oil supply, as they do not change blade pitch in flight.



Constant Speed, Non-counterweighted, Non-feathering Propeller Assembly
Figure 2-5

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

Propeller models (P)HC-A3(MV,V)(F,K)-4( )
Refer to Figure 2-5.

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 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 allows 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 blade angle. A variable hydraulic force (oil under pressure from the engine driven governor) toward a higher blade angle opposes the summation of these forces. Oil is metered by the governor to oppose these constant forces and maintain a constant engine RPM.

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.

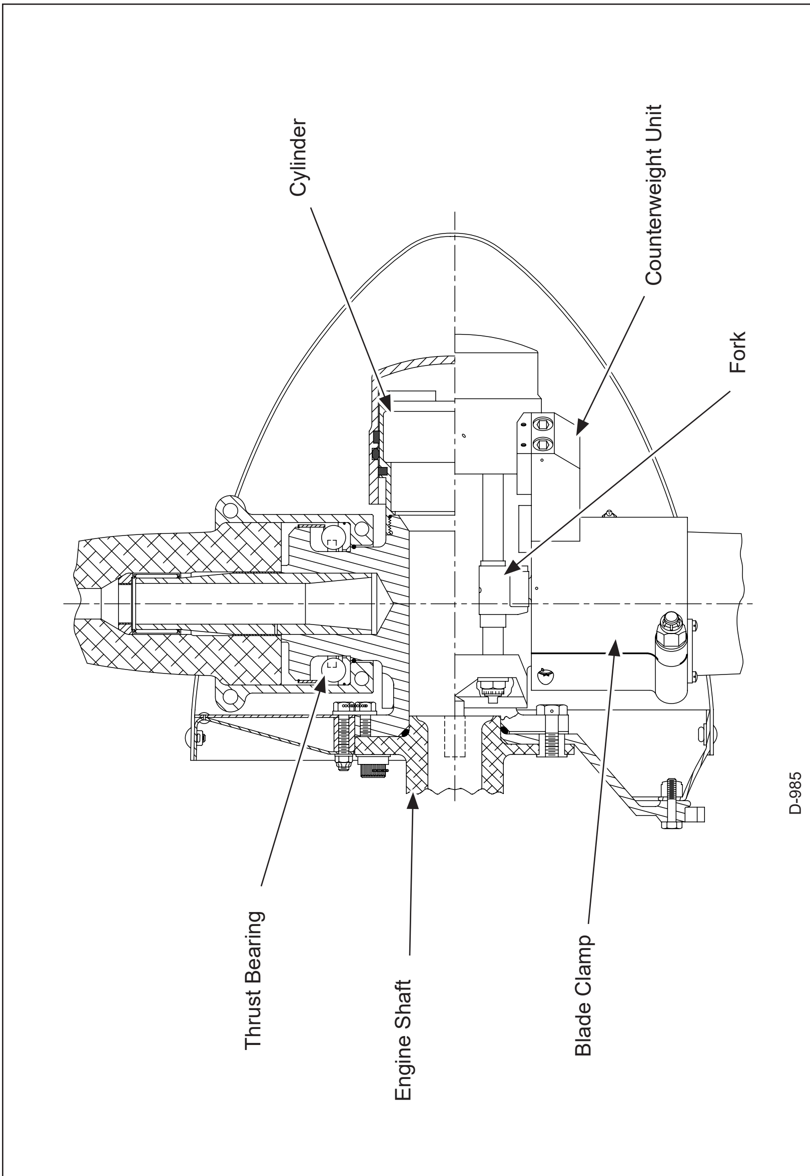
The weight of each propeller blade when spinning, generates centrifugal force and a twisting force that attempts to rotate each blade to a lower blade angle.

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

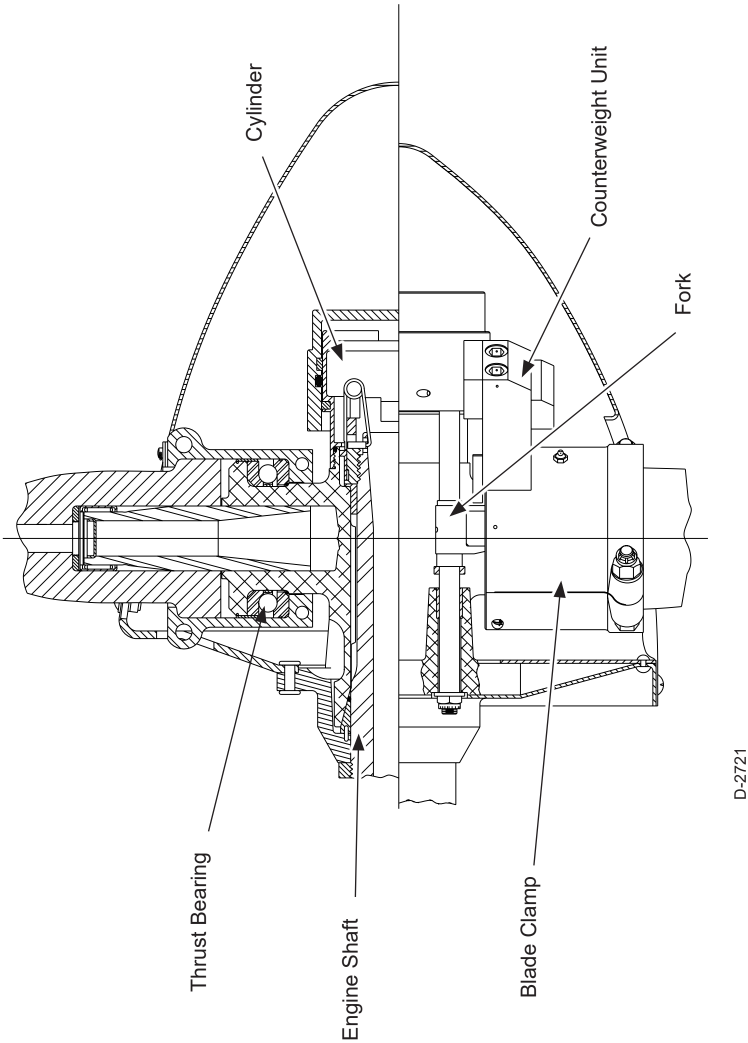
A governor is an engine speed-sensing device that maintains a constant engine/propeller RPM by changing blade angle and varying load on the engine.

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 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.



Constant Speed, Counterweighted, Non-feathering Propeller Assembly
Figure 2-6



Constant Speed, Counterweighted, Non-feathering Propeller Assembly
Figure 2-7

D. Constant Speed, Counterweighted, Non-feathering Propellers

Propeller models (B)HC-A2(MV,V)(F,K,L)-1( ), HC-A2(MV,V)20-1A, HC-A3(MV,V)20-1( ), and HC-A2(MV,V)L-6F.
Refer to Figures 2-6 and 2-7.

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 allows the blade to change angle with the blade under centrifugal load.

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

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

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.

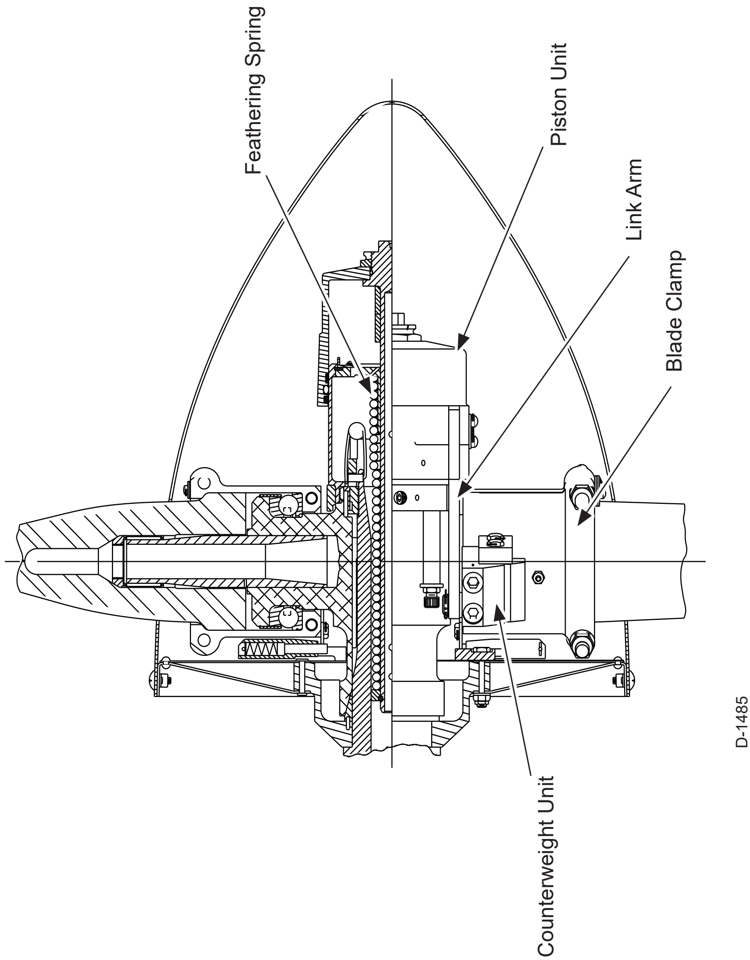
Air flow around the blade generates lift and an aerodynamic twisting moment that will attempt to increase or decrease blade angle, depending on flight condition and blade design. This force is generally very small in relation to the other forces.

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.

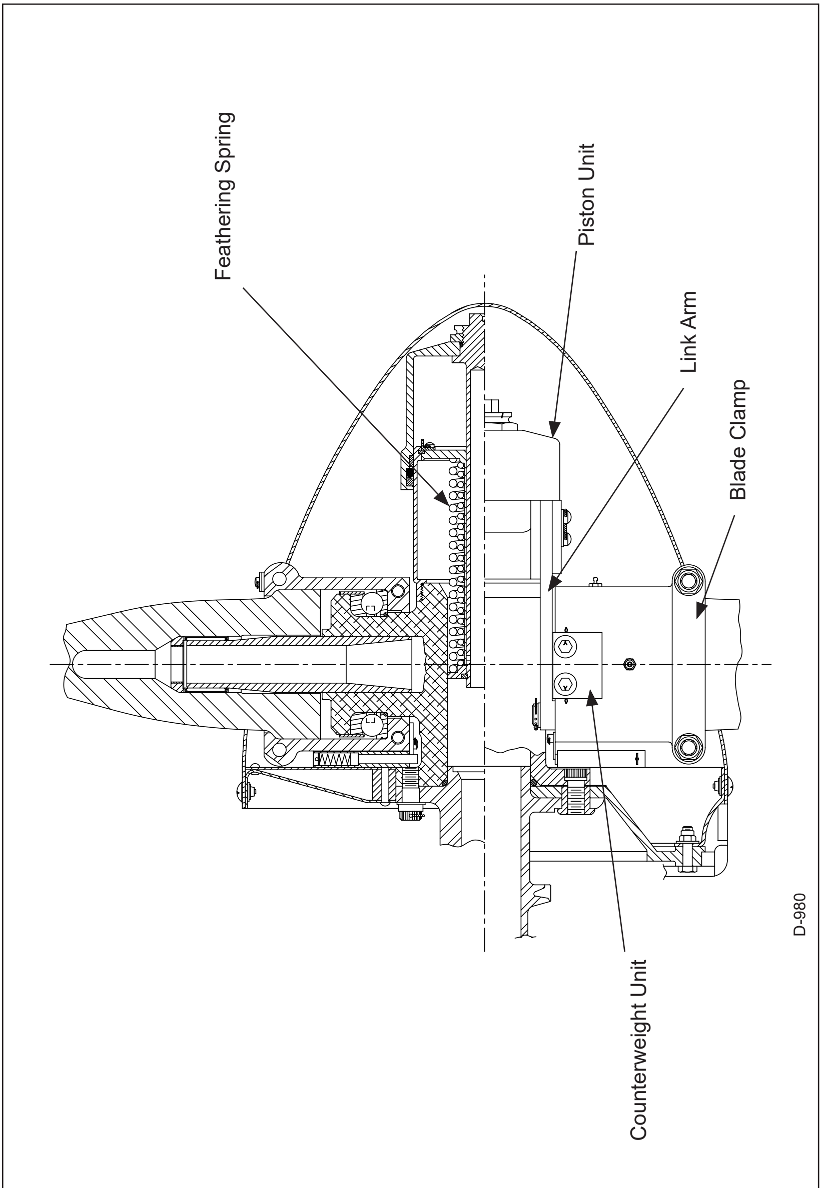
The governor uses an internal pump that is driven by an accessory drive from the engine. This pump uses an engine oil supply and increases the engine oil pressure for supply to the propeller. Engine speed sensing hardware within the governor controls the supply of oil to, or drain of oil from the propeller, 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 decreases blade angle to increase engine RPM. Decreasing the oil volume increases blade angle to decrease engine RPM. By changing the blade angle, the governor maintains constant engine RPM (within limits), independent of the throttle setting.

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.



Constant Speed, Feathering Propeller Assembly
Figure 2-8



Constant Speed, Feathering Propeller Assembly
Figure 2-9

E. Constant Speed and Feathering Propellers

Propeller models HC-A2(MV,V)(F,K,L)-2( ), HC-A2(MV,V)20-2, (E,P)HC-A3(MV,V)F-2( ), HC-A3(MV,V)K-2( )( ), and HC-A3(MV,V)20-2( ). Refer to Figures 2-8 and 2-9.

A constant speed and feathering propeller is typically used on a twin engine aircraft. It is counterweighted, and is controlled by an engine speed-sensing device (governor) to maintain a constant engine/propeller RPM by changing blade angle and varying load on the engine.

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 either a link arm system, or through a sliding rod and fork system, connected to a blade clamp that rotates with the blade. Each blade is retained on the propeller hub by a blade clamp and thrust bearing. The thrust bearing allows the blade to change angle.

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 pitch. Counterweighted propellers require governor supplied oil to decrease blade pitch. If the oil supply is lost, the counterweighted propeller will go to feather.

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.

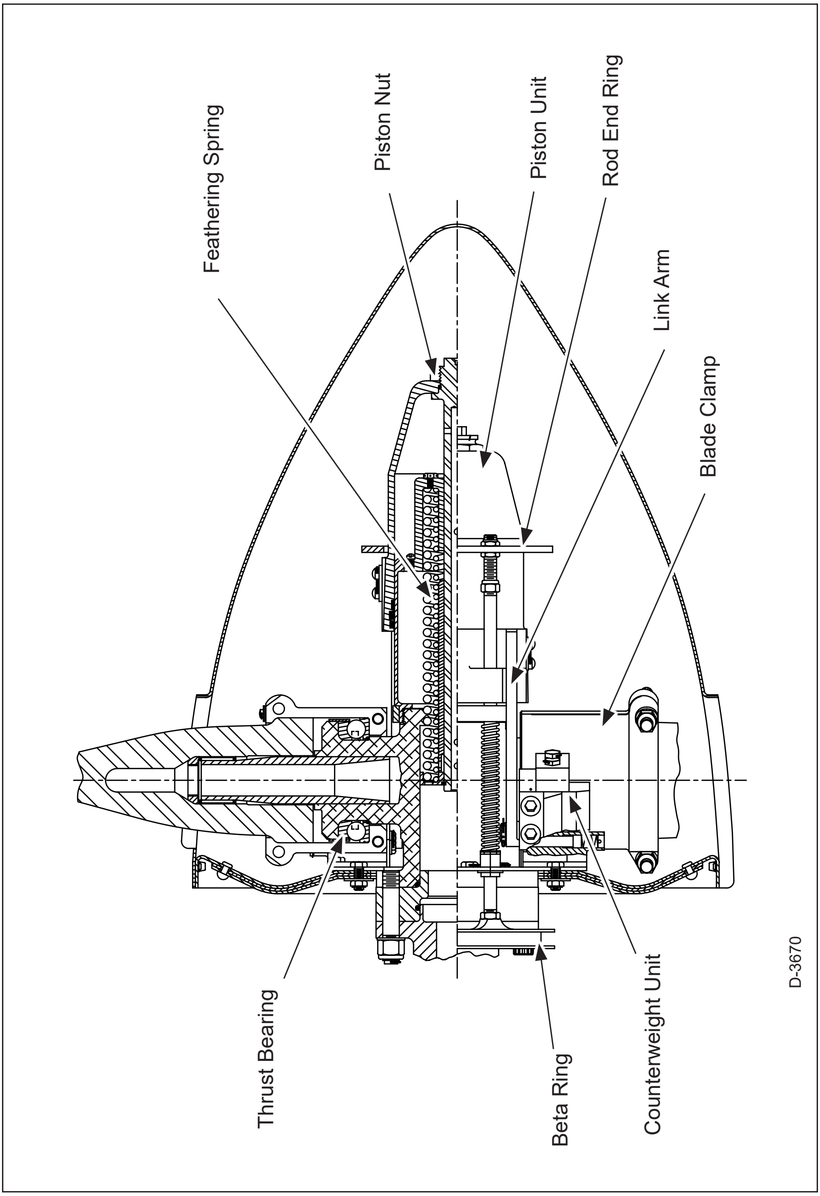
Oil pressure from the engine-driven governor is supplied to the propeller mounted hydraulic cylinder through the engine shaft and propeller hub. Increasing the oil volume within the hydraulic cylinder decreases blade angle to increase engine RPM. Decreasing the oil volume will increase the blade angle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

If the 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 allows 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.



Constant Speed, Feathering and Reversing Propeller Assembly (External Beta System)
Figure 2-10

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

Propeller models (P)HC-A3(MV,V)F-5R.
Refer to Figure 2-10.

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

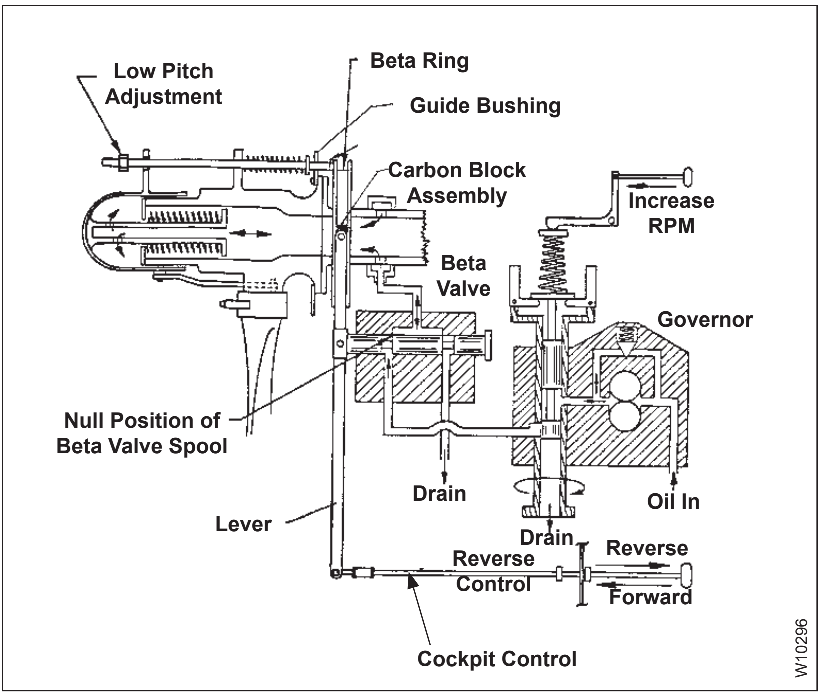
The forces of the installed spring and counterweight attempt to rotate the blades to a higher blade angle.

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 with an External Beta System
Figure 2-11

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 decreases 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.

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 2-11.

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 low pitch blade angle.

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

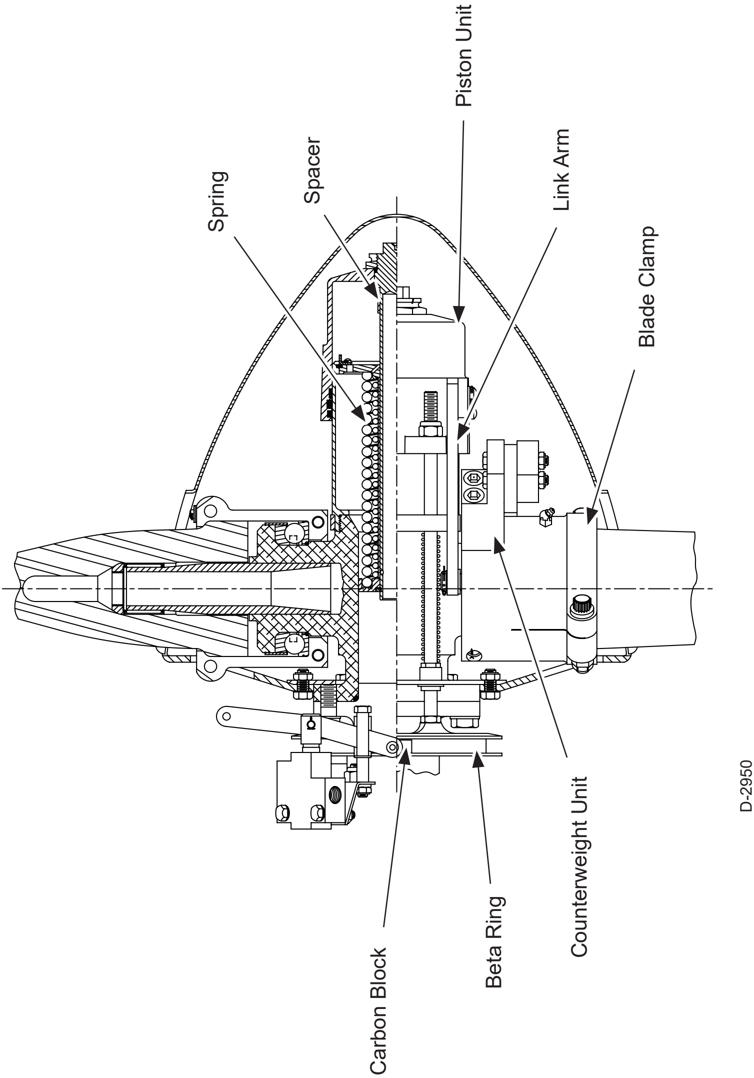
The blade angle selection by the cockpit control must be moved to the low pitch position before the engine is shut down. Otherwise, the reversing mechanism as shown in Figure 2-11 may be damaged when the internal propeller forces move the blades to a high blade angle above low pitch, even though the reversing linkage is still set for operation in the beta blade angle range.

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 allows 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 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 pins (start locks). If the propeller rotation is approximately 800 RPM or above, the pins are disengaged by centrifugal force acting on the them 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.



Constant Speed and Reversing Propeller Assembly
(External Beta System)
Figure 2-12

G. Constant Speed and Reversing Propellers (External Beta System)

Propeller models BHC-A2(MV,V)F-3, HC-A2(MV,V)20-3L, HC-A3(MV,V)F-3L, and HC-A3(MV,V)20-3L
Refer to Figure 2-12.

A constant speed and reversing propeller is typically used on a single engine amphibian aircraft or aircraft on floats.

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 allows 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 decreases 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 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.

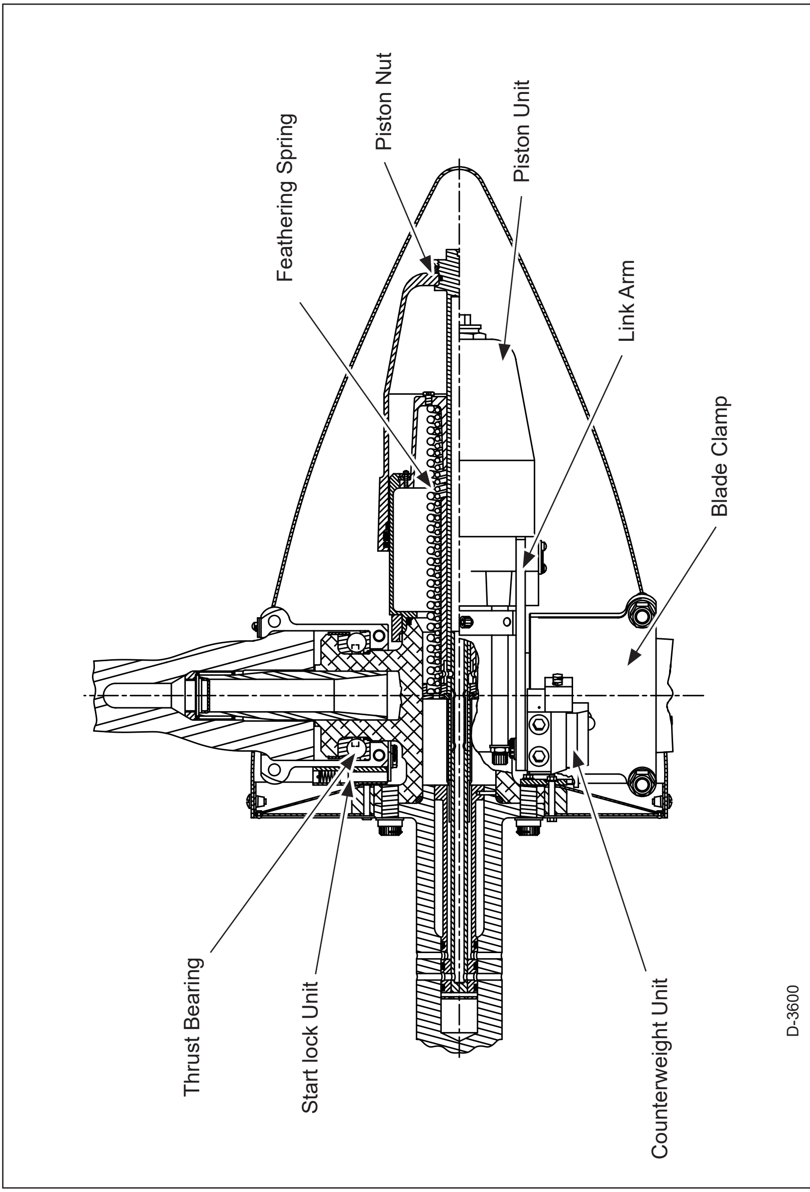
Fundamental elements of a reversing system include a beta valve, cockpit control cable, propeller mounted blade angle feedback mechanism (beta ring), carbon block, and a lever that interfaces between those four elements and the governor operating in underspeed (as an oil pressure source). Refer to Figure 2-11.

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 low pitch blade angle.

<u>NOTE</u>: Blade angle may be moved into beta only when the governor is in an 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 2-11 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.

If oil supply is lost during flight, the propeller will go to high pitch. This 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 high pitch stop.



Constant Speed, Feathering and Reversing Propeller Assembly (Internal Beta System)
Figure 2-13

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

Propeller models HC-A3MVF-5A(L)
Refer to Figure 2-13.

A constant speed, feathering and reversing propeller is typically used on a twin engine aircraft. It is counterweighted and uses internal and external reversing control hardware.

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 allows 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 decreases 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.

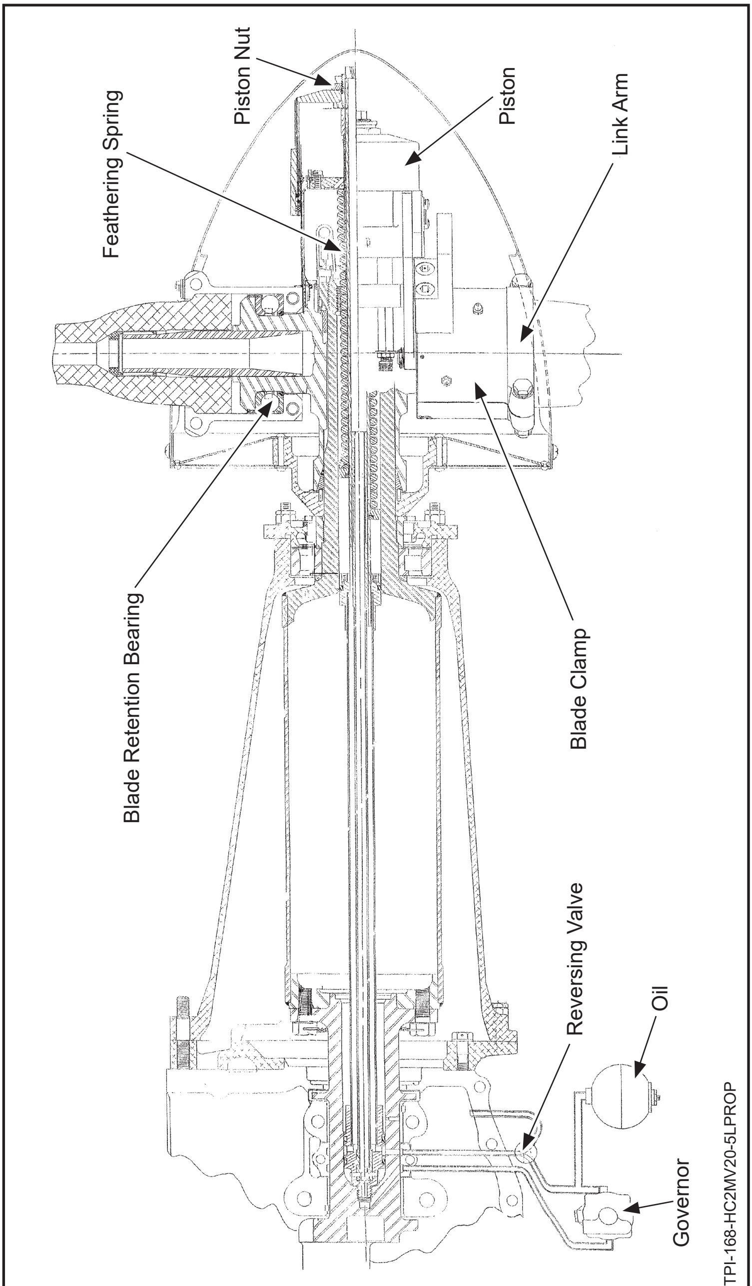
The lowest blade angle attainable by the governor is low pitch. An external valve and internal valve hydraulically control the low pitch stop and the blade angles between low pitch and reverse. Beta refers to the blade angle range between low pitch and full reverse blade angles.

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 external valve (through cockpit controls) controls the blade angle, rather than RPM.

Fundamental elements of a reversing system include an external valve, cockpit control cable, internal valve (mounted inside the engine shaft, interfacing internally with the propeller) and hydraulic lines to connect between the governor, external valve, and engine. Refer to Figure 2-11.

The propeller blade angle must be positioned at the low pitch hydraulic stop, and the governor must be underspeeding to allow reverse blade angle operation.

Propeller blade angle is moved into the beta range by manually repositioning the cockpit control to move the lever on the external valve and move the valve spool to supply oil from the governor pump to the propeller. If this lever/cockpit control position is maintained, propeller blade angle will move to full reverse. To pause and hold at some intermediate blade angle between full reverse and low pitch, the cockpit control must be moved to a position in the middle of its travel capability. This positions the lever on the external valve to position a valve spool that will not allow the governor supplied oil to enter the propeller (decrease pitch) or propeller oil to drain to engine sump (increase pitch). Propeller blade angle is moved to a higher blade angle by repositioning the cockpit control to a position opposite that used to select reverse blade angle. This will move a lever on the external valve to position a valve spool, allowing propeller oil to drain to the engine sump and increase blade angle. If this position is maintained, blade angle will return to the low pitch stop position. The cockpit control must remain in this position for normal governor control of blade angle above low pitch blade angle and to prevent unwanted movement of blade angle below the hydraulic low pitch stop.



Constant Speed and Reversing Propeller Assembly (External and Internal Beta System)
Figure 2-14

I. Constant Speed and Reversing Propellers (External and Internal Beta System)

Propeller model HC-A2(MV,V)20-5L
Refer to Figure 2-14.

A constant speed and reversing propeller is typically used on a single engine amphibian aircraft or aircraft on floats. It is counterweighted and uses internal and external reversing control hardware.

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 allows 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.

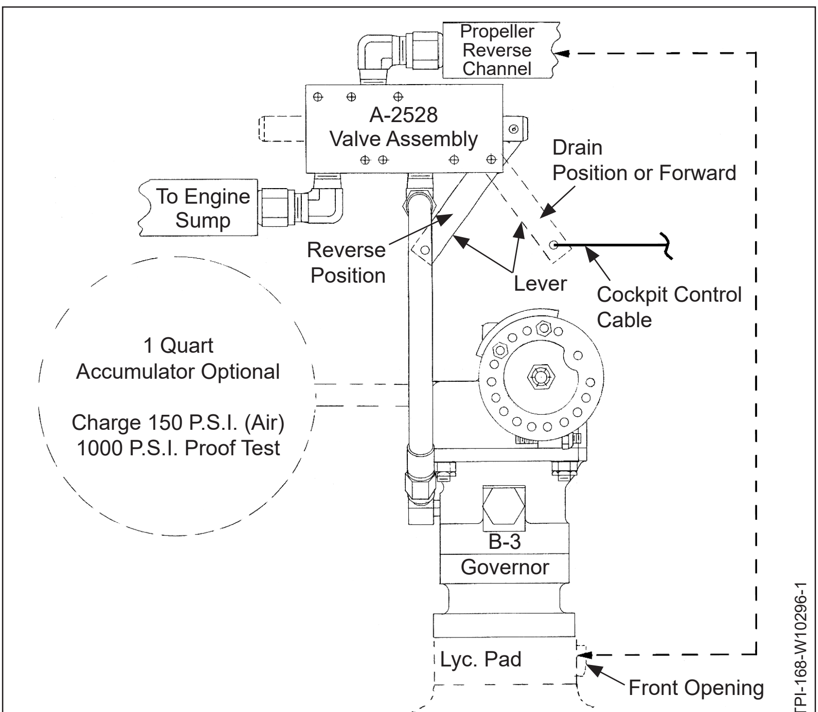
The counterweight is a weight that is attached to each blade clamp to cause the blade to rotate to a higher blade angle.

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 decreases 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 setting.



External Beta System
Figure 2-15

If oil supply is lost during flight, the propeller will go to high pitch. This 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 high pitch stop.

The lowest blade angle attainable by the governor is low pitch. An external beta valve and internal beta valve hydraulically control 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: An internal beta valve mounts internal to the engine extension. The external beta valve mounts on the outside of the engine. The internal beta valve interfaces internally with the propeller. Hydraulic lines connect between the governor and the external beta valve. The cockpit control cable connects with the external beta valve mounted lever.

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 an external beta valve, an internal beta valve, cockpit control cable, and a lever that interfaces between the external beta valve and the cockpit control cable. Refer to Figure 2-14 and Figure 2-15.

The propeller blade angle must be positioned at the low pitch hydraulic stop and the governor must be underspeeding to allow reverse blade angle operation.

Propeller blade angle is moved into the beta range by manually repositioning the cockpit control to move the lever on the external valve and move the valve spool to supply oil from the governor pump to the propeller. If this lever/cockpit control position is maintained, propeller blade angle will move to full reverse. To pause and hold at some intermediate blade angle between full reverse and low pitch, the cockpit control must be moved to a position in the middle of its travel capability. With the lever in this position on the external valve, it positions a valve spool that will not permit the governor supplied oil to enter the propeller (decrease pitch) or propeller oil to drain to engine sump (increase pitch). Propeller blade angle is moved to a higher blade angle by repositioning the cockpit control to a position opposite that used to select reverse blade angle. This will move a lever on the external valve to position a valve spool, allowing propeller oil to drain to the engine sump and increase blade angle. If this position is maintained, blade angle will return to the low pitch stop position. The cockpit control must remain in this position for normal governor control of blade angle above low pitch blade angle and to prevent unwanted movement of blade angle below the hydraulic low pitch stop.

B HC - A 2 MV F - 1 D1

D1 — MINOR MODIFICATIONS NOT AFFECTING BASIC PROPELLER OPERATION

SPECIFIC DESIGN FEATURES

1 -	NON-FEATHERING, COUNTERWEIGHTS, OIL TO DECREASE PITCH, NO SPRING
2 -	FEATHERING, COUNTERWEIGHTS, OIL TO DECREASE PITCH, FEATHERING SPRING
3, 5R-	COUNTERWEIGHTS AND REVERSING (EXTERNAL BETA SYSTEM)
4 -	NON-FEATHERING, NO COUNTERWEIGHTS, NO SPRING, EXTENDED LINK SCREW
4A -	CONSTANT SPEED, COUNTERWEIGHT, OIL TO DECREASE PITCH
5A, 5AL, 5L -	FEATHERING OR NON-FEATHERING, COUNTERWEIGHTS AND REVERSING (EXTERNAL AND INTERNAL BETA SYSTEM)
6 -	NON-FEATHERING, NO COUNTERWEIGHTS, NO SPRING, OIL TO INCREASE PITCH

SHAFT MOUNTING

	BOLT CIRCLE	DOWELS No.	DOWELS DIA.	NO. OF BOLTS OR STUDS
K FLANGE	4.75 inches (120.7 mm)			6 (0.50 inch) (12.7 mm)
F FLANGE	4.00 inches (101.6 mm)	2	0.50 inch (12.7 mm)	6 (0.50 inch) (12.7 mm)
L FLANGE	4.75 inches (120.7 mm)			6 (0.44 inch) (11.2 mm)
20	SPLINE, SAE 20			

BASIC SHANK

- **MV** - SINGLE SHOULDER BLADE RETENTION SYSTEM OR MODIFIED DOUBLE SHOULDER BLADE RETENTION SYSTEM
- **V** - DOUBLE SHOULDER BLADE RETENTION SYSTEM

NO. OF BLADES — **2 or 3**

BASIC HUB DESIGN — **A -** LIGHT STEEL HUB, SPLIT BEARING RETENTION, SUPERSEDES 8 STEEL HUB

- HA - HARTZELL ADJUSTABLE - GROUND ADJUSTABLE
- HC - HARTZELL CONTROLLABLE

FLANGE ANGULAR INDEX — WITH RESPECT TO #1 BLADE, VIEWED CLOCKWISE FACING THE PROPELLER FLANGE

PREFIX	ANGULAR INDEX	CLOCKING FEATURE	FLANGE
BLANK -	90 AND 270 DEGREES	DOWEL PINS	F
BLANK -	0 AND 180 DEGREES	NON-COUNTER BORED HOLES	K,L
B -	30 AND 210 DEGREES	DOWEL PINS	F
B -	120 AND 300 DEGREES	NON-COUNTER BORED HOLES	K,L
E, P -	0 AND 180 DEGREES	DOWEL PINS	F

Propeller Model Designations
Table 2-1

BHC-A2MVF-1D1

FLANGED:

( )HC-A2(MV,V)(F,K,L)-1, -6

1A - DIFFERENT HUB, PISTON, SPINNER, "A" DOWEL LOCATION, ALUMINUM DOWEL

HC-A2(MV,V)(F,K,L)-2

A - DIFFERENT SPRING ASSEMBLY
B - DIFFERENT SPRING ASSEMBLY, C-2530 SPINNER, 830-12 STOP UNIT

( )HC-A3MV(F,K)-2

A - 838-1060 CLAMP ASSY.
B - 838-1011A CLAMP ASSY.
C - 838-1006 CLAMP ASSY.
D - 838-1023 CLAMP ASSY.
L - LEFT HAND ROTATION

( )HC-A3V(F,K)-2

A - 838-60 CLAMP ASSEMBLY
B - 838-11A CLAMP ASSEMBLY
C - 838-6 CLAMP ASSEMBLY
D - 838-23 CLAMP ASSEMBLY
L - LEFT HAND ROTATION

( )HC-A2(MV,V)F-3

NO MINOR MODIFICATIONS/LETTER CHANGES

HC-A3(MV,V)F-3L

L - LEFT HAND ROTATION

( )HC-A3(MV,V)(F,K)-4

D - DIFFERENT SPINNER

HC-A3MVF-5(A,AL)

A - FOR LYCO GO-480, 838-1077 CLAMP ASSEMBLY, B-1457 REVERSE VALVE
L - LEFT HAND ROTATION

HC-A3VF-5(A,AL)

A - FOR LYCO GO-480, 838-77 CLAMP ASSEMBLY, B-1457 REVERSE VALVE
L - LEFT HAND ROTATION

( )HC-A3(MV,V)F-5R

R - BETA RING

20 SPLINE:

HC-A2(MV,V)20-1

A - 834-3A GUIDE COLLAR

Propeller Model Designations, Continued
Table 2-1

BHC-A2MVF-1D1

20 SPLINE, CONTINUED:

HA-A2(MV,V)20-1B

GROUND ADJUSTABLE BLADE PITCH
NO OIL SUPPLY NEEDED

HC-A2(MV,V)20-2

NO MINOR MODIFICATIONS/LETTER CHANGES

HC-A2(MV,V)20-3L

Feathering, reversing with beta ring
A - FOR LYC GO480 ENGINE, A-4117 REVERSING VALVE ASSEMBLY
B - FOR LYC GO435 ENGINE, A-2372 REVERSING VALVE ASSEMBLY
L - LEFT HAND ROTATION

HC-A2(MV,V)20-5L

CONTINENTAL IO-470-P
A-2528 EXTERNAL BETA VALVE ASSEMBLY
D-2006 INTERNAL BETA VALVE ASSEMBLY
L - LEFT HAND ROTATION

HC-A3MV20-1

A - OBSOLETE, REPLACED BY -1B
B - A-50-3 CONE
C - OBSOLETE, REPLACED BY -1D
D - A-50-5 CONE
E - A-50-5 CONE, 838-1025R CLAMP
F - SAME AS "E" EXCEPT DIFFERENT SPINNER

HC-A3V20-1

A - OBSOLETE, REPLACED BY -1B
B - A-50-3 CONE
C - OBSOLETE, REPLACED BYY -1D
D - A-50-5 CONE
E - A-50-5 CONE, 838-25R CLAMP
F - SAME AS "E" EXCEPT DIFFERENT SPINNER

HC-A3MV20-2

-2 (With 8433 blades) 838-1006 Clamps, 830-5 Stops
-2 (With 9333 blades) 838-1023 Clamps
-2 (With 9333CH blades) 838-1023 Clamps, 830-18 Stops
A - NO STOPS
L - LEFT HAND ROTATION

HC-A3V20-2

-2 (With 8433 blades) 838-6 Clamps, 830-5 Stops
-2 (With 9333 blades) 838-23 Clamps
-2 (With 9333CH blades) 838-23 Clamps, 830-18 Stops
A - NO STOPS
L - LEFT HAND ROTATION

HC-A3(MV,V)20-3L

Feathering, reversing with beta ring
L - LEFT HAND ROTATION

Propeller Model Designations, Continued
Table 2-1

J. Propeller Model Designation

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

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

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

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

Blade model/ MV 84 33 N - 2( )

Dash Number (or + number), diameter reduction (or increase) from basic design. In this example, the nominal 84 inch diameter has been reduced 2 inches = 82 inch dia. (with some exceptions)
there may be a letter following the dash number:
R - specifically rounded tip
Q - Q-tip, factory 90 degree bent tip
S - square tip (Exception: Blade model 8433NS was manufactured with a square tip; however, the "S" square tip designator in the model number did not follow a dash.)

Suffix letters:
blank - original design, no changes
B - anti-ice boot (alcohol) or de-ice boot (wire element)
N - shank modification (V-shank pilot tube hole)
S - Shot peen (Exception: Blade model M10474 was manufactured with a shot peened surface; however, the "S" shot peen designator was not included in the model number.

Engineering designation for design characteristics

The first 2 or 3 numbers indicate initial design diameter (in inches)
(not necessarily the actual propeller diameter)

Prefix of up to 3 letters:
L - left hand rotation
MV - single shoulder blade retention or modified double shoulder blade retention
V - double shoulder blade retention

Aluminum Blade Model Designation
Table 2-2

2. Propeller Blades

A. Description of Aluminum Blades

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

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

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

B. Blade Model Designation

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

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

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

(3) Refer to the Table 2-2, "Aluminum Blade Model Designation" for a description of the characters used in the blade model number.

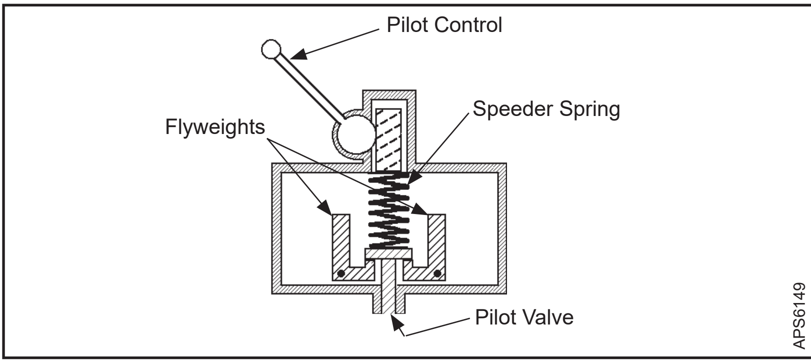
C. Conversion From V-shank to MV-shank

(1) V-shank models, which have double-shoulder configuration, have additional repetitive inspections required by Airworthiness Directive 97-18-02.

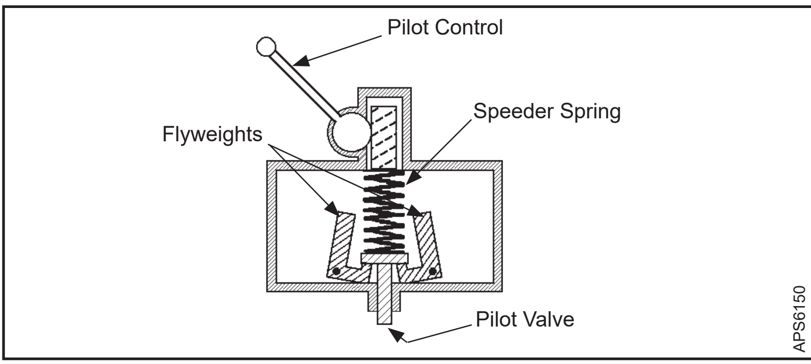
(2) MV-shank models, which have a single-shoulder configuration, are not affected by the subject Airworthiness Directive.

(3) V-shank blades can be converted to MV-shank to avoid the inspections required by the Airworthiness Directive. After conversion, the propeller model number changes to reflect the conversion. For example, HC-A2V20-1/V8433N becomes HC-A2MV20-1/MV8433N.

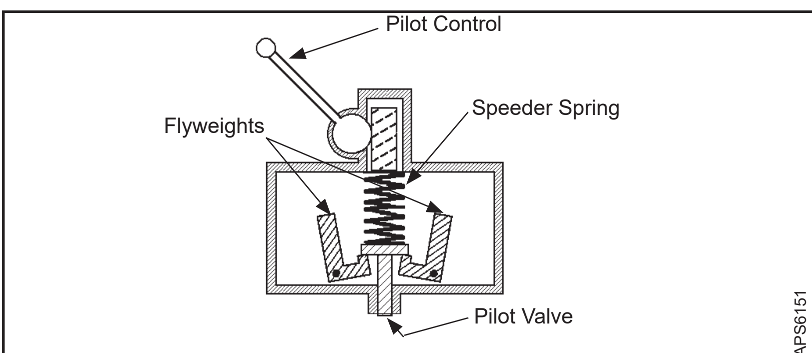
(4) AD 97-18-02 does not apply to ( )HC-A( )MV( )-( ) propellers. These propellers are equipped with MV blade shank retention systems.



Governor in Onspeed Condition
Figure 2-16



Governor in Underspeed Condition
Figure 2-17



Governor in Overspeed Condition
Figure 2-18

3. Governors (Rev. 3)

A. Theory of Operation

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

(2) When the engine is operating at the RPM set by the pilot using the cockpit control, the governor is operating **onspeed**. Refer to Figure 2-16. 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.

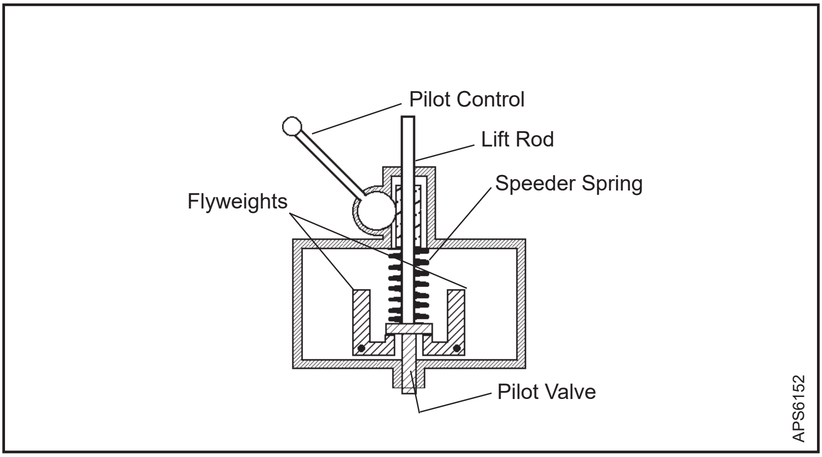
(3) When the engine is operating below the RPM set by the pilot using the cockpit control, the governor is operating **underspeed**. Refer to Figure 2-17. In an underspeed condition, the flyweights tilt inward because there is not enough centrifugal force on the flyweights to overcome the force of the 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 2-18. In an overspeed condition, the centrifugal force acting on the flyweights is greater than the speeder spring force. The flyweights tilt outward, and raise the pilot valve. The pilot valve then meters oil flow to increase propeller pitch and lower engine RPM.

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

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

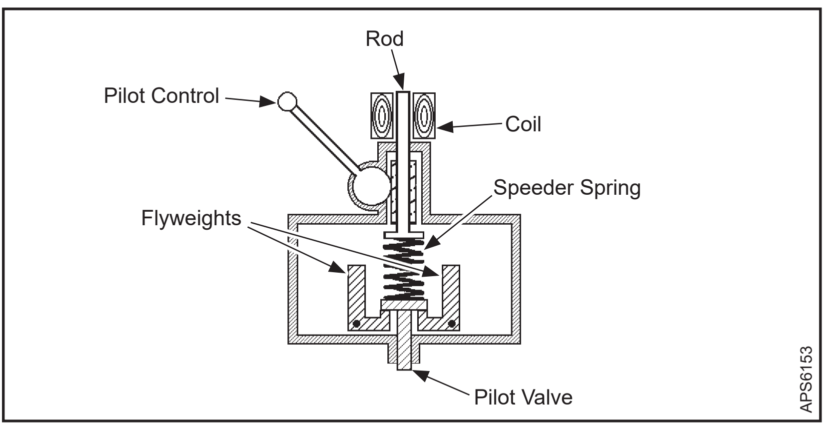
(b) Figure 2-19 illustrates another feathering propeller governor system. When it is desired to feather the propeller, the lift rod may be moved by the cockpit control to mechanically engage the valve. The lifted valve dumps oil to increase propeller pitch until the propeller feathers.



Feathering Governor
Figure 2-19

(6) A synchronizing system can be employed in a multi- engine aircraft to keep the engines operating at the same RPM. A synchrophasing system not only keeps the RPM of the engines consistent, but also keeps the propeller blades in phase with each other. Both synchronizing and synchrophasing systems serve to reduce noise and vibration. Figure 2-20 illustrates a governor as a component of a synchronizing or synchrophasing system.

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



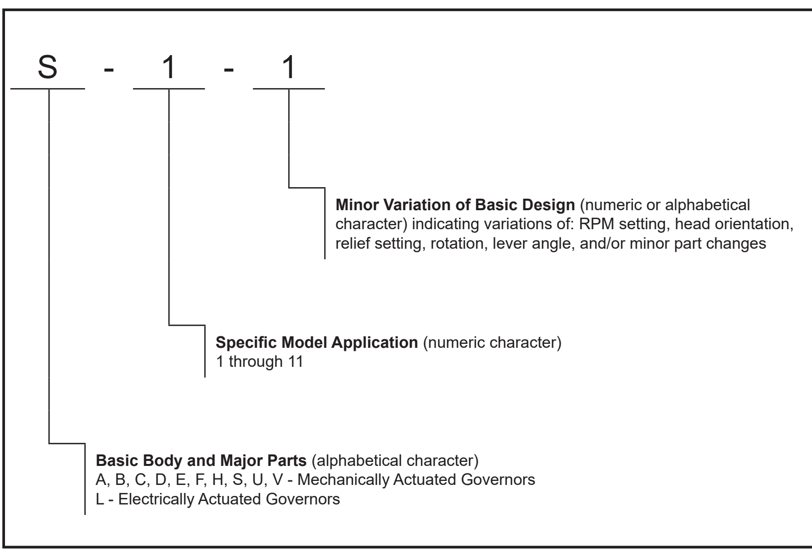
Synchronizer/Synchrophaser Governor
Figure 2-20

B. Governor Model Designation

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

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

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



Governor Model Designations
Table 2-3

4. Unfeathering Accumulators (Rev. 3)

A. System Overview

(1) An unfeathering accumulator is a device that stores a volume of oil at a pressure and supplies it to the propeller when commanded to. This supplied pressure will lower blade angle which will cause the propeller to windmill and make the engine easier to start.

(2) Hartzell Propeller manufactures an accumulator that is a cylinder with a moveable internal piston. One end of the cylinder and piston is filled with engine oil, and the other end of the cylinder and piston is filled with air or nitrogen to a designated pressure through an air valve. The accumulator is a self-contained unit and is usually installed at some remote location in the engine compartment. An oil supply hose is connected between the accumulator and the governor.

(3) Hartzell Propeller manufactures governors that have unfeathering and feathering capability; although some governors are able to feather a propeller they are not automatically capable of unfeathering the propeller.

B. Mechanical Models

(1) The governor has a fitting or threaded hole to attach with an oil supply hose that is connected to the accumulator on the other end. During operation of the engine and propeller, the governor supplies oil to the accumulator and maintains oil in the accumulator during engine operation.

(2) The pilot commands feather of the propeller by moving the RPM control of the governor toward lower RPM to reach the feather command location. The governor disconnects the oil supply to the accumulator and seals a volume of oil under pressure in the accumulator. The governor then connects the oil supply line from the propeller piston and permits the propeller blades to move to a feather stop in the propeller.

(3) Unfeathering occurs when the governor RPM control is moved by the pilot from the feather location to a higher RPM selection for governing. The governor disconnects the propeller oil supply from the drain and reconnects it to the governor oil supply line from the governor. At that point there is no oil available from the engine oil pump to the governor; therefore, no governed oil is available from the governor for controlling the propeller blade angle and RPM. Further movement of the governor RPM control toward higher RPM will cause the governor to connect the accumulator to the oil supply line from governor to the propeller. The air or nitrogen pressure in one side of the accumulator will push a piston to force oil from the other side of the accumulator through the governor to the propeller piston to move the propeller blades from feather to a lower blade angle. The propeller will then begin to windmill and will permit the engine to start.

C. Electrical Models

(1) In an electrical model a switch activates a solenoid coil allowing oil to reverse out of a valve resulting in a lower blade angle for the purpose of starting the associated engine.

(2) The governor has a fitting or threaded hole to attach with an oil supply hose that is connected on the other side to the accumulator solenoid valve that is connected to the oil side of the accumulator. During operation of the engine and propeller, the governor supplies oil to the accumulator through the solenoid valve's check valve until equal pressure is reached allowing the check valve to then close and maintain oil pressure at engine shutdown.

(3) When the engine has shut down or failed, no oil is available from the engine oil pump to the governor; therefore, no governed oil is available from the governor for controlling the propeller blade angle and RPM. Unfeathering occurs when a switch is activated energizing the coil on the accumulator solenoid valve. The activated coil changes the valve from a one-way valve to an open passage allowing reverse flow back out of the accumulator and to the governor. The air or nitrogen pressure in one side of the accumulator will push a piston to force oil from the other side of the accumulator through the governor to the propeller piston to move the propeller blades from feather to a lower blade angle. The propeller will then begin to windmill and permit the engine to start.

5. <u>Propeller Ice Protection Systems</u> (Rev. 1)

A. System Description

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

INSTALLATION AND REMOVAL - CONTENTS

INSTALLATION AND REMOVAL - CONTENTS, CONTINUED

INSTALLATION AND REMOVAL - CONTENTS, CONTINUED

LIST OF FIGURES

LIST OF FIGURES, CONTINUED

LIST OF FIGURES, CONTINUED

LIST OF TABLES

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-A3MV**F**-2B indicates an F-flange. HC-A3MV**20**-2 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

NOTE: The use of torque wrench adapters for F-flange and K-flange installations will vary according to specific application.

F-flange

- Safety wire pliers (Alternate safety cable tool)
- Calibrated torque wrench
- Torque wrench adapter, Hartzell P/Ns AST-2917, AST-2805, or a locally procured torque wrench adapter of the appropriate size

K-flange

- Safety wire pliers (Alternate safety cable tool)
- Calibrated torque wrench
- Torque wrench adapter, Hartzell P/N AST-2805 or a locally procured torque wrench adapter of the appropriate size

L-flange

- Safety wire pliers (Alternate safety cable tool)
- Calibrated torque wrench
- Locally procured torque wrench adapter of the appropriate size

20 Spline

- Shaft nut wrench Hartzell P/N BST-2910

B. Consumables
- Quick Dry Stoddard Solvent or Methyl-Ethyl-Ketone (MEK)
- Anti-Seize Compound (MIL-PRF-83483)

C. Expendables
- 0.032 inch (0.81 mm) Stainless steel Aircraft Safety wire (Alternate: 0.032 inch [0.81 mm] aircraft safety cable and associated hardware)
- O-rings (see Table 3-1)

2. Pre-Installation (Rev. 3)

A. Inspection of Shipping Package

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

(a) If the box is damaged, contact the freight company for a freight claim.

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

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

B. Uncrating

(1) Put the propeller on a firm support.

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

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

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

(4) Put the propeller on a padded surface that supports the entire length of the propeller.

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

C. Inspection after Shipment

NOTE: The ability to rotate the blades during propeller installation will make it easier to access the propeller mounting bolts on -3 propeller models.

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

D. Reassembly of a Propeller Disassembled for Shipment

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

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

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

E. Air Charge Pressure Check

(1) Perform an air charge pressure check before propeller installation. Refer to the section, "Air Charge" in the Maintenance Practices chapter of this manual.

(a) If the air pressure loss is not within the specified limits, refer to the section, "Failure to Feather" in the Testing and Troubleshooting chapter of this manual.

3. <u>Propeller Mounting Hardware and Torque Information</u> (Rev. 1)

A. Propeller Mounting Hardware

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

B. Torque Information

(1) The structural integrity of joints in the propeller that are held together with threaded fasteners is dependent upon proper torque application.

(a) Vibration can cause an incorrectly tightened fastener to fail in a matter of minutes.

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

(c) Correct tension is achieved by application of measured torque.

(2) Use accurate wrenches and professional procedures to make sure of correct tensioning.

(3) For torque values to use when installing a Hartzell propeller, refer to Table 3-2, "Torque Table".

(4) When an adapter is used with a torque wrench, use the equation in Figure 3-1.1 to determine the correct torque value.

(5) Refer to Figure 3-2 for the proper torquing sequence of the propeller mounting bolts/nuts.

4. Spinner Adapter Ring Installation (if applicable) (Rev. 1)

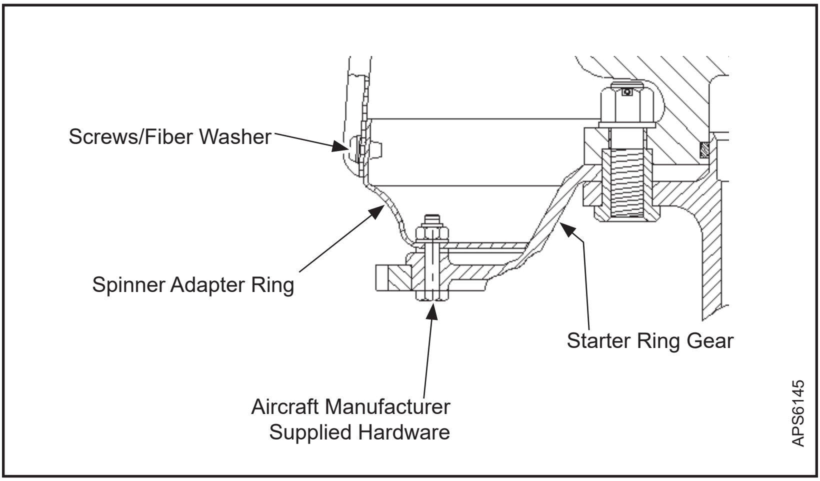
A. Installation

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

CAUTION: BOLTS INSTALLED INCORRECTLY CAN DAMAGE ENGINE COMPONENTS.

(a) Install spinner adapter bolts so that the bolt heads are at the rear of the starter ring gear. Refer to Figure 3-1.

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



Spinner Adapter Ring
Figure 3-1

Part	Propeller Model	Part No.
Cone, Rear	HC-A2(MV,V)20-1A	A-50-3
	HA-A2(MV,V)20-1B	A-50-1
	HC-A2(MV,V)20-2	A-50-3
	HC-A2(MV,V)20-3L	A-50-1
	HC-A2(MV,V)20-5L	A-50-3
	HC-A3(MV,V)20-1B	A-50-3
	HC-A3(MV,V)20-1(D,E,F)	A-50-5
	HC-A3(MV,V)20-2(L)	A-50-3
	HC-A3(MV,V)20-3L	A-50-1
Dowel Pin	(B)HC-A2(MV,V)F-1( )	B-6138-8-8
	HC-A2(MV,V)F-2( )	B-6138-8-8
	BHC-A2(MV,V)-3	B-6138-8-8
	( )HC-A3(MV,V)F-2( )	B-6138-8-8
	HC-A3(MV,V)F-3L	B-6138-8-8
	( )HC-A3(MV,V)F-4( )	B-6138-8-8
	( )HC-A3(MV,V)F-5A( )	B-6138-8-8
Felt Dust Seal	HA-A2(MV,V)20-1B	B-1843
	HC-A2(MV,V)20-1A	B-1843
	HC-A2(MV,V)20-2	B-1843
	HC-A2(MV,V)20-3L	B-1843
	HC-A2(MV,V)20-5L	B-1843
	HC-A3(MV,V)20-1( )	B-1843
	HC-A3(MV,V)20-2( )	B-1843
	(E,P)HC-A3(MV,V)F-2( )	B-1843
	HC-A3(MV,V)20-3L	B-1843
Mounting Bolt/Stud	(B)HC-A2(MV,V)K-1( )	A-1333-3
	(B)HC-A2(MV,V)L-1( )	B-322
	HC-A2(MV,V)F-2( )	A-1328-1
	HC-A2(MV,V)L-2	B-6489-25 (4)
		B-6489-20 (2)
	BHC-A2(MV,V)F-3	A-1328-1
	(B)HC-A2(MV,V)F-1( )	A-1328-1
	HC-A2(MV,V)K-2( )	A-1333 (2)
		A-1333-3(ALT) (2)
		A-1328 (4)
	HC-A2(MV,V)L-6F	B-322
	HC-A3(MV,V)K-2( )(L)	A-1328 (4)
		A-1333-3 (2)
	(P)HC-A3(MV,V)F-2( )	A-1328-1
	EHC-A3(MV,V)F-2B	A-2983 STUD
	HC-A3(MV,V)F-3L	A-2983 STUD
	HC-A3(MV,V)F-5A(L)	A-1328-1
	HC-A3(MV,V)F-5R	A-2983 STUD
	PHC-A3(MV,V)F-5R	A-2983-2 STUD
	(E,P)HC-A3(MV,V)F-4( )	A-1328-2
	HC-A3(MV,V)K-4	A-1333-3

Propeller Mounting Parts/Hardware
Table 3-1

Part	Propeller Model	Part No.
Check Nut, Piston Rod	HC-A2(MV,V)20-2 (E,P)HC-A3(MV,V)F-2( ) HC-A2(MV,V)20-5L HC-A3(MV,V)K-2( )( ) HC-A3(MV,V)F-4( ) HC-A3(MV,V)K-4 HC-A3(MV,V)F-5A( ) (P)HC-A3(MV,V)20-2( )	B-3368 B-3368 B-3368 B-3368 B-3368 B-3368 B-3368 B-3368
Nut, Fork Rod	(B)HC-A2(MV,V)F-1A HC-A2(MV,V)K-1 HC-A2(MV,V)L-1 HC-A2VL-6F HC-A3(MV,V)20-1( )	A-848-2 A-848-2 A-848-2 A-848-2 A-848-2
Piston Nut	BHC-A2(MV,V)F-3 HA-A2(MV,V)20-1B HC-A2(MV,V)20-2 HC-A2(MV,V)20-3L HC-A2(MV,V)20-5L (E,P)HC-A3(MV,V)F-2( ) HC-A3(MV,V)K-2( )( ) HC-A3(MV,V)F-3L HC-A3(MV,V)F-5A( ) PHC-A3(MV,V)F-5R HC-A3(MV,V)20-2( ) HC-A3(MV,V)20-3L	A-880-2 A-880-1 A-880-1 A-880-1 A-880-1 A-880-2 A-880-2 A-880-2 A-880-1 A-880-1 A-880-1 A-880-1
Nut, Shaft/Hub and Puller Ring	HC-A2(MV,V)20-1A HA-A2(MV,V)20-1B HC-A2(MV,V)20-2 HC-A2(MV,V)20-3L HC-A3(MV,V)20-1( ) HC-A3(MV,V)20-2( ) HC-A3(MV,V)20-3L	A-63-B + A-870 A-63-B + A-870 A-63-B + A-870 A-63-B + A-870 A-63-B + A-870 A-63-B + A-870 A-63-B + A-870
Nut, Mounting Stud	EHC-A3(MV,V)F-2B HC-A3(MV,V)F-3L	A-2044 A-2044

Propeller Mounting Parts/Hardware
Table 3-1

Part	Propeller Model	Part No.
O-ring, Shaft/Engine Flange	(B)HC-A2(MV,V)F-1( ) (B)HC-A2(MV,V)(K,L)-1( ) HC-A2(MV,V)F-2( ) HC-A2(MV,V)(K,L)-2( ) BHC-A2(MV,V)F-3 HC-A2(MV,V)L-6F (E,P)HC-A3(MV,V)F-2( ) HC-A3(MV,V)F-3L (P)HC-A3(MV,V)F-5R HC-A3(MV,V)F-5A( ) (E,P)HC-A3(MV,V)F-4( ) (E,P)HC-A3(MV,V)K-2( ) (E,P)HC-A3(MV,V)K-4( )	C-3317-228 C-3317-329 C-3317-228 C-3317-329 C-3317-228 C-3317-329 C-3317-228 C-3317-228 C-3317-228 C-3317-228 C-3317-228 C-3317-329 C-3317-329
O-ring, Propeller Side (for use with B-2982 spacer)	EHC-A3(MV,V)F-2B	C-3317-228
O-ring, Propeller Mounting	EHC-A3(MV,V)F-2B	C-3317-228
O-ring, Piston	HA-A2(MV,V)20-1B HC-A2(MV,V)20-1A HC-A2(MV,V)20-2 HC-A2(MV,V)20-3L HC-A2(MV,V)20-5L HC-A3(MV,V)20-1( ) HC-A3(MV,V)20-2( ) (E,P)HC-A3(MV,V)F-2( ) HC-A3(MV,V)20-3L	C-3317-343-1 C-3317-343-1 C-3317-343-1 C-3317-343-1 C-3317-343-1 C-3317-343-1 C-3317-343-1 C-3317-343-1
O-ring, Rear Cone	HA-A2(MV,V)20-1B HC-A2(MV,V)20-1A HC-A2(MV,V)20-2 HC-A2(MV,V)20-3L HC-A2(MV,V)20-5L HC-A3(MV,V)20-1( ) HC-A3(MV,V))20-2(L) HC-A3(MV,V)20-3L	C-3317-229 C-3317-229 C-3317-229 C-3317-229 C-3317-229 C-3317-229 C-3317-229 C-3317-229
O-ring, Rod	HA-A2(MV,V)20-1B HC-A2(MV,V)20-2 HC-A2(MV,V)20-3L HC-A2(MV,V)20-5L HC-A3(MV,V)20-2( ) HC-A3(MV,V)20-3L	C-3317-020 C-3317-020 C-3317-020 C-3317-020 C-3317-020 C-3317-020

Propeller Mounting Parts/Hardware
Table 3-1

Part	Propeller Model	Part No.
Pitch Change Block	(B)HC-A2(MV,V)F-1A HC-A2(MV,V)K-1 HC-A2(MV,V)L-1 HC-A2(MV,V)L-6 HC-A2(MV,V)20-1A HC-A3(MV,V)20-1( )	A-95-A A-95-A A-95-A A-95-A A-95-A A-95-A
Plate, Spinner	BHC-A2(MV,V)F-3 HC-A3(MV,V)F-3L HC-A3(MV,V)F-5R PHC-A3(MV,V)F-5R	C-2954 C-3675 C-3673 C-3676
Plate, Support	HC-A2(MV,V)20-3L HC-A3(MV,V)20-3L	C-1981 C-1958
Safety Pin, Hub Nut	HA-A2(MV,V)20-1B HC-A2(MV,V)20-1A HC-A2(MV,V)20-2 HC-A2(MV,V)20-3L HC-A2(MV,V)20-5L HC-A3(MV,V)20-1( ) HC-A3(MV,V)20-2( ) HC-A3(MV,V)20-3L	A-847 A-847 A-847 A-847 A-847 A-847 A-847 A-847
Screw, Socket Head Cap (on piston rod)	HC-A2(MV,V)20-2 HC-A2(MV,V)20-5L HC-A3(MV,V)20-2( ) (E,P)HC-A3(MV,V)F-2( ) HC-A3(MV,V)K-2( )( ) (P)HC-A3(MV,V)F-4( ) HC-A3(MV,V)K-4 HC-A3(MV,V)F-5A( )	A-2037 A-2037 A-2037 A-2037 A-2037 A-2037 A-2037 A-2037
Shim	HC-A2(MV,V)K-1 HC-A2(MV,V)L-1 HC-A2(MV,V)K-2 HC-A2(MV,V)L-2 HC-A2(MV,V)L-6F HC-A3(MV,V)K-2( )( ) HC-A3(MV,V)K-4	B-1322 B-933-1 B-1322 B-933-1 B-933-1 B-1322 B-1322
Spacer, Flange	EHC-A3(MV,V)F-2B HC-A3(MV,V)F-3L HC-A3(MV,V)F-5R PHC-A3(MV,V)F-5R	B-2982 B-2982 B-2982 B-2984-3

Propeller Mounting Parts/Hardware
Table 3-1

Part	Propeller Model	Part No.
Washer, Fork Rod	(B)HC-A2(MV,V)F-1A HC-A2(MV,V)K-1 HC-A2(MV,V)L-1 HC-A2(MV,V)20-1A HC-A2(MV,V)L-6F HC-A3(MV,V)20-1( )	A-965 A-965 A-965 A-965 A-965 A-965
Washer, (Mounting Bolt/Stud)	(B)HC-A2(MV,V)F-1( ) HC-A2(MV,V)F-2( ) HC-A2(MV,V)K-2 HC-A2(MV,V)L-2 BHC-A2(MV,V)F-3 (E,P)HC-A3(MV,V)F-2( ) HC-A3(MV,V)F-3L (E,P)HC-A3(MV,V)F-4( ) HC-A3(MV,V)F-5A( ) (P)HC-A3(MV,V)F-5R	A-1381 A-1381 A-1381 B-6527-7 (4) (with B-6489-25 bolt) B-6329-7 (2) (with B-6489-20 bolt) A-1381 A-1381 A-1381 A-1381 / A-2482-1(ALT) A-1381 A-1381
Washer (Guide Rod)	HC-A2(MV,V)20-5L	A-1444

Propeller Mounting Parts/Hardware
Table 3-1

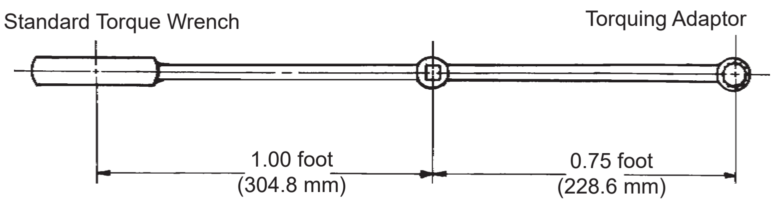
CAUTION 1: FOR A PROPELLER THAT DOES NOT USE A LUBRICATED (WET) TORQUE, THE MOUNTING HARDWARE MUST BE CLEAN AND DRY TO PREVENT EXCESSIVE PRELOAD OF THE MOUNTING FLANGE.

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

CAUTION 3: REFER TO Figure 3-1.1 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.

Hardware	Torque
F-flange propeller mounting bolts A-1333-( ) and A-1328-( )	80-90 Ft-Lb (108-122 N•m)
F-flange mounting nuts (on stud) A-2044 Nut	80-90 Ft-Lb (108-122 N•m)
K-flange propeller mounting bolts A-1333-( ) & A-1328, except on Lycoming IO-720 engine A-1333-( ) & A-1328, ONLY on Lycoming IO-720 engine	60-70 Ft-Lb (81-95 N•m) 100-125 Ft-Lb (136-170 N•m)
L-flange propeller mounting bolts B-322 and B-6489-( )	50 Ft-Lb (68 N•m)
Shaft Nut A-63B	450 Ft-Lb (610 N•m)
Piston Nut A-880-( )	120 Ft-Lb (163 N•m)
Low-pitch stop nut (on piston rod) A-848-2, A-2043-( ), A-3359, B-3382 or alternate A-3439	20-22 Ft-Lb (27-30 N•m)
Spinner Bulkhead Attachment Bolts/Nuts B-3384-( )/B-3808-( )	8 to 12 Ft-Lb (11-16 N•m)
Governor Mounting Nut B-3808-5	18-20 Ft-Lb (24.5-27 N•m)
Nut "E" (jam nut) A-3439	12 Ft-Lb (16 N•m)
NOTE 1: Torque tolerance is ±10% unless otherwise noted. NOTE 2: Torque values are based on non-lubricated threads.	

Torque Table
Table 3-2



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

EXAMPLE:

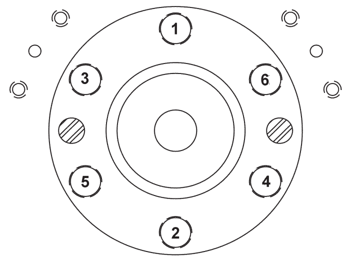
$$\frac{\text{100 Ft-Lb (136 N•m) x 1 ft (308.4 mm)}}{\text{1 ft (308.4 mm) + 0.75 ft (228.6 mm)}} = \text{57.1 Ft-Lb (77.4 N•m)} < \text{reading on torque wrench with 9-inch (228.6 mm) adapter for actual torque of 100 Ft-Lb (136 N•m)}$$

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

APS212

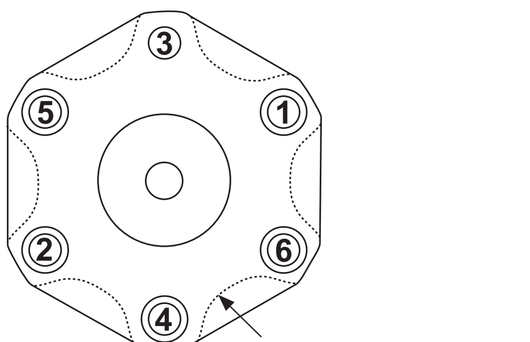
Calculating Torque When Using a Torque Wrench Adapter
Figure 3-1.1

F-flange



Step 1 -Torque all bolts/nuts to 40 Ft-Lbs (54 N•m).
Step 2 -Torque all bolts/nuts in accordance with Table 3-2.

K-flange and L-flange



Step 1 - Torque all bolts/nuts to 40 Ft-Lbs (54 N•m) and Figure 3-1.1 in the sequence shown

Step 2 - Torque all mounting bolts/nuts to the final torque value in accordance with Table 3-2 and Figure 3-1.1 in the sequence shown

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

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

5. Propeller 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.

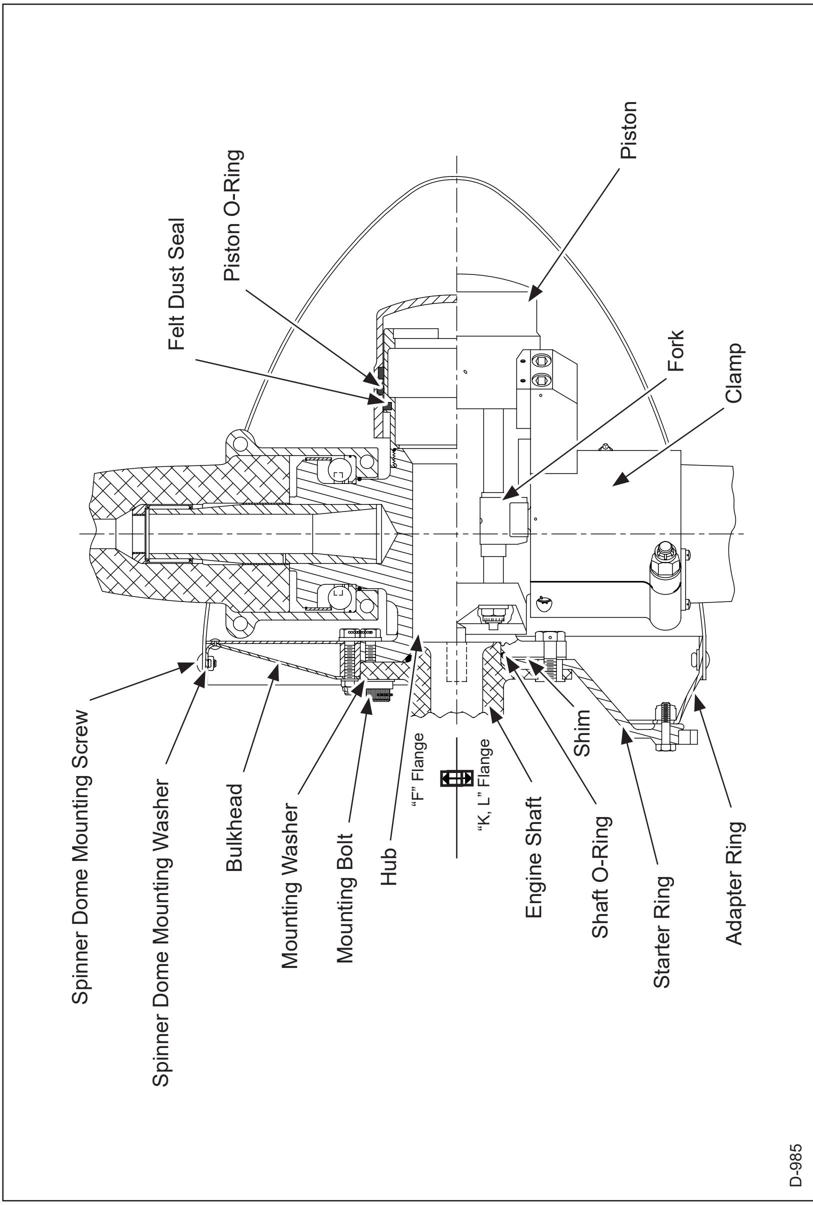
WARNING 2: WHEN INSTALLING THE PROPELLER, FOLLOW THE AIRFRAME MANUFACTURER'S MANUALS AND PROCEDURES, AS THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS OWNER'S MANUAL.

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

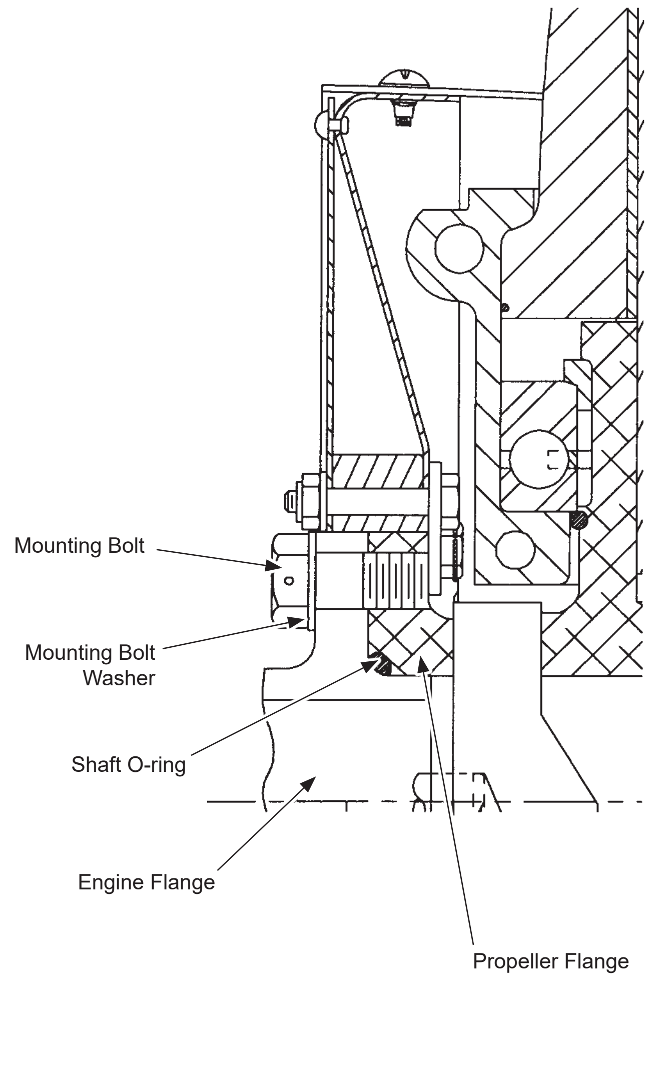
(2) Follow the airframe manufacturer's instructions for installing the propeller. If such instructions are not in the airframe manufacturer's manual, then follow the instructions in this manual; however, mechanics must consider that this owner's manual does not describe important procedures that are beyond Hartzell's control. In addition to propeller installation procedures, items such as rigging and preflight testing of flight idle blade angle, 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

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



(B)HC-A2(MV,V)(F,K,L)-1( ) Propeller Assembly
Figure 3-3



F-flange Installation on -1( ) Propeller Models
Figure 3-4

C. Installing Propeller Models, (B)HC-A2(MV,V)F-1( )
Refer to Figure 3-3

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(1) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller side of the hub flange. The dowel pins will protrude from the engine side of the hub flange to engage the engine flange.

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.

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

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

(4) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine shaft.

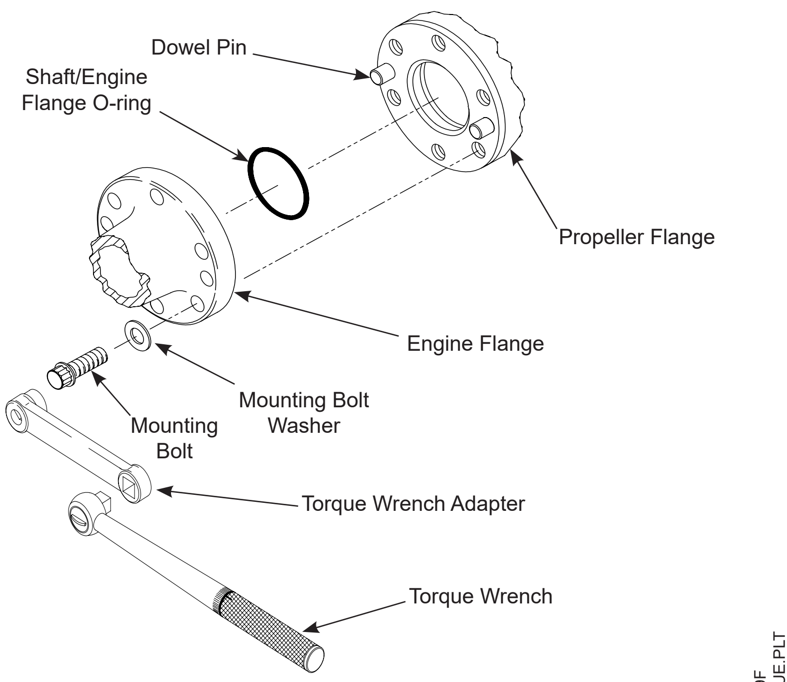
CAUTION: USE CARE TO AVOID SCRAPING ALUMINUM FROM THE BORE OF THE SPINNER BULKHEAD. SCRAPINGS COULD BECOME WEDGED BETWEEN THE FLANGE SURFACES.

(5) Slide the spinner bulkhead onto the propeller flange OD.

(6) Align the spinner bulkhead mounting holes with the holes in the four tabs that are bolted to the propeller hub.

(7) Install the spinner bulkhead attachment bolts, washers, and self-locking hex head nuts to hold the spinner bulkhead to the hub flange mounted tabs.

(8) Torque the spinner bulkhead attachment bolts and self-locking hex head nuts in accordance with Table 3-2, "Torque Table".



NOTE: If torque wrench adapter is used, use the calculation in Figure 3-1.1 to determine correct torque wrench setting.

Installing an F-flange Propeller on the Engine Flange
Figure 3-5

(9) 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.

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

CAUTION 2: USE CARE TO AVOID SCRAPING ALUMINUM FROM THE BORE OF THE SPINNER BULKHEAD. SCRAPINGS COULD BECOME WEDGED BETWEEN THE FLANGE SURFACES.

(10) Slide the propeller flange onto the engine flange.

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

(11) Install the mounting bolts (Table 3-1) with washers (if applicable) through the engine flange from the engine side and into the tapped holes in the propeller flange. Refer to Figure 3-4 and Figure 3-5.

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

(12) Use a torque wrench with the appropriate torque wrench adapter to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

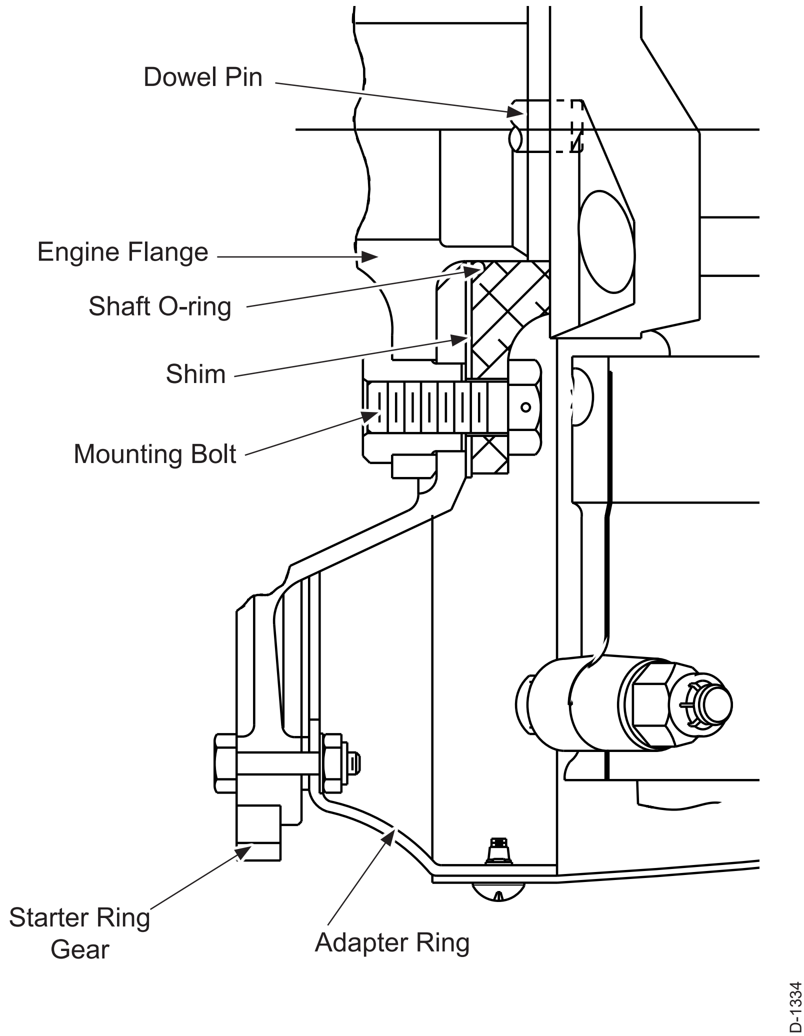
(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

(14) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



K-flange and L-flange Installations on -1( ), -4, and -6F Propeller Models
Figure 3-6

D. Installing Propeller Models, HC-A2(MV,V)(K,L)-1( ) and HC-A2(MV,V)L-6F
Refer to Figure 3-3.

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.

(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 AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

(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 ring gear. Refer to Figure 3-6.

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

(4) Install the shim (Table 3-1) on the engine shaft between the starter ring gear and the propeller flange. Refer to Figure 3-6.

(5) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine flange. Refer to Figure 3-6.

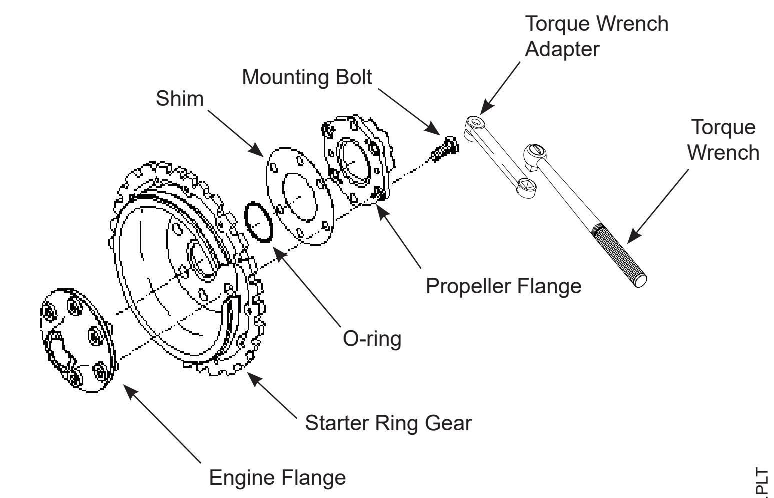
(6) Align the six mounting bolts (already installed in the propeller hub flange) with the threaded bushings in the engine flange.

NOTE: Six 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.

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 and shim.

NOTE: Insert the engine bushings into the counterbores that encircle the propeller mounting bolts in the propeller flange.



NOTE: If torque wrench adapter is used, use the calculation in Figure 3-1.1 to determine correct torque wrench setting.

Installing a K-flange or L-flange Propeller on the Engine Flange
Figure 3-7

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

(8) Thread the six preinstalled mounting bolts (Table 3-1) through the propeller flange from the propeller side, and into the bushings in the engine flange. Refer to Figure 3-7.

NOTE: The mounting bolts are preinstalled during the assembly of the propeller. Replacement of one of these bolts between overhauls must be performed only by a certified propeller repair station with the appropriate rating.

(9) Use a torque wrench with the appropriate torque wrench adapter (Figure 3-7) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

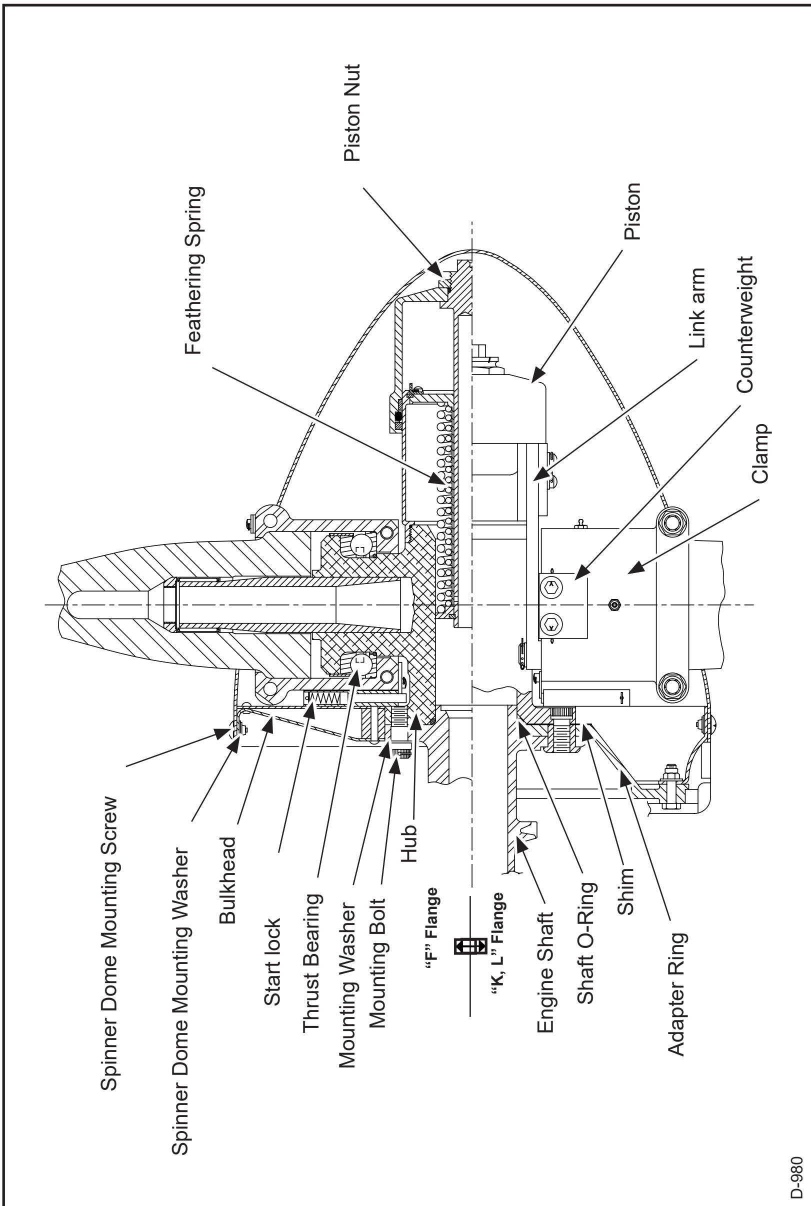
(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

(11) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



HC-A2(MV,V)(F,K,L)-2( ) Propeller Assembly
Figure 3-8

E. Installing Propeller Models, HC-A2(MV,V)F-2( )
Refer to Figure 3-8.

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(1) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller side of the hub flange. The dowel pins will protrude from the engine side of the hub flange to engage the engine flange.

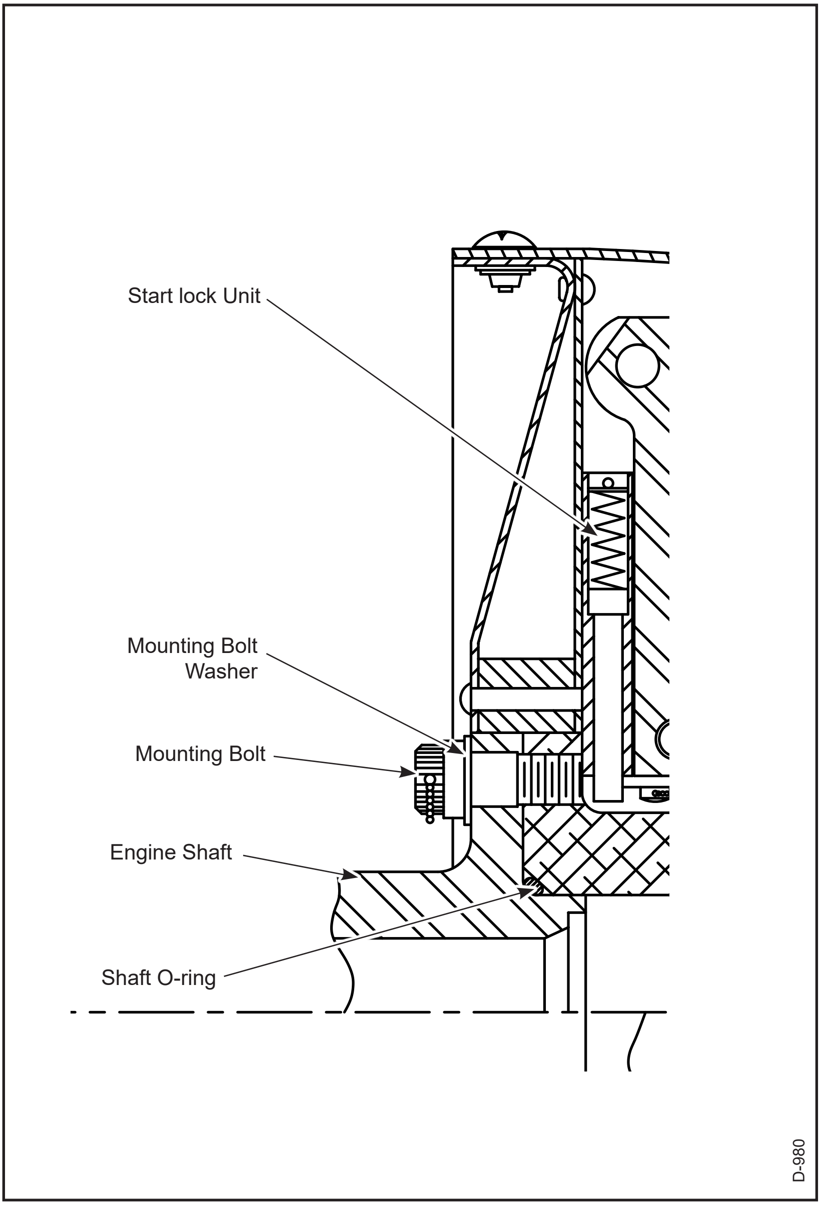
WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

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 AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

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



F-flange Installation on -2 Propeller Models
Figure 3-9

WARNING: USE CAUTION DURING INSTALLATION IF THE START LOCKS HAVE BEEN ENGAGED TO FACILITATE INSTALLATION OF THE SPINNER BULKHEAD. IF THE BLADES ARE RELEASED SUDDENLY, THE EXTREME FORCE CAN CAUSE SERIOUS INJURY AND DAMAGE TO THE PROPELLER.

(4) If the spinner bulkhead is to be installed and is not already in place, perform the following steps:

NOTE: The start locks must be engaged to provide access to the spinner bulkhead mounting bolts when installing the spinner bulkhead.

(a) Position the spinner bulkhead on 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 (Table 3-1) on the propeller side of the start locks to secure the attaching bolts and the bulkhead.

(5) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine flange Refer to Figure 3-9.

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.

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 engine side 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 the appropriate torque wrench adapter (Figure 3-7) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

(10) Safety all mounting bolts with 0.032 inch (0.810 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable and associated hardware (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, rotate 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 1-13/16 inch crowfoot wrench and a torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-1.1 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.

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.

(13) Position the propeller on the start locks.

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

(14) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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

F. Installing Propeller Models, HC-A2(MV,V)(K,L)-2
Refer to Figure 3-8.

WARNING 1: TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT MAY HAVE BEEN REMOVED TO ALLOW ROTATING OF THE BLADES BEFORE PACKAGING. FOR SAFETY REASONS, IF THE PISTON NUT WAS NOT REMOVED, THE PROPELLER MUST BE PLACED IN FEATHER POSITION BEFORE IT IS INSTALLED ON THE AIRCRAFT.

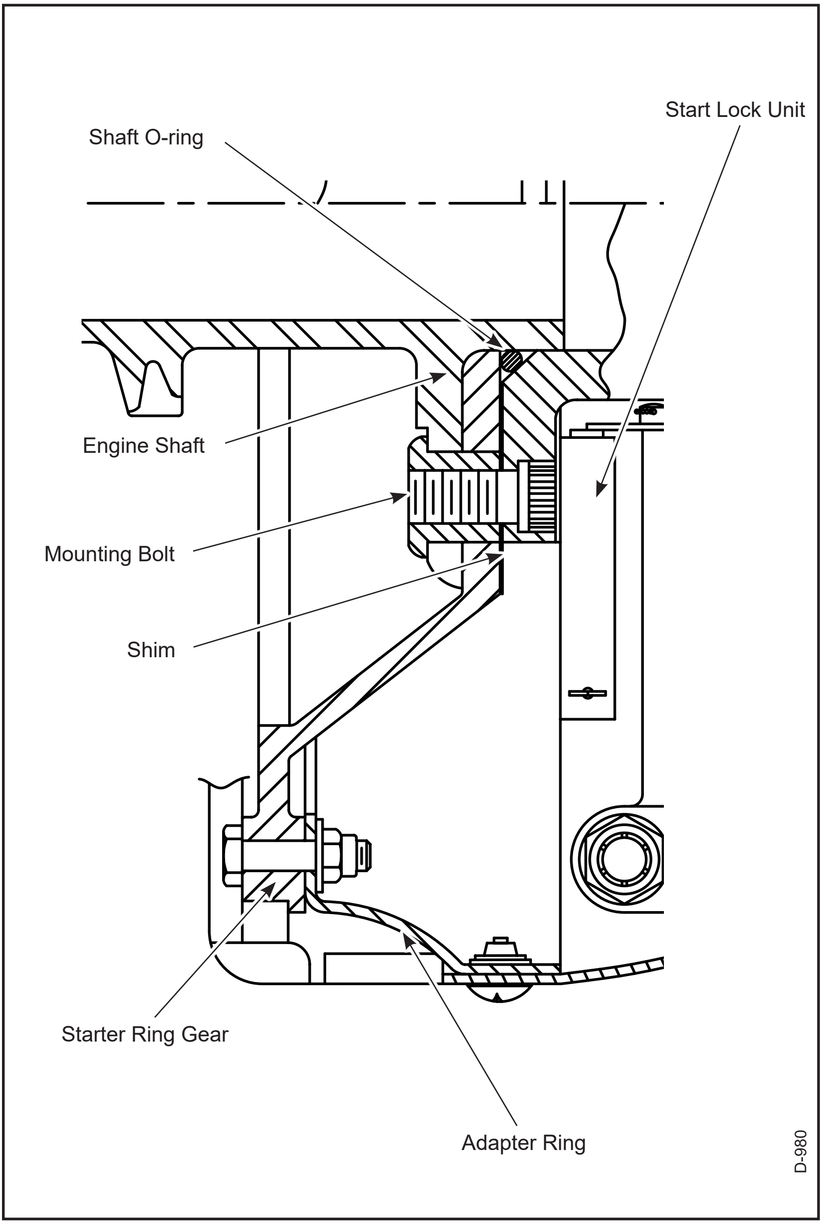
WARNING 2: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

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 AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

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



K-flange and L-flange Installation on -2 Propeller Models
Figure 3-10

(3) Install the spinner adapter ring on the engine starter ring gear. Refer to Figure 3-10.

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 (Table 3-1) on the engine shaft between the starter ring gear and the propeller flange. Refer to Figure 3-10.

(5) Install the specified O-ring (Table 3-1) on the engine flange. Refer to Figure 3-10.

CAUTION: USING A FELT-TIPPED PEN, IDENTIFY EACH START LOCK AND ITS ADJACENT BLADE CLAMP WITH A CORRESPONDING LETTER. THIS WILL INSURE THAT EACH START LOCK WILL BE REINSTALLED WITH THE CORRECT BLADE CLAMP TO MAINTAIN THE SAME BLADE ANGLES FOR ENGINE START.

(6) Remove each start lock to allow access to preinstalled propeller mounting bolts.

(7) Align the two mounting bolts (already installed in the propeller hub flange) with the threaded bushings in the engine flange.

NOTE: Two propeller mounting bolts will already be installed in the propeller flange. Interference with blade clamps requires that the bolts be installed during propeller assembly.

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

(8) Slide the propeller flange onto the engine flange, against the starter ring gear and shim.

NOTE: Insert the engine bushings into the counterbores that encircle the propeller mounting bolts in the propeller flange.

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

(9) Thread the two preinstalled mounting bolts (Table 3-1) through the propeller flange from the propeller side, and into the bushings in the engine flange. Refer to Figure 3-10.

NOTE: Two of the mounting bolts are preinstalled during the assembly of the propeller. Replacement of one of these bolts between overhauls must be performed only by a certified propeller repair station with the appropriate rating.

(10) Install four mounting bolts (Table 3-1) in the remaining four mounting holes and thread them through the propeller flange from the propeller side into the bushings in the engine flange. Refer to Figure 3-10.

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

(11) Use a torque wrench with the appropriate torque wrench adapter to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

(12) Reinstall each start lock adjacent to the blade clamp that has a corresponding felt-tip marked letter.

(13) Safety all mounting bolts with 0.032 inch (0.810 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable and associated hardware (two bolts per safety).

NOTE: The mounting bolts that are adjacent to the start lock units must be safety-wired to the hex head bolts that attach the start lock brackets to the hub.

(14) 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, rotate 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 1-13/16 inch crowfoot wrench and a torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-1.1 for the proper torque value.

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

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

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.

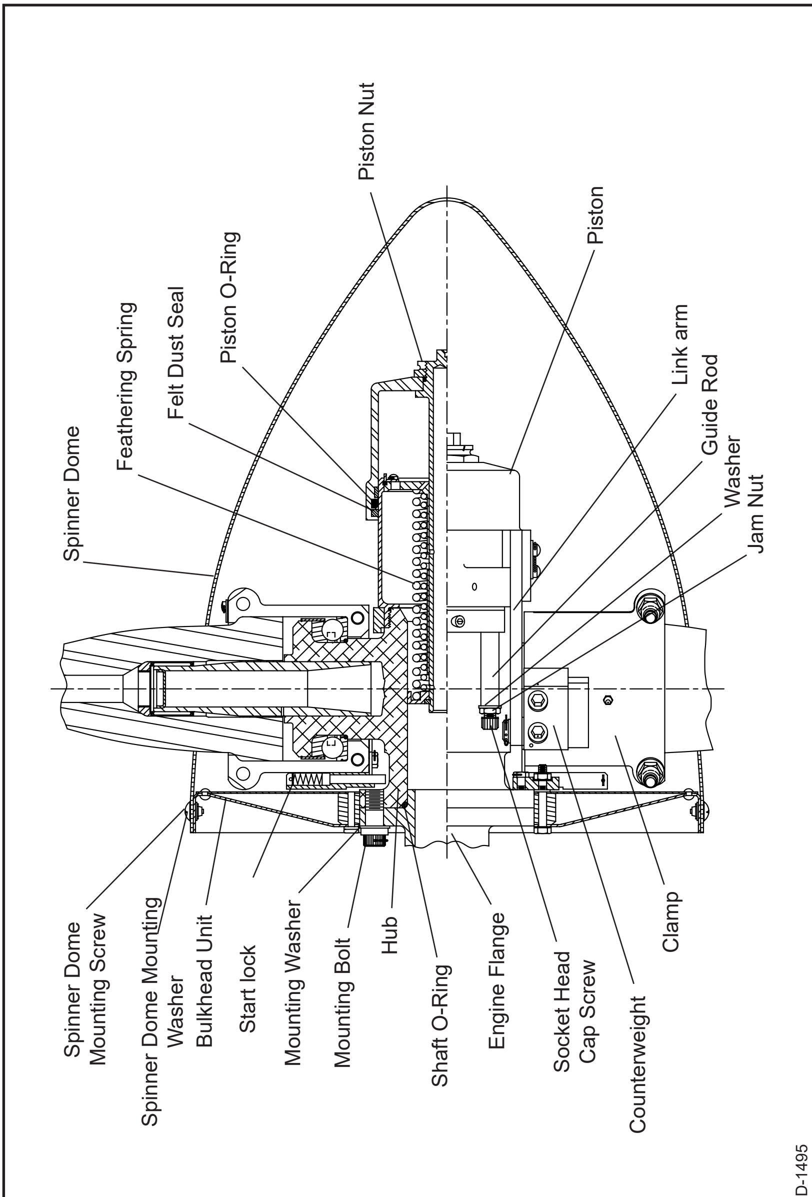
(16) Position the propeller on the start locks.

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

(17) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



(E,P)HC-A3(MV,V)F-2( )( ) Propeller Assembly
Figure 3-11

G. Installing Propeller Models, (E,P)HC-A3(MV,V)F-2( ) That Do Not Use a Spacer
Refer to Figure 3-11.

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(1) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller side of the hub flange. The dowel pins will protrude from the engine side of the hub flange to engage the engine flange.

WARNING 1: TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT MAY HAVE BEEN REMOVED TO ALLOW ROTATION OF THE BLADES BEFORE PACKAGING.

WARNING 2: 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.

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

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

WARNING: USE CAUTION DURING INSTALLATION IF THE START LOCKS HAVE BEEN ENGAGED TO FACILITATE INSTALLATION OF THE SPINNER BULKHEAD. IF THE BLADES ARE RELEASED SUDDENLY, THE EXTREME FORCE CAN CAUSE SERIOUS INJURY AND DAMAGE TO THE PROPELLER.

(4) If the spinner bulkhead is to be installed and is not already in place, perform the following steps:

NOTE: The start locks must be engaged to provide access to the spinner mounting bolts when installing the spinner bulkhead.

(a) Install the spinner bulkhead facing toward the engine.

(b) From the engine side of the bulkhead, insert the attaching bolts through the bulkhead and into the start lock units.

(c) Install the washers and locking nuts (Table 3-1) on the propeller side of the start lock to secure the attaching bolts and the bulkhead.

(5) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine flange.

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.

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 engine side 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 the appropriate torque wrench adapter (Figure 3-5) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

(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 1-13/16 inch crowfoot wrench and a torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-1.1 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.

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.

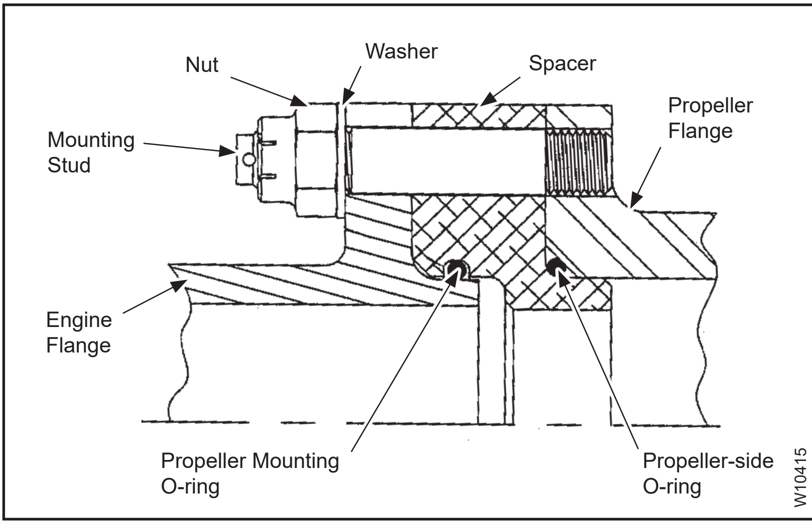
(13) Position the propeller on the start locks.

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

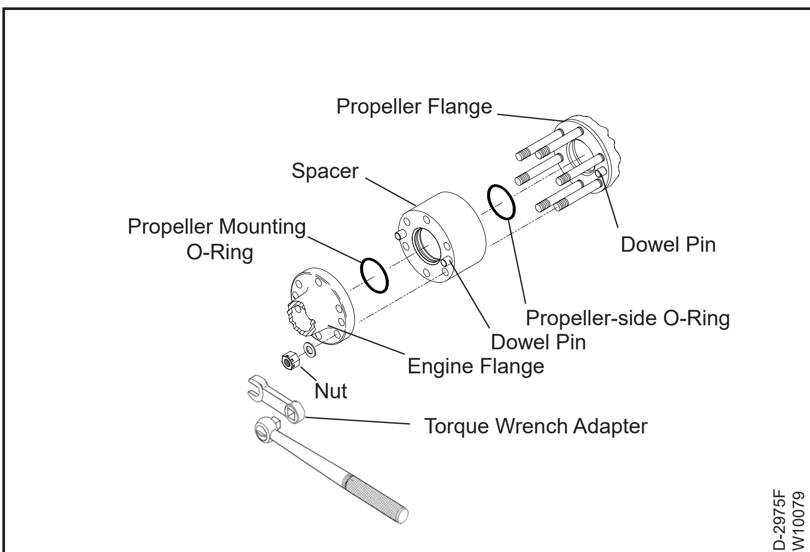
(14) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



EHC-A3(MV,V)F-2B Mounting Parts
Figure 3-12



EHC-A3(MV,V)F-2B Installation
Figure 3-13

H. Installing Propeller Models, EHC-A3(MV,V)F-2B That Use a Spacer

NOTE: Propellers that use a spacer are installed on, but not limited to, the Beech 95-55, -A55, -B55, Colemill Baron Aircraft Engines, and Aero Commander Aircraft. Refer to Figure 3-12 and Figure 3-13.

(1) If the spacer, four dowel pins, and spacer-to-propeller flange O-ring are already installed on the propeller, go to step (6) of this procedure.

WARNING: TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT MAY HAVE BEEN REMOVED IN ORDER TO ALLOW ROTATING OF THE BLADES BEFORE PACKAGING.

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(2) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller side of the hub flange. The dowel pins will protrude from the engine side of the hub flange to engage the engine flange.

(3) Install the propeller side O-ring (Table 3-1) on the spacer, facing the propeller flange. Refer to Figure 3-12 and Figure 3-13.

(4) 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. Refer to Figure 3-13.

(5) Press two dowel pins (Table 3-1) in the two 0.50 inch (12.7 mm) diameter holes in the spacer, approximately 0.50 inch (12.7 mm) deep. Refer to Figure 3-13.

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.

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

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

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

CAUTION: DO NOT INSTALL THE PROPELLER MOUNTING O-RING DIRECTLY ON THE ENGINE FLANGE.
STEEL HUB PROPELLERS WITH ALUMINUM SPACERS REQUIRE ONLY INSTALLATION OF A SINGLE PROPELLER MOUNTING O-RING INTO THE O-RING GROOVE INSIDE THE ALUMINUM SPACER.

(8) Install the propeller mounting O-ring (Table 3-1) into the recessed O-ring groove in the aluminum spacer. Refer to Figure 3-12 and Figure 3-13.

(9) Align the mounting and dowel pin holes in the engine flange with the mounting studs and dowel pins in the spacer.

(10) Slide the spacer and propeller on the engine flange.

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

<u>CAUTION 2</u>: NEW PROPELLER NUTS AND WASHERS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

(11) Install mounting washers and nuts (Table 3-1) onto the mounting studs that protrude through the engine side of the engine flange. Refer to Figure 3-13.

<u>NOTE</u>: For propeller removals between overhaul intervals, studs, nuts, and washers may be reused if they are not damaged or corroded.

(12) Use a torque wrench with the appropriate torque wrench adapter (Figure 3-13) to torque all mounting nuts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

<u>NOTE</u>: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting nuts to half of the final torque, beginning with any mounting nut, and moving around the clock in either direction.

(b) Final torque the mounting nuts in sequence, beginning with any mounting nut, and moving around the clock in either direction.

(13) 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 1-13/16 inch crowfoot wrench and a torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-1.1 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.

(14) Remove the wires from the start lock brackets, if applicable.

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.

(15) Position the propeller on the start locks.

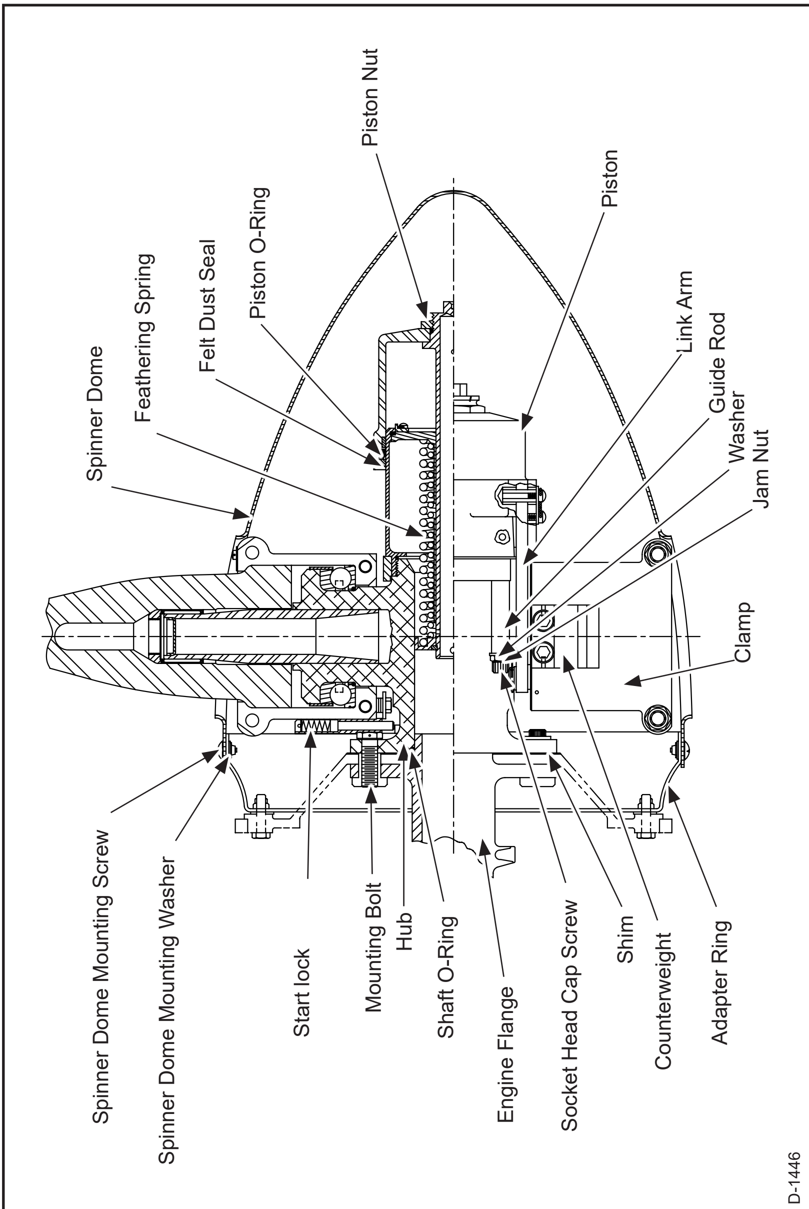
(a) Using the blade paddles, slowly rotate the blades simultaneously toward low pitch until the start lock pins engage the start lock plates.

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

(17) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



HC-A3(MV,V)K-2( )( ) Propeller Assembly
Figure 3-14

I. Installing Propeller Models, HC-A3(MV,V)K-2( )( )
Refer to Figure 3-14.

WARNING 1: TO FACILITATE BOXING AND SHIPPING OF THE PROPELLER, THE PISTON NUT MAY HAVE BEEN REMOVED IN ORDER TO ALLOW 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 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.

(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 AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

(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 ring gear. Refer to Figure 3-10.

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 (Table 3-1) on the engine shaft between the starter ring gear and the propeller flange. Refer to Figure 3-10.

(5) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine flange.

CAUTION: USING A FELT-TIPPED PEN, IDENTIFY EACH START LOCK AND ITS ADJACENT BLADE CLAMP WITH A CORRESPONDING LETTER. THIS WILL INSURE THAT EACH START LOCK WILL BE REINSTALLED WITH THE CORRECT BLADE CLAMP TO MAINTAIN THE SAME BLADE ANGLES FOR ENGINE START.

(6) Remove each start lock to allow access to preinstalled propeller mounting bolts.

(7) Align the three mounting bolts (already installed in the propeller hub flange) with the threaded bushings in the engine flange.

NOTE: Three 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.

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

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

NOTE: Insert the engine bushings into the counterbores that encircle the propeller mounting bolts in the propeller flange.

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

(9) Thread the three mounting bolts (Table 3-1) through the propeller flange from the propeller side, and into the bushings in the engine flange. Refer to Figure 3-10.

(10) Install three mounting bolts in the remaining three mounting holes and thread them through the propeller flange from the propeller side, into the bushings in the engine flange. Refer to Figure 3-10.

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

(11) Use a torque wrench with the appropriate torque wrench adapter (Figure 3-7) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

(12) Reinstall each start lock adjacent to the blade clamp that has a corresponding felt-tip marked letter.

(13) Safety all mounting bolts with 0.032 inch (0.810 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable and associated hardware (two bolts per safety).

NOTE: The mounting bolts that are adjacent to the start lock units must be safety-wired to the hex head bolts that attach the start lock brackets.

(14) 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 1-13/16 inch crowfoot wrench and a torque wrench, torque the piston nut. Refer to Table 3-2 and Figure 3-1.1 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.

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

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.

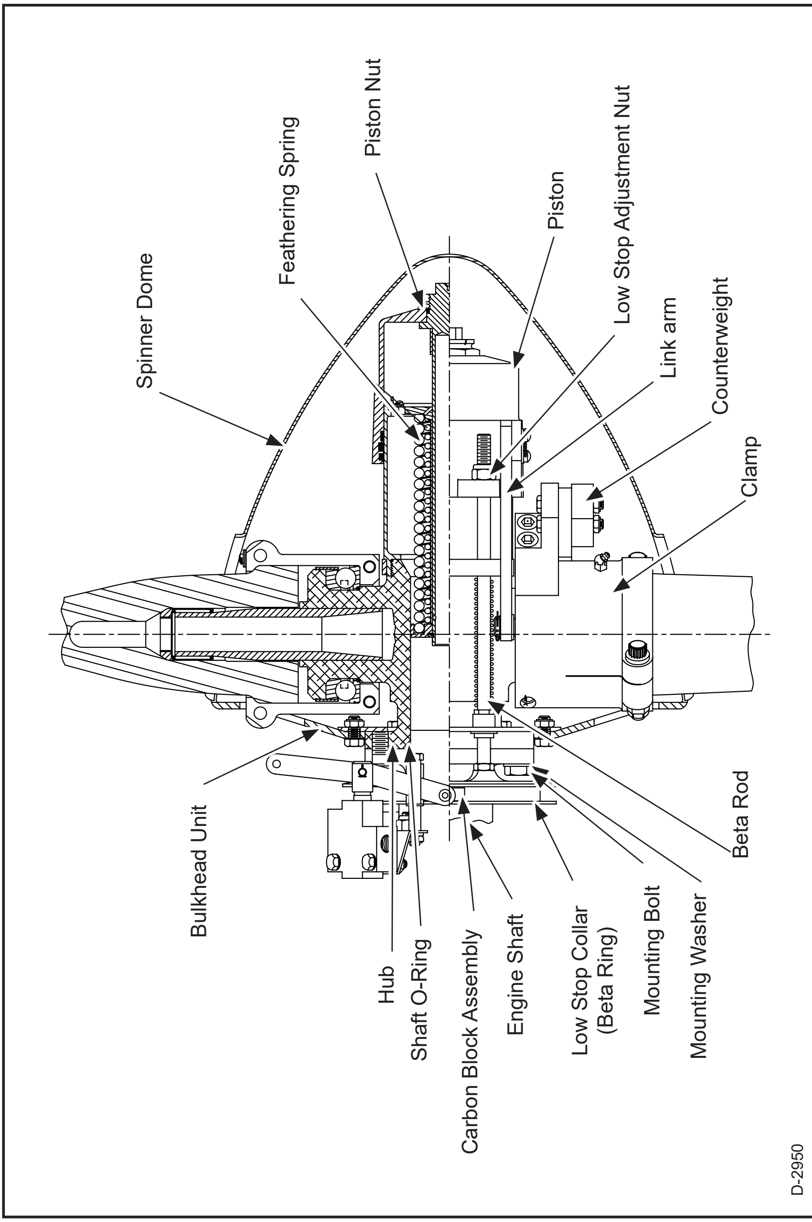
(16) Position the propeller on the start locks.

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

(17) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



BHC-A2(MV,V)F-3 Propeller Assembly
Figure 3-15

J. Installing Propeller Models, BHC-A2(MV,V)F-3
Refer to Figure 3-15.

(1) Use a beta system puller CST-2987 (Figure 3-16) to compress the beta system and pull the beta ring forward to allow installation of the double hex head propeller mounting fasteners.

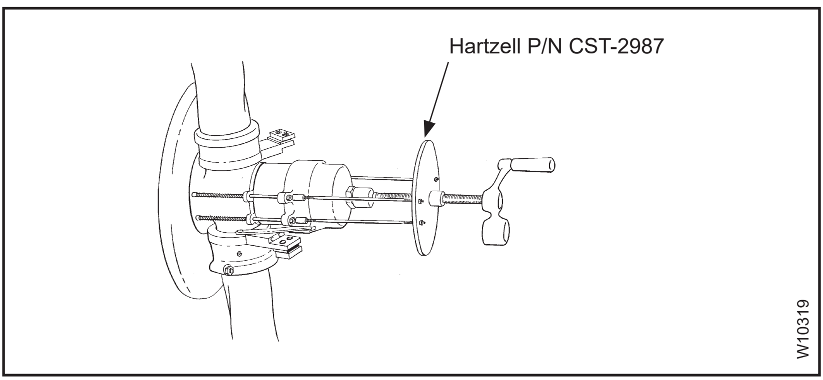
WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

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.

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

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



Tool for Decompressing External Beta System
Figure 3-16

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(4) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller side of the hub flange. The dowel pins will protrude from the engine side of the hub flange to engage the engine flange.

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

(6) Align the mounting and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins or mounting studs in the engine flange. Refer to Figure 3-5.

(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 AND THE ENGINE FLANGE.

CAUTION 2: NEW PROPELLER MOUNTING BOLTS 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 3-15.

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 the appropriate torque wrench adapter (Figure 3-5) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

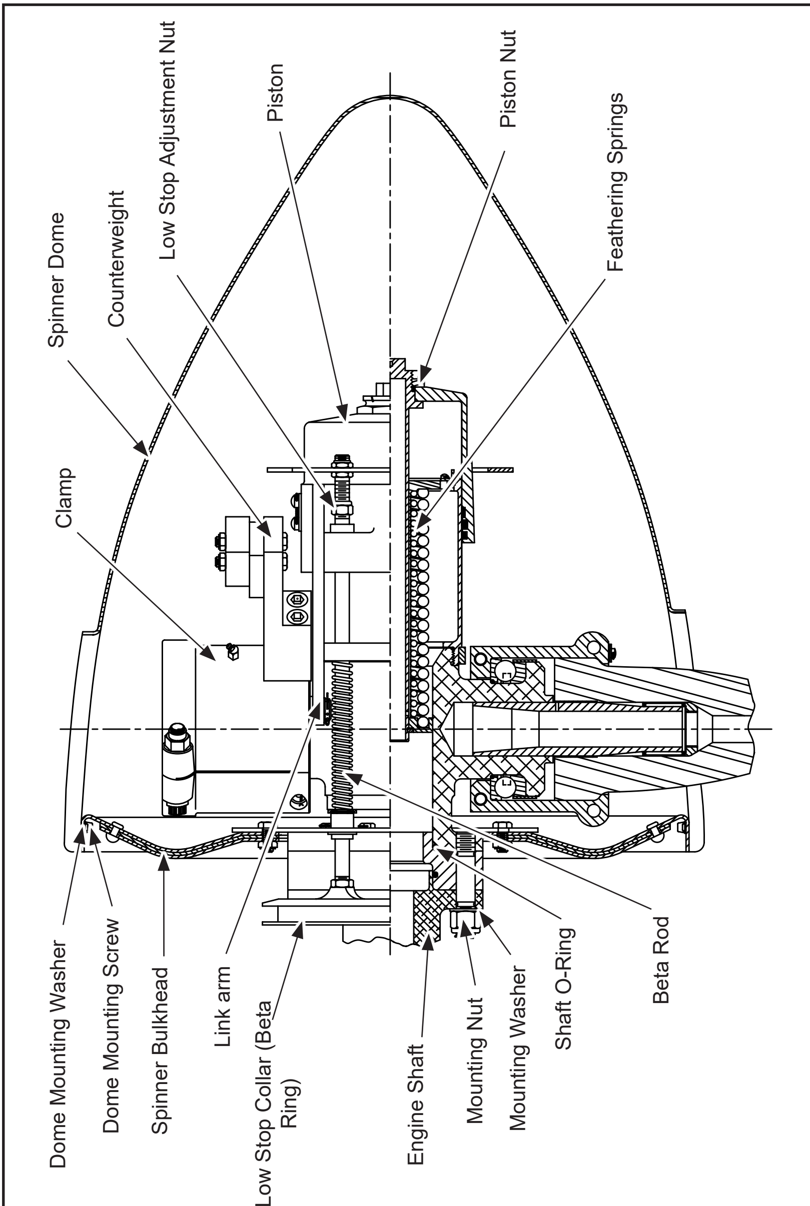
(11) Decompress and remove the beta system puller.

(12) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

(14) Install the beta valve, governor, and linkage in accordance with the section, "Beta Valve Assembly, Governor, and Linkage Installation" in this chapter.

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



HC-A3(MV,V)F-3L Propeller Assembly
Figure 3-17

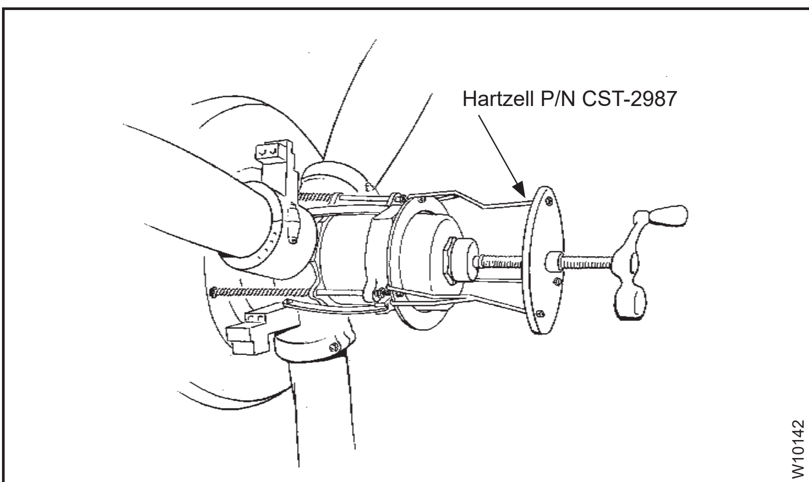
K. Installing Propeller Models, HC-A3(MV,V)F-3L
Refer to Figure 3-17.

(1) Use a beta system puller CST-2987 (Figure 3-18) to compress the beta system and pull the beta ring forward to allow installation of the double hex head 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.



Tool for Decompressing External Beta System
Figure 3-18

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

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

(4) If dowel pins are not installed in the spacer and propeller flange, perform the following steps:

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(a) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller-side of the hub flange.

NOTE: The dowel pins will protrude from the hub flange surface facing the engine, to engage the spacer.

CAUTION: INSERT THE DOWEL PINS INTO THE SPACER USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE SPACER.

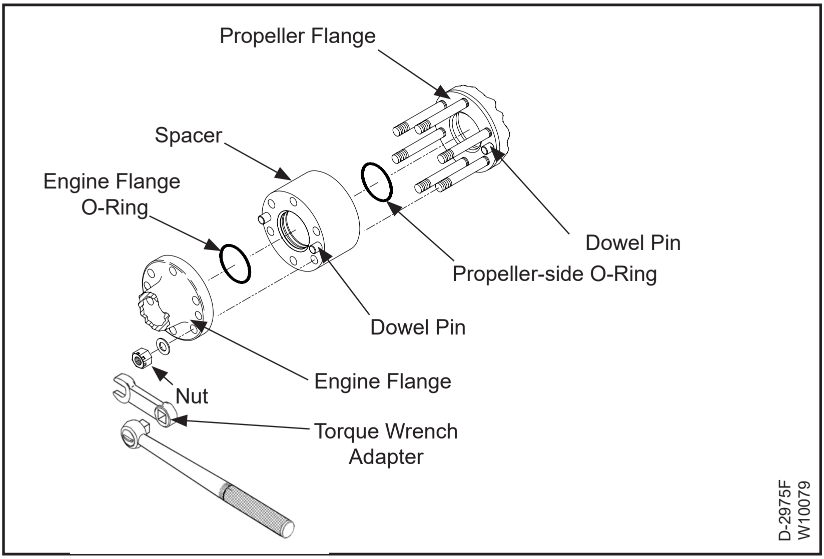
(b) Insert two dowel pins (Table 3-1) into the dowel pin holes on the engine-side of the spacer. Refer to Figure 3-19.

NOTE: The dowel pins must protrude 0.50 inch (12.7 mm) from the engine side of the spacer.

(5) Install the specified O-ring (Table 3-1) on the side of the spacer, facing the propeller flange.

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

(7) Slide the spacer onto the propeller flange.



HC-A3(MV,V)F-3L Installation
Figure 3-19

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

(8) Install the specified O-ring (Table 3-1) in the inside diameter groove of the spacer, facing the engine.

(9) Align the mounting and dowel pin holes in the engine flange with the mounting studs and dowel pins in the spacer.

(10) Slide the spacer and propeller onto the engine flange.

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

CAUTION 2: NEW PROPELLER NUTS AND WASHERS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

(11) Install mounting washers and nuts (Table 3-1) onto the mounting studs that protrude through the engine side of the engine flange. Refer to Figure 3-19.

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

CAUTION: MAKE SURE THE STUDS DO NOT TURN WHEN THE MOUNTING NUTS ARE TORQUED. ALLOWING THE STUDS TO TURN WILL LOAD THEM AGAINST THE SPINNER MOUNTING PLATE AND MAY LEAD TO FAILURE OF THE SPINNER MOUNTING BOLTS.

(12) Use a torque wrench with the appropriate torque wrench adapter (Figure 3-19) to torque all mounting nuts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting nuts to half of the final torque, beginning with any mounting nut, and moving around the clock in either direction.

(b) Final torque the mounting nuts in sequence, beginning with any mounting nut, and moving around the clock in either direction.

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

(14) Decompress and remove the beta system puller.

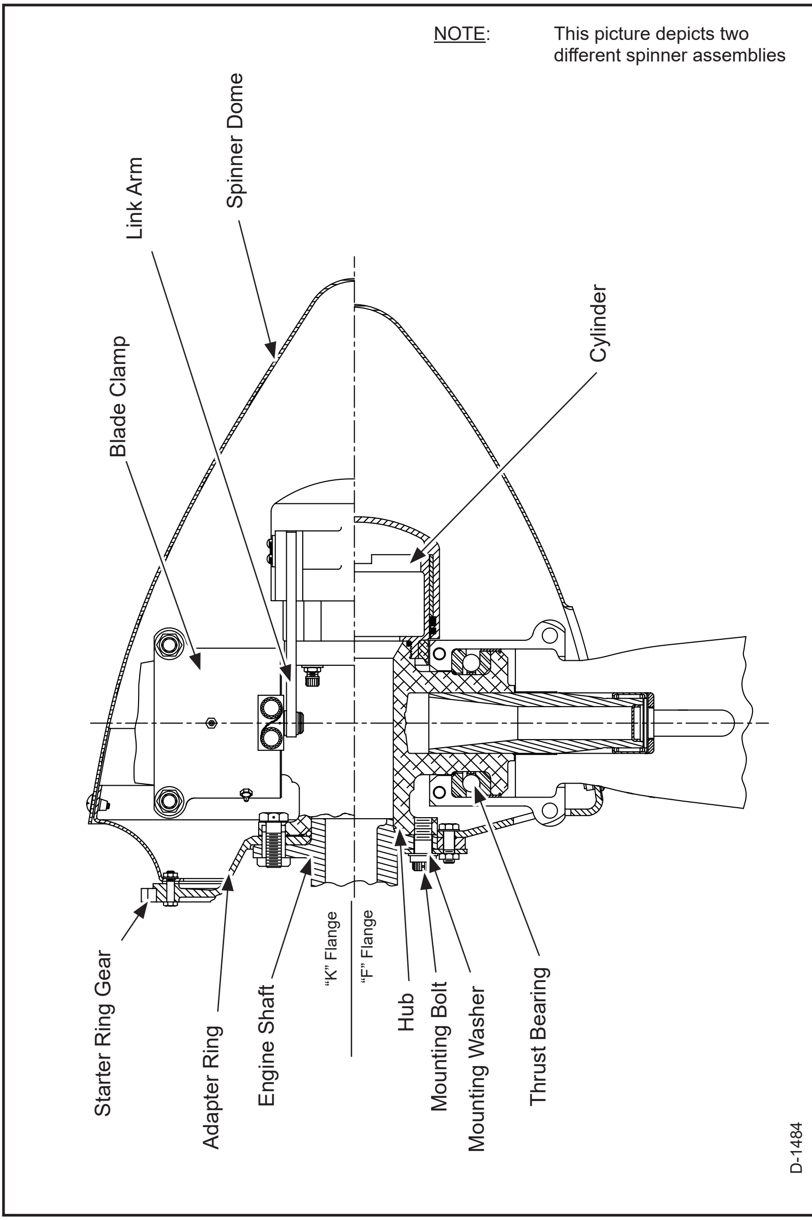
(15) Install, adjust, and safety the beta linkage in accordance with the airframe manufacturer's instructions.

(16) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

(14) Install the beta valve, governor, and linkage in accordance with the section, "Beta Valve Assembly, Governor, and Linkage Installation" in this chapter.

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



(E,P)HC-A3(MV,V)(F,K)-4( ) Propeller Assembly
Figure 3-20

L. Installing Propeller Models, (E,P)HC-A3(MV,V)F-4( )
Refer to Figure 3-20.

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(1) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller side of the hub flange. The dowel pins will protrude from the engine side of the hub flange to engage the engine flange.

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.

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

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

(4) PHC-A3(MV,V)F-4( ) Models only:

   (a) Slide the ring for the spinner mounting onto the engine flange.

   (b) Position the two piece plate (Table 3-1) against the engine side of the engine flange.

   (c) Position the spinner bulkhead on the propeller side of the ring for the spinner mounting.

   (d) Install the hex head bolts from the propeller side, through four holes in the bulkhead, adapter ring, and two piece plates to secure all three together.

   (e) Install the washer and nut on each bolt from the engine side.

   (f) Torque the bolts/nuts in accordance with Table 3-2, "Torque Table".

(5) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine shaft.

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

CAUTION 2: USE CARE TO AVOID SCRAPING ALUMINUM FROM THE BORE OF THE SPINNER BULKHEAD. SCRAPINGS COULD BECOME WEDGED BETWEEN THE FLANGES.

(7) Slide the propeller onto the engine shaft.

<u>CAUTION</u>: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

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

<u>NOTE</u>: 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 the appropriate torque wrench adapter (Figure 3-5) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

<u>NOTE</u>: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

(11) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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

M. Installing Propeller Models, HC-A3(MV,V)K-4
Refer to Figure 3-20.

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.

(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 AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

(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 ring gear. Refer to Figure 3-6.

(4) Align the blade openings in the adapter ring to the propeller blade positions.

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

(5) Install the shim (Table 3-1) on the engine shaft between the starter ring gear and the propeller flange. Refer to Figure 3-6.

(6) Lubricate the specified shaft O-ring (Table 3-1) and install it on the engine flange. Refer to Figure 3-6.

(7) Align the three mounting bolts (already installed in the propeller hub flange) with the threaded bushings in the engine flange.

NOTE: Three 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.

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

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

NOTE: Insert the engine bushings into the counterbores that encircle the propeller mounting bolts in the propeller flange.

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

(9) Thread the three mounting bolts (Table 3-1) through the propeller flange from the propeller side, and into the bushings in the engine flange. Refer to Figure 3-6 and Figure 3-7.

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

(10) Use a torque wrench with the appropriate torque wrench adapter (Figure 3-7) to torque all mounting bolts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

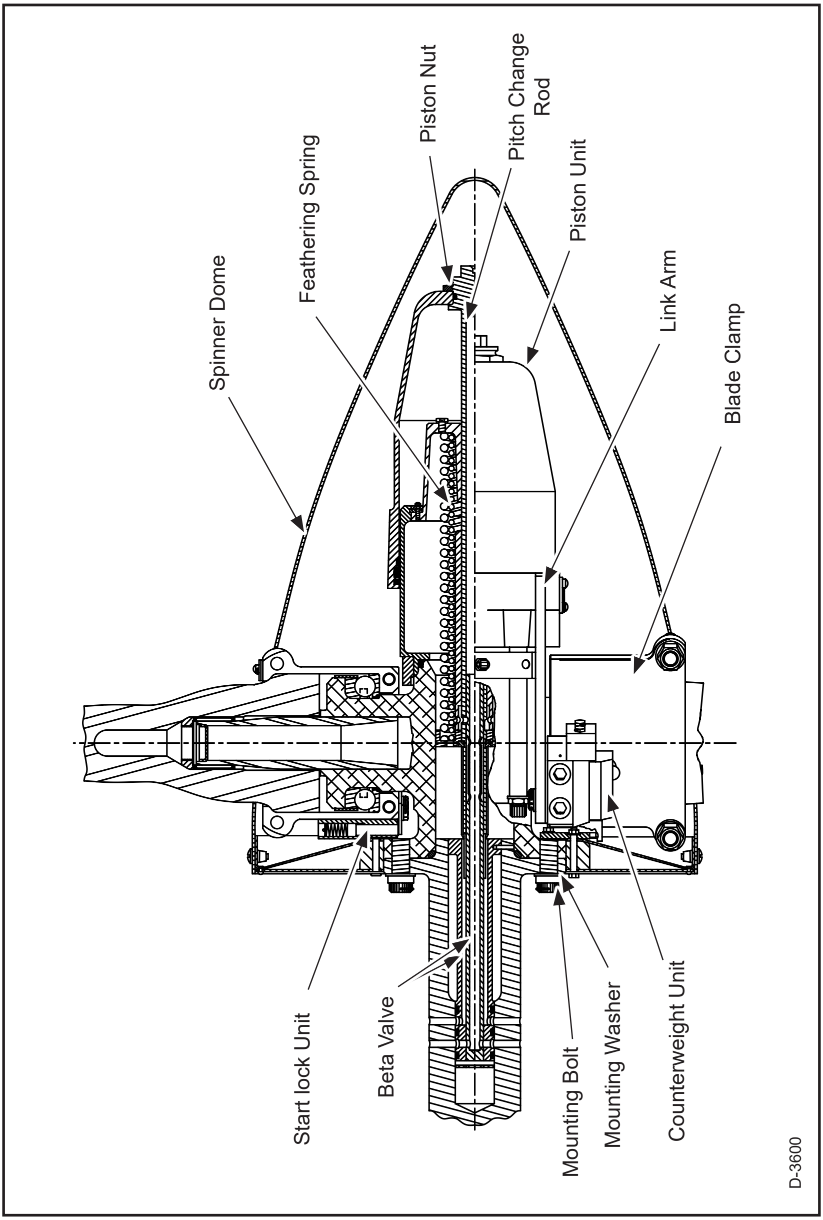
(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

(12) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



HC-A3(MV,V)F-5A(L) Propeller Assembly
Figure 3-21

N. Installing Propeller Models, HC-A3(MV,V)F-5A(L)
Refer to Figure 3-21.

(1) Install the beta valve inside the engine shaft. Refer to the engine manufacturer's instructions.

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.

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

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

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

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

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

CAUTION 2: MAKE SURE THE PITCH CHANGE ROD ACCURATELY ALIGNS WITH THE ENGINE-MOUNTED BETA VALVE. MISALIGNMENT WILL DAMAGE THE BETA VALVE AND/OR THE PITCH CHANGE ROD.

(6) Slide the propeller 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 with washers through the engine flange and into the propeller hub flange. Refer to Figure 3-21.

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

(8) Use a torque wrench with the appropriate torque wrench adapter to torque all mounting bolts in sequences and steps shown in Figure 3-2. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting bolts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the bolts in sequence, beginning with any mounting bolt, and moving around the clock in either direction.

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

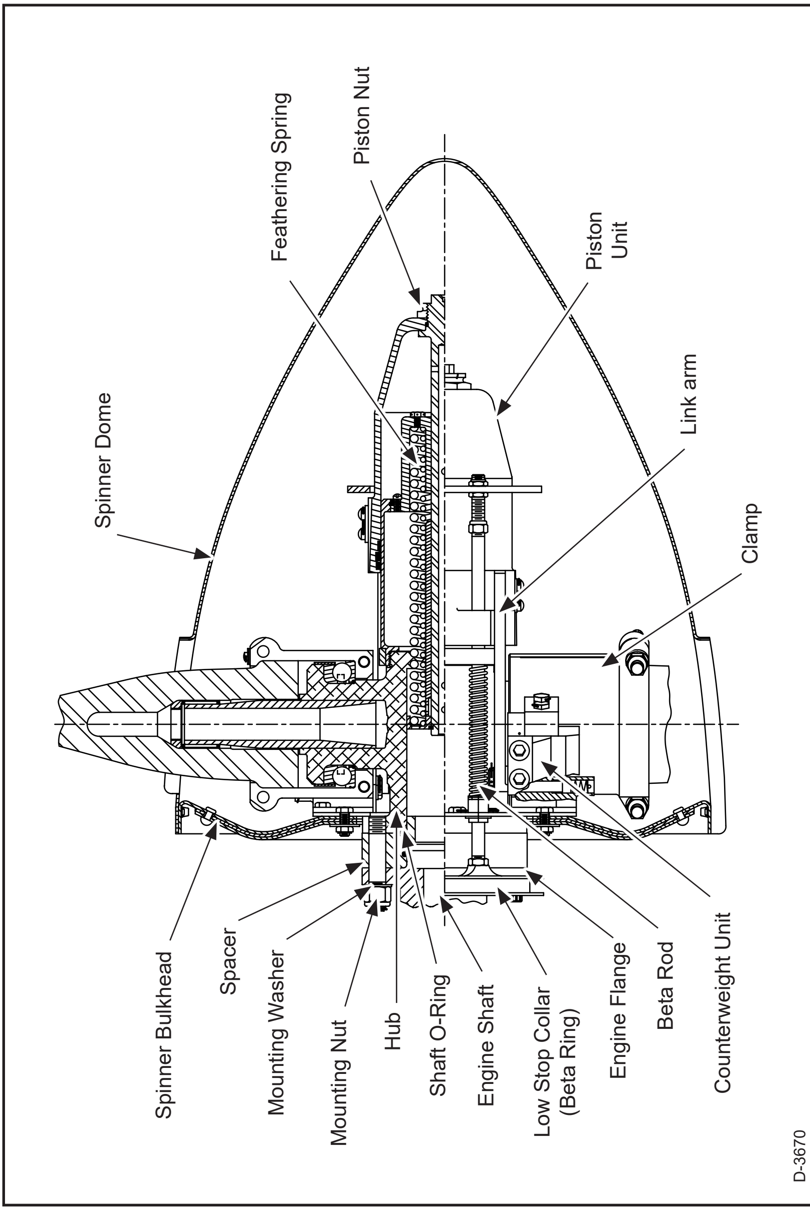
(10) Install the beta tube per the airframe and/or engine manufacturer's instructions.

NOTE 1: Follow the airframe manufacturer's instructions for adjusting the beta tube to obtain the correct low pitch (flight idle blade angle).

NOTE 2: Refer to the Aircraft Type Certificate Data Sheet for the low pitch blade angle setting.

(11) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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



(P)HC-A3(MV,V)F-5R Propeller Assembly
Figure 3-22

O. Installing Propeller Models, (P)HC-A3(MV,V)F-5R
Refer to Figure 3-22.

(1) Use a beta system puller CST-2987 (Figure 3-16) to compress the beta system and pull the beta ring forward to allow installation of the propeller mounting nuts and washers.

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.

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

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

(4) If dowel pins are not installed in the spacer and propeller flange, perform the following steps:

CAUTION: INSERT THE DOWEL PINS INTO THE PROPELLER FLANGE USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE PROPELLER FLANGE.

(a) Insert two dowel pins (Table 3-1) through the threadless holes in the propeller flange, flush with the propeller-side of the hub flange.

NOTE: The dowel pins will protrude from the hub flange surface facing the engine, to engage the spacer.

CAUTION: INSERT THE DOWEL PINS INTO THE SPACER USING A BRASS HAMMER OR EQUIVALENT TOOL TO PREVENT DAMAGE TO THE DOWEL PINS. THE DOWEL PINS ARE AN INTERFERENCE FIT WITH THE SPACER.

(b) Insert two dowel pins (Table 3-1) into the dowel pin holes on the engine-side of the spacer. Refer to Figure 3-23.

NOTE: The dowel pins must protrude 0.50 inch (12.7 mm) from the engine side of the spacer.

(5) Install the specified O-ring (Table 3-1) on the side of the spacer, facing the propeller flange.

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

(7) Slide the spacer onto the propeller flange.

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

(8) Install the specified O-ring (Table 3-1) in the inside diameter groove of the spacer, facing the engine.

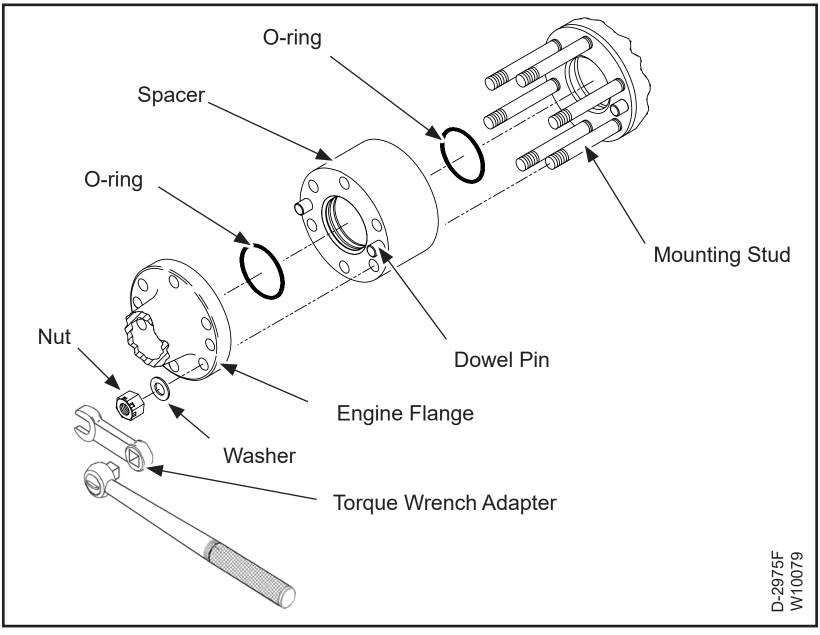
CAUTION: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE ENGINE HUB FLANGE AND THE SPACER.

(9) Align the mounting and dowel pin holes in the engine flange with the mounting studs and dowel pins in the spacer.

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

(10) Install mounting washers and nuts (Table 3-1) onto the protruding studs in the engine flange. Refer to Figure 3-23.

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



(P)HC-A3(MV,V)F-5R Installation
Figure 3-23

CAUTION: MAKE SURE THE STUDS DO NOT TURN WHEN THE NUTS ARE TORQUED. ALLOWING THE STUDS TO TURN WILL LOAD THEM AGAINST THE SPINNER MOUNTING PLATE AND MAY LEAD TO FAILURE OF THE SPINNER MOUNTING BOLTS.

(11) Use a torque wrench with the appropriate torque wrench adapter (Figure 3-5) to torque all mounting nuts in sequence. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

NOTE: Refer to the Tools, Consumables, and Expendables section in this chapter for a list of applicable torque wrench adapters.

(a) Torque the mounting nuts to half of the final torque, beginning with any mounting bolt, and moving around the clock in either direction.

(b) Final torque the nuts in sequence, beginning with any mounting nut, and moving around the clock in either direction.

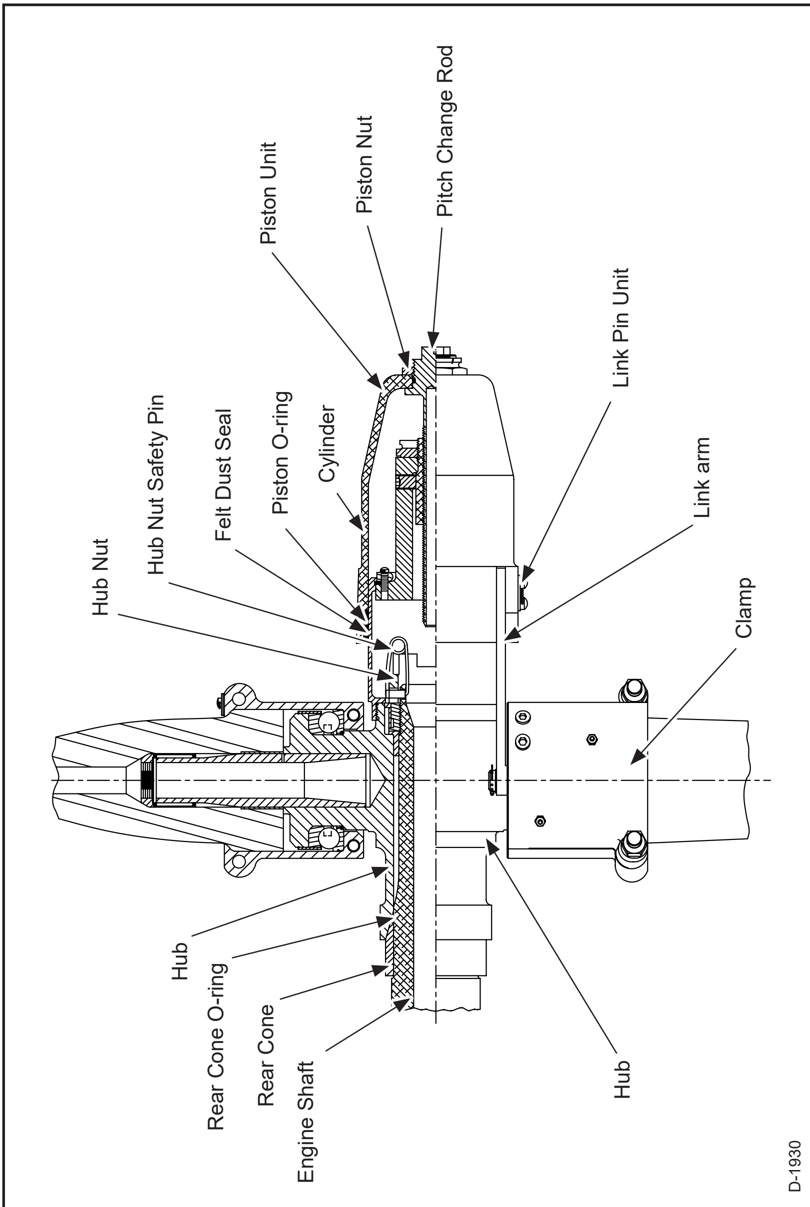
(12) Safety all mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable and associated hardware (two studs per safety).

(13) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

(15) Install the beta valve, governor, and linkage in accordance with the section, "Beta Valve Assembly, Governor, and Linkage Installation" in this chapter.

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



HA-A2(MV,V)20-1B Propeller Assembly
Figure 3-24

P. Installing Splined Propeller Models, HA-A2(MV,V)20-1B Refer to Figure 3-24.

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.

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

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

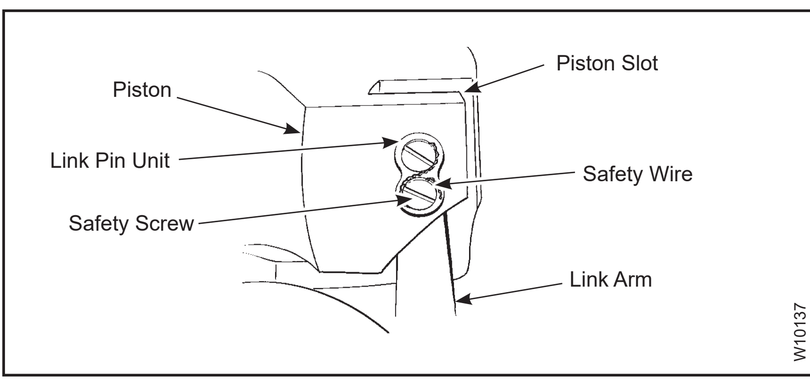
(2) Piston Removal (Refer to Figure 3-24 and Figure 3-25.)

(a) Remove the piston nut.

(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.



Piston-to-Link Arm Attachment Details
Figure 3-25

(e) The piston ears and link arms should have corresponding index numbers (1 and 2) impression-stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

NOTE: This will insure that the components are reassembled in their original location.

(f) Slide the link arms out of the piston slots.

(g) Slide the piston off the cylinder.

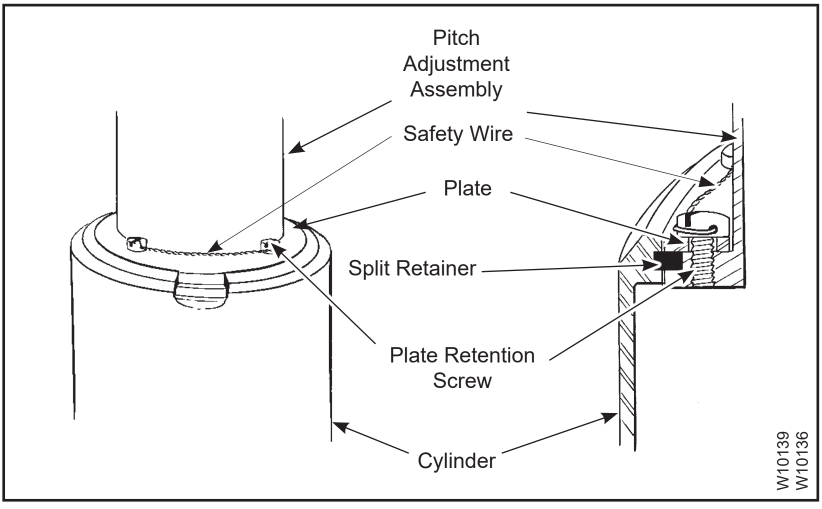
CAUTION: THE PITCH ADJUSTMENT ASSEMBLY MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE PITCH ADJUSTMENT ASSEMBLY HAS ALREADY BEEN REMOVED, PROCEED TO STEP (4) OF THIS PROCEDURE.

(3) Pitch adjustment assembly removal

Refer to Figure 3-26.

(a) Remove the plate retention screw safety wire (if installed).

(b) Remove the plate retention screws.



Pitch Adjustment Assembly-to-Cylinder Attachment Details
Figure 3-26

(c) Remove the plate.

(d) Remove the split retainer.

(e) Remove the pitch adjustment assembly from the cylinder.

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

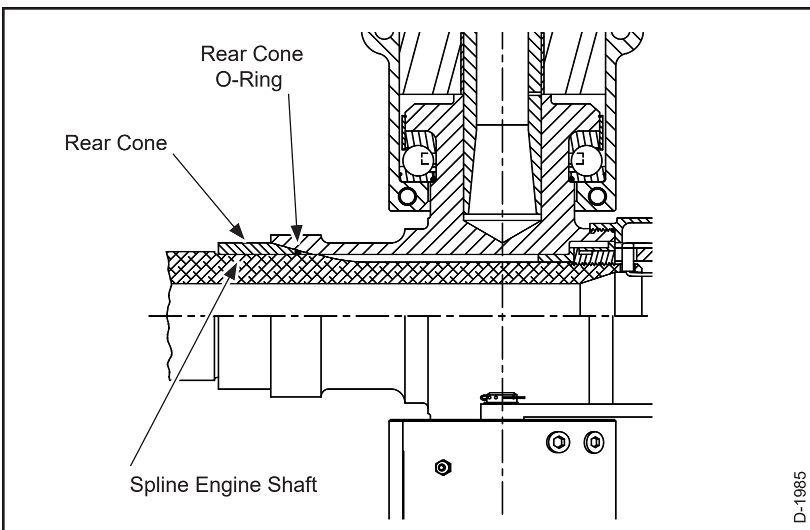
(4) Clean the propeller hub spline and engine spline surfaces with Quick Dry Stoddard Solvent or MEK.

(5) Slide the spinner bulkhead onto the shaft.

(6) Install the rear cone onto the engine, with the tapered end of the cone facing the propeller hub. Refer to Figure 3-27.

(7) Install the rear cone O-ring (Table 3-1) over the shaft. Refer to Figure 3-27.

(8) Slide the propeller hub onto the engine shaft and tighten the shaft nut.



Rear Hub Mounting Parts on HA-A2(MV,V)20-1B Propeller
Figure 3-27

(9) Torque the propeller shaft nut using tool BST-2910. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

(10) Safety the shaft nut (Table 3-1) to the engine shaft using a hub nut safety pin (Table 3-1). Refer to Figure 3-28.

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

(11) Install the pitch adjustment assembly into the cylinder.

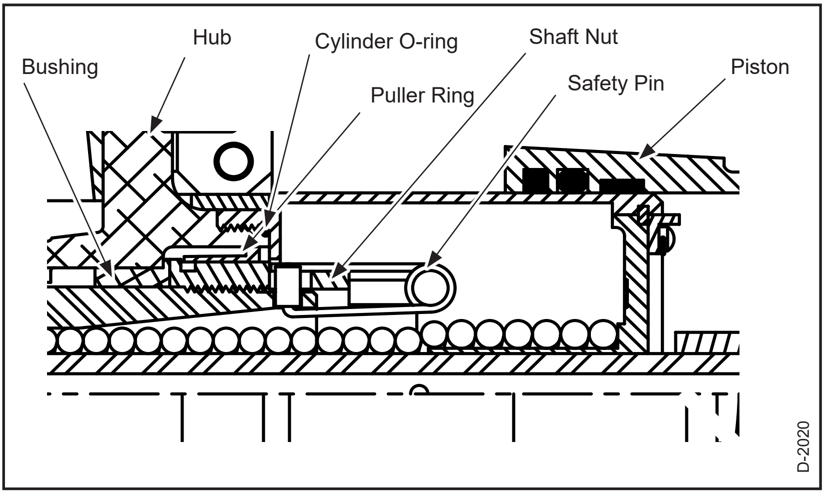
(12) Install the split retainer into the recess in the cylinder.

(13) Pull the pitch adjustment assembly forward, tight against the split retainer, locking the split retainer into place.

(14) Install the ring retention plate, which secures the split retainer, into place.

(15) Install the plate retention screws and tighten them until snug.

(16) Safety the plate screws using 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two screws per safety).



Safetying the Shaft Nut on the Propeller
Figure 3-28

(17) 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 3-29.

(a) Lubricate the piston O-ring and carefully install it in the inner groove provided for it in the piston.

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

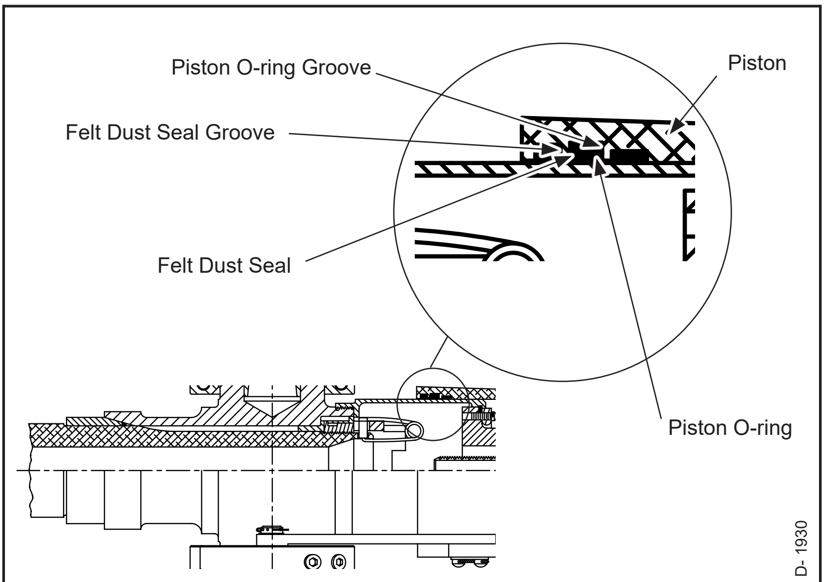
NOTE: Cut the felt dust seal material on a 30 degree diagonal so there will be an overlap with a smooth, fuzz-free surface.

(c) Soak the felt dust seal material in aviation grade reciprocating engine oil until it is completely saturated.

(d) Squeeze the excess oil from the felt dust seal.

(e) Install the felt dust seal material in the outer groove provided for it in the piston.

(f) Install the rod O-ring (Table 3-1) in the groove at the end of the threaded portion of the pitch change rod.



Installing Piston O-ring and Felt Dust Seal
Figure 3-29

CAUTION: TO MAINTAIN PROPER BLADE ANGLES, REINSTALL THE PISTON 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.

(18) Locate and match up the index numbers (1 and 2) 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.

(19) Oil the surface of the cylinder.

(20) Slide the piston onto the cylinder.

(21) Slide the link arms into the piston slots.

(22) Connect the link arms to the piston.

(23) Install the link pin units.

(24) Install the link pin safety screws.

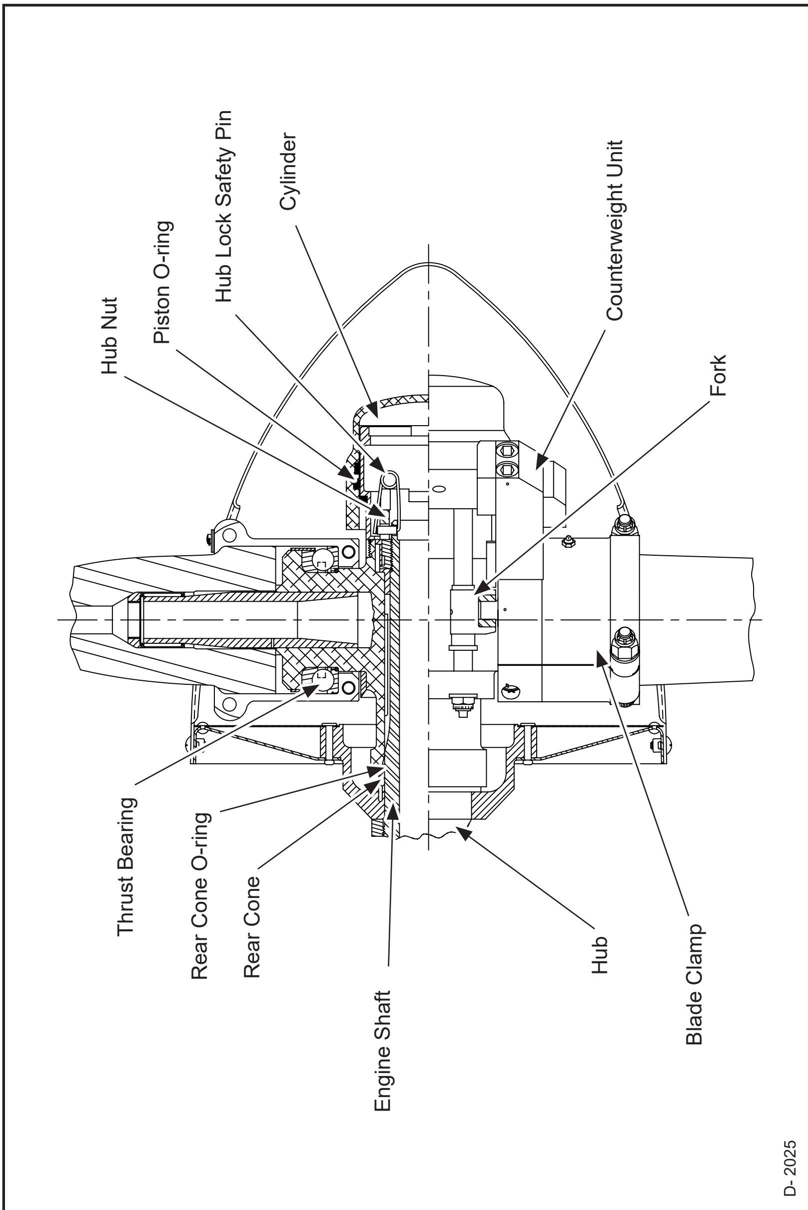
(25) Safety the link pin screws together with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. Refer to Figure 3-25.

(26) Rotate the blades to a higher pitch to seat the piston onto the pitch change rod.

(27) Install the piston nut and torque in accordance with Table 3-2, "Torque Table".

(28) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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



HC-A2(MV,V)20-1A Propeller Assembly
Figure 3-30

Q. Installing Splined Propeller Models, HC-A2(MV,V)20-1A Refer to Figure 3-30.

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.

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

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

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

(2) Piston removal

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

NOTE: This will insure that the components are reassembled in their original location.

(b) Move the piston to low pitch.

(c) Loosen the set screw in each fork.

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

(e) Remove the self-locking nut from the end of each guide rod.

(f) Remove the washer from each guide rod.

(g) Lift the piston from the cylinder.

(h) Remove the sleeve from each bulkhead boss.

(i) Remove the high stop spacer from each sleeve.

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

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

(4) Slide the 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. Refer to Figure 3-27. Push the cone against the bulkhead.

(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.

(8) 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.

(9) Carefully slide the spinner dome over the installed propeller.

(10) To properly position the rear bulkhead, temporarily install the spinner dome using at least three screws.

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

(12) Remove the spinner dome.

(13) Torque the propeller shaft nut (Table 3-1) using tool BST-2910. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

(14) Safety the hub nut using the hub lock safety pin (Table 3-1). Refer to Figure 3-28.

(15) 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 3-29.

(a) Lubricate the piston O-ring and carefully install it in the inner groove provided for it in the piston.

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

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

(c) Soak the felt dust seal material in aviation grade reciprocating engine oil until it is completely saturated.

(d) Squeeze the excess oil from the felt dust seal.

(e) Install the felt dust seal material in the outer groove provided for it in the piston.

(f) 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, REINSTALL THE PISTON 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.

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

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

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

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

(19) Oil the entire surface of the cylinder.

(20) 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.

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

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

(23) 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.

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

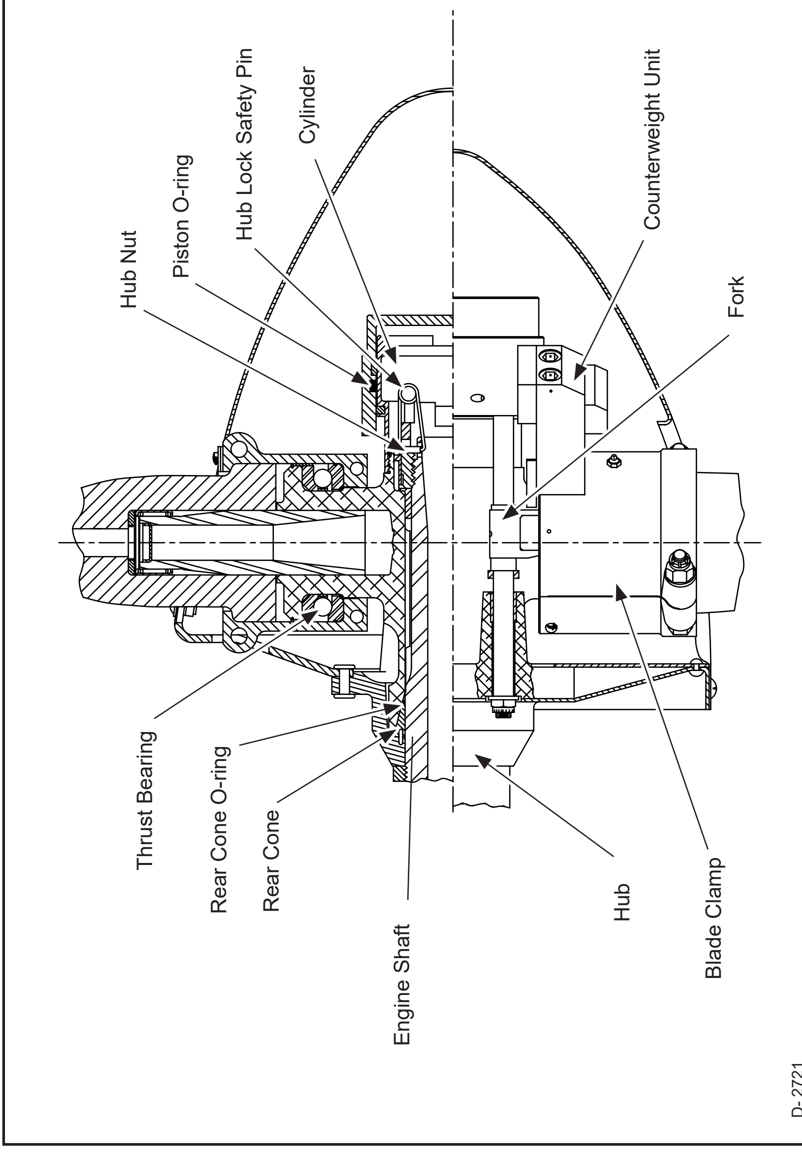
(25) Tighten the set screw in each fork until snug.

(26) Safety the set screws.

(27) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

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

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



HC-A3(MV,V)20-1( ) Propeller Assembly
Figure 3-31

R. Installing Splined Propeller Models, HC-A3(MV,V)20-1( ) Refer to Figure 3-31.

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.

(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.

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

(2) Piston removal

(a) 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 insure that the components are reassembled in their original location.

(b) Move the piston to low pitch.

(c) Loosen the set screw in each fork.

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

(e) Remove the self-locking nut from the end of each guide rod.

(f) Remove the washer from each guide rod.

(g) Lift the piston from the cylinder.

(h) Remove the sleeve from each bulkhead boss.

(i) Remove the high stop spacer from each sleeve.

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

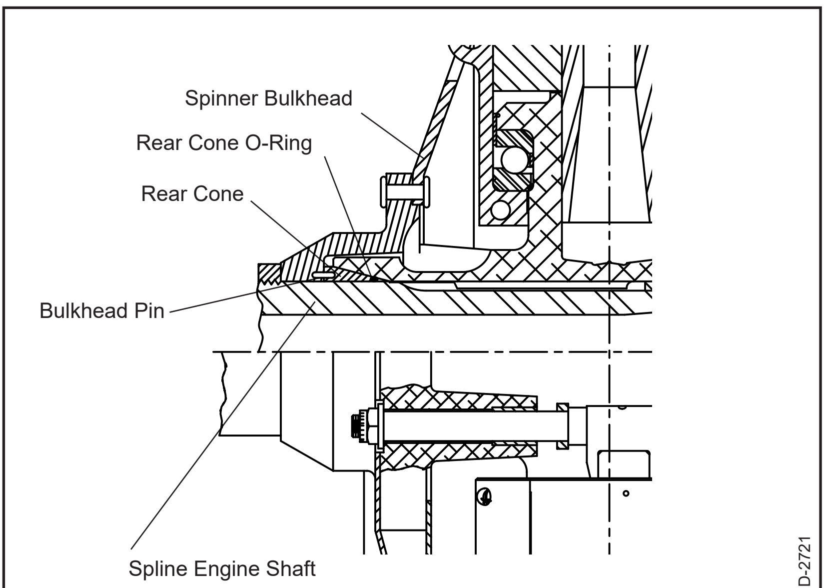
(3) Clean the propeller hub spline and engine spline surfaces with Quick Dry Stoddard Solvent or MEK.

(4) If the rear cone is not installed, install it on the bulkhead, matching the holes in the cone with the pins in the bulkhead. Push the cone against the bulkhead.

(5) Slide the rear spinner bulkhead onto the engine shaft.

(6) Install the rear cone O-ring (Table 3-1) over the shaft and against the cone. Refer to Figure 3-32.

(7) Slide the propeller hub onto the engine shaft and tighten the hub nut until the rear bulkhead is snug, but not tight. Do not torque the nut.



Rear Hub Mounting Parts on HC-A3(MV,V)20-1( ) Propeller
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 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 with at least four 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 (Table 3-1). Refer to Table 3-2 and Figure 3-1.1 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 3-28.

(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 3-29.

(a) Lubricate the piston O-ring and carefully install it in the inner groove provided for it in the piston.

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

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

(c) Soak the felt dust seal material in aviation grade reciprocating engine oil until it is completely saturated.

(d) Squeeze the excess oil from the felt dust seal.

(e) Install the felt dust seal material in the outer groove provided for it in the piston.

(f) 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, REINSTALL THE PISTON 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 spacer(s) (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) Install the piston:

(a) Engage the forks on the pitch change blocks.

(b) 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.

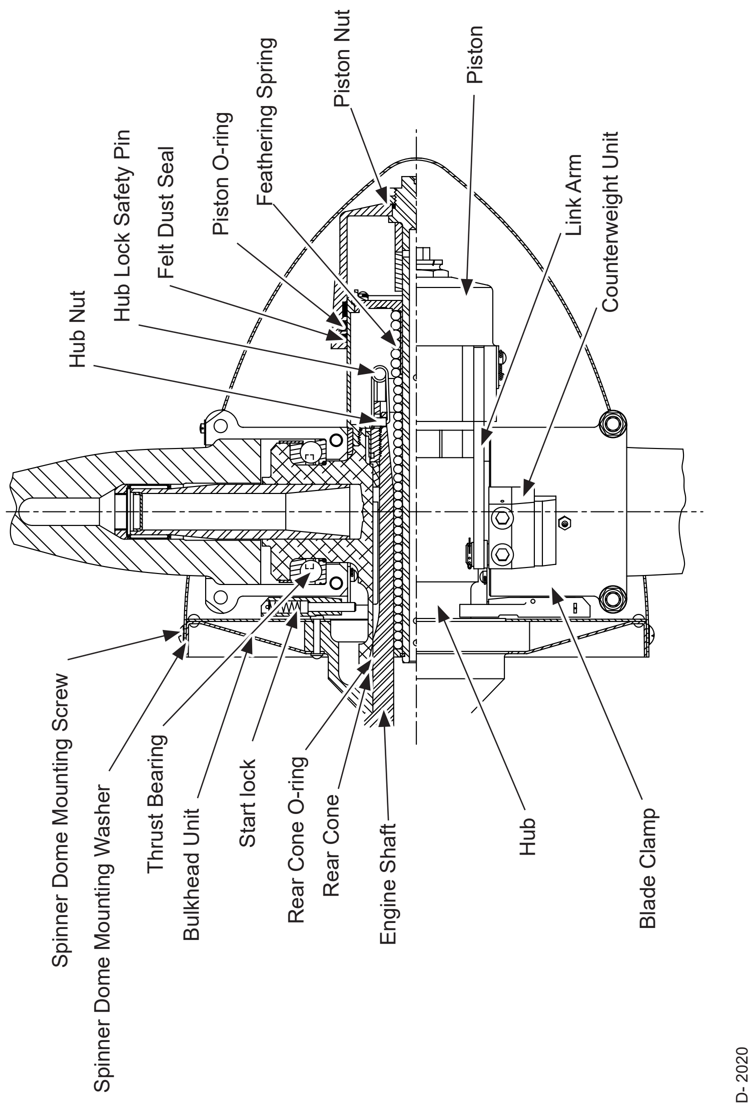
NOTE: Align the forks with the pitch change blocks.

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

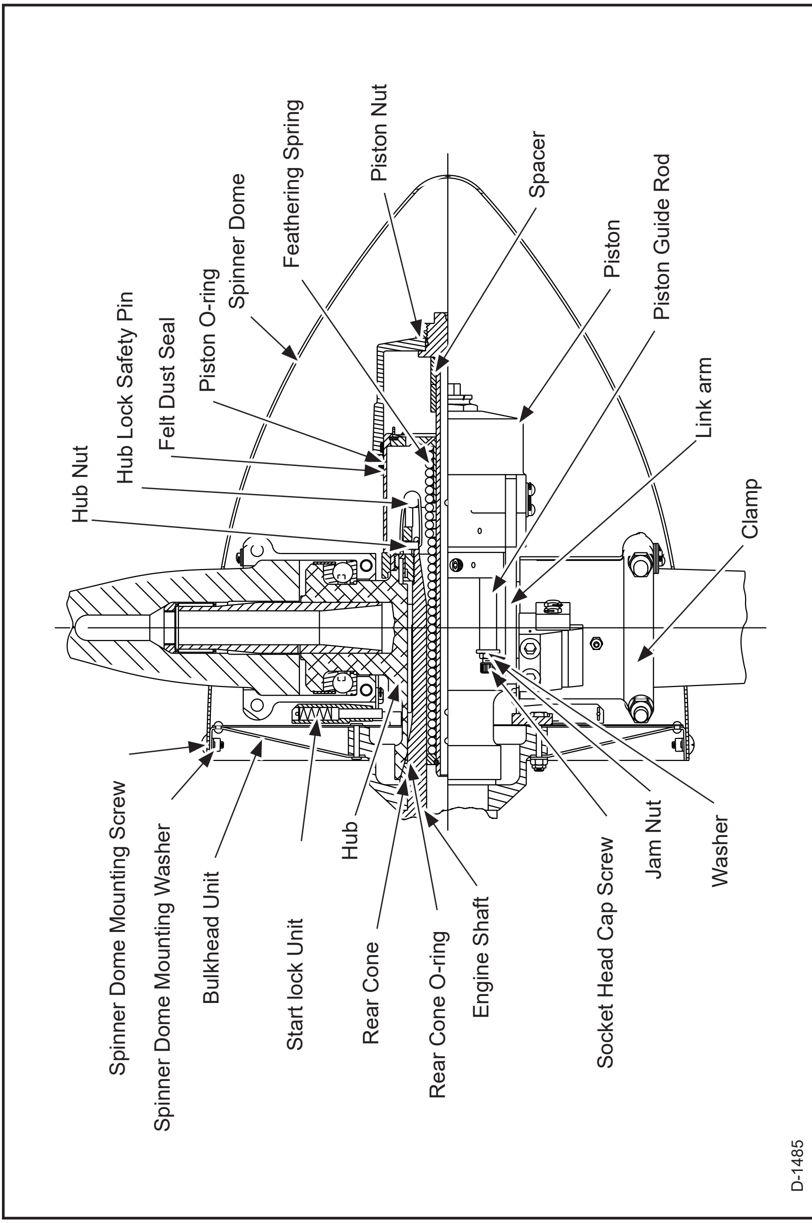
(24) Tighten the set screw in each fork until snug.

(25) Safety the set screws with CM162 safety wire.

(26) Install the spinner dome in accordance with the section, "Spinner Dome Installation" in the chapter.



HC-A2(MV,V)20-2 Propeller Assembly
Figure 3-33



HC-A3(MV,V)20-2( ) Propeller Assembly
Figure 3-34

S. Installing Splined Propeller Models, HC-A2(MV,V)20-2 and HC-A3(MV,V)20-2( )
Refer to Figure 3-33 and 3-38.

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

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

NOTE: If the propeller is equipped with an anti-ice or a de-ice system, follow the applicable manufacturer's instructions for installation of the anti-ice or de-ice system hardware.

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

(2) Piston Removal (Refer to Figures 3-29, 3-37, and 3-38).

(a) Remove the piston nut, 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 and 2 on a 2-blade propeller; 1, 2, and 3 on a 3-blade propeller) 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) 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.

CAUTION: THE FEATHERING SPRING ASSEMBLY MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE FEATHERING SPRING ASSEMBLY HAS ALREADY BEEN REMOVED, PROCEED TO STEP (4) OF THIS PROCEDURE.

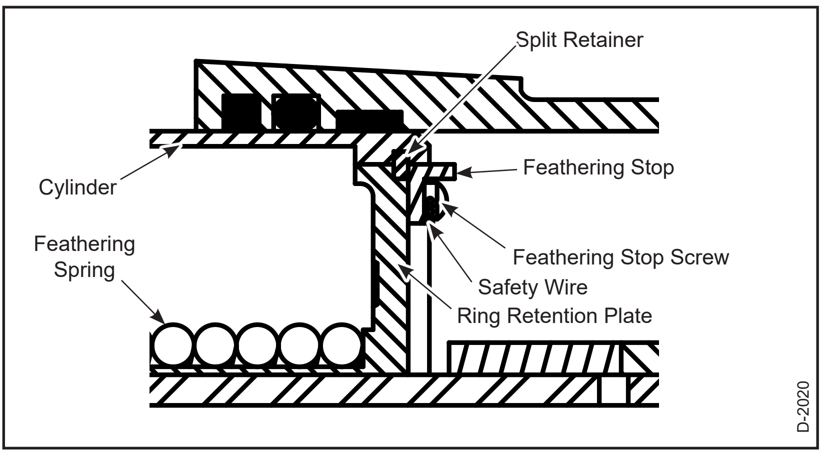
(3) Feathering spring assembly removal:
Refer to Figure 3-35.

WARNING: DO NOT FORCE THE FEATHERING SPRING TO RELEASE THE SPLIT RINGS IN THE CYLINDER. FORCING THE FEATHERING SPRING MAY CAUSE THE RELEASE OF THE SPLIT RING RETAINERS IN THE SPRING ASSEMBLY, RESULTING IN THE EXPLOSIVE RELEASE OF THE FEATHERING SPRINGS.

(a) Remove the safety wire (if installed) from the feathering stop screws.

(b) Remove the two screws from each of the two feathering stops on the front spring retainer.

(c) Remove the feathering stops.



Spring Assembly-to-Cylinder Attachment Details
Figure 3-35

(d) Remove the front spring retainer split rings by first pushing the spring assembly into the cylinder about 0.25 inch (6.3 mm), allowing the split rings to fall out of the groove in the piston.

(e) Remove the feathering spring assembly from the cylinder.

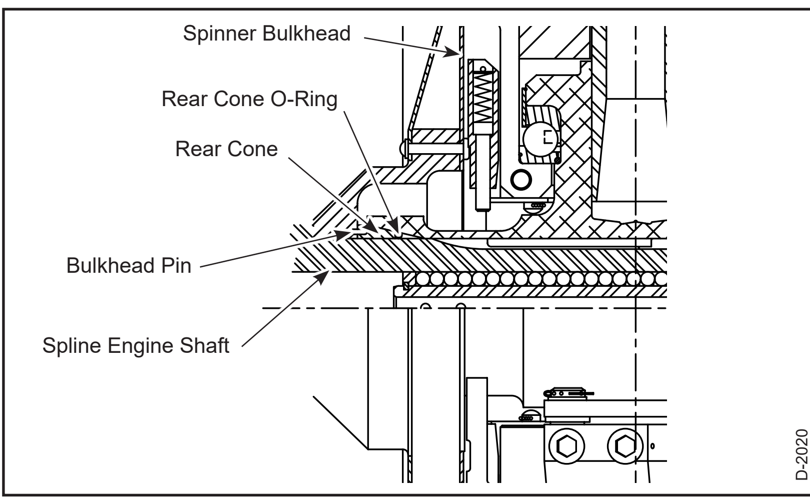
WARNING: CLEANING AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

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

(5) Slide the spinner bulkhead onto the shaft.

(6) Install the rear cone onto the bulkhead, matching the holes in the cone with the pins in the bulkhead. Refer to Figure 3-36.

(7) Retract the start lock pins and hold them in place with a heavy wire inserted through the hole of each start lock housing.



Rear Hub Mounting Parts
Figure 3-36

(8) Install the rear cone O-ring (Table 3-1) over the shaft. Refer to Figure 3-36.

(9) Slide the propeller hub onto the shaft and tighten the shaft nut until the rear bulkhead is snug, but not tight.

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.

(10) Carefully slide the spinner dome over the installed propeller.

(11) To properly position the rear bulkhead, temporarily install the spinner dome with at least four screws.

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

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

(13) Remove the spinner dome.

(14) Using tool BST-2910, torque the propeller shaft nut (Table 3-1). Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.

(15) Safety the shaft nut to the engine shaft using a hub lock safety pin (Table 3-1). Refer to Figure 3-28.

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

(16) Install the spring assembly.

(a) Put the feathering spring assembly into the engine shaft, with the front spring retainer inside the cylinder.

(b) Install the front split retainer between the cylinder and the front spring retainer, sliding the split retainer into the recess in the cylinder.

(c) Pull the spring retainer tight against the front split retainer.

(d) Install the feathering stop plate, which secures the split retainer, into place.

(e) Install the stop screws and tighten them until they are snug.

(f) Safety the stop screws with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two per safety).

(17) 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 3-29.

(a) Lubricate the piston O-ring and carefully install it in the inner groove provided for it in the piston.

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

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

(c) Soak the felt dust seal material in aviation grade reciprocating engine oil until it is completely saturated.

(d) Squeeze the excess oil from the felt dust seal.

(e) Install the felt dust seal material in the outer groove provided for it in the piston.

(f) Install the rod O-ring (Table 3-1) in the groove at the end of the threaded portion of the pitch change rod.

(18) Install the rod O-ring (Table 3-1) in the groove at the end of the threaded portion of the pitch change rod.

<u>CAUTION</u>: TO MAINTAIN PROPER BLADE ANGLES, REINSTALL THE PISTON 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 and 2 on 2-blade propeller; 1, 2, and 3 on 3-blade propeller) on the piston ears with the corresponding index numbers on the guide collar. Refer to Figure 3-37.

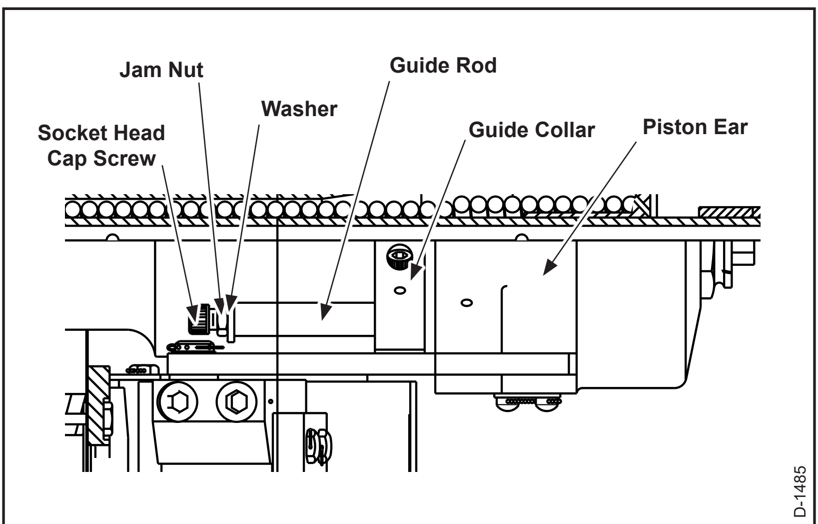
<u>NOTE</u>: The index marks will be either impression-stamped or drawn with a felt-tipped pen.

(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. Refer to Figure 3-37.

(22)Install the washer, jam nut, and socket head cap screw at the end of each guide rod. Refer to Figure 3-37.

(23)Connect the link arms to the piston. Refer to Figure 3-25.



Guide Rod Attachment Details
Figure 3-37

(24) Install the link pin units.

(25) Install the link pin safety screws. Refer to Figure 3-25.

(26) Safety the two screws together with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. Refer to Figure 3-25.

(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. Refer to Table 3-2, "Torque Table".

(29) Torque the jam nut against the guide rod. Refer to Table 3-2, "Torque Table".

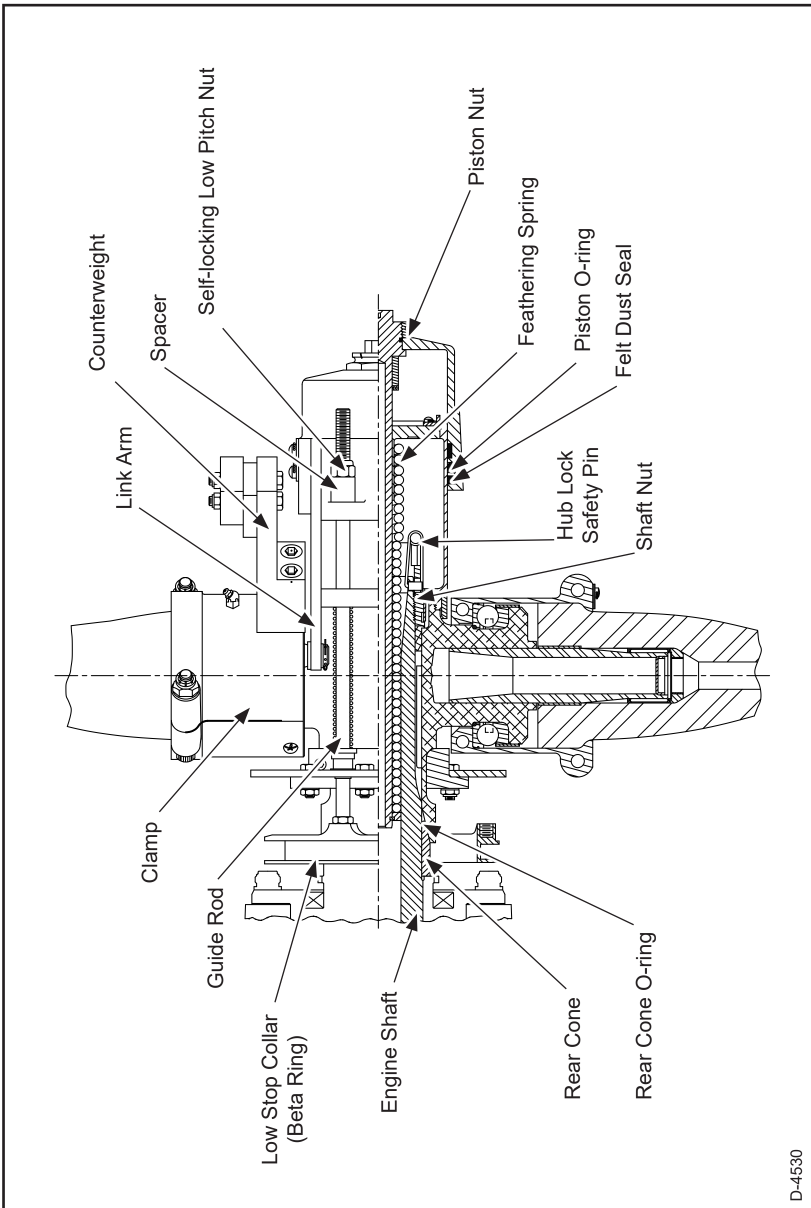
(30) Remove the wires from the start lock brackets.

(31) Position the propeller on the start locks.

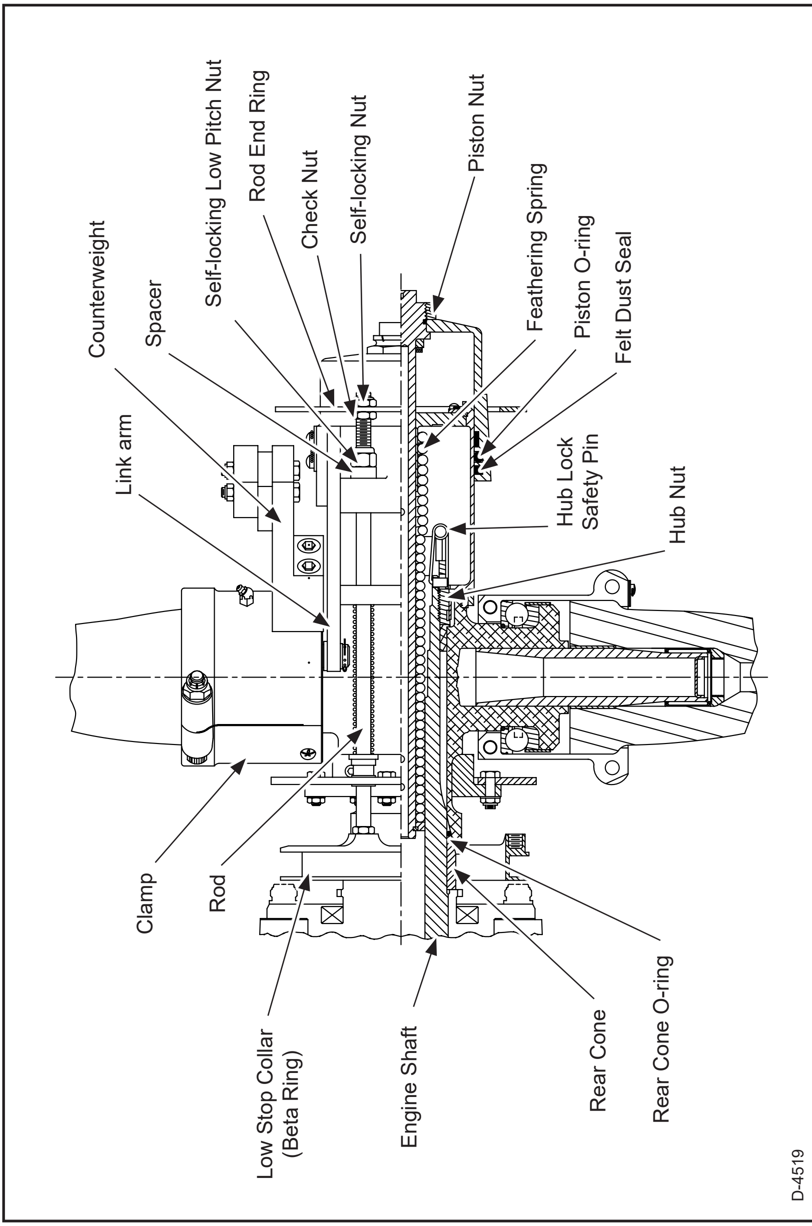
CAUTION: DO NOT PUT THE BLADE PADDLE IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BLADE PADDLE IN THE THICKEST AREA OF THE BLADE, JUST OUTSIDE OF THE DE-ICE BOOT. USE ONE BLADE PADDLE PER BLADE.

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

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



HC-A2(MV,V)20-3L Propeller Assembly
Figure 3-38



HC-A3(MV,V)20-3L Propeller Assembly
Figure 3-39

T. Installing Splined Propeller Models, HC-A2(MV,V)20-3L and HC-A3(MV,V)20-3L
Refer to Figure 3-38 and Figure 3-39.

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

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

NOTE: If the propeller is equipped with an anti-ice or a de-ice system, follow the applicable manufacturer's instructions for installation of the anti-ice or de-ice system hardware.

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

(2) Piston Removal:

Refer to Figure 3-25.

(a) Remove the piston nut.

(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 and 2 for a two blade propeller, and 1, 2, and 3 for a three blade propeller) 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) Slide the link arms out of the piston slots.

CAUTION: THE POSITION OF THE LOW STOP COLLAR (BETA RING) IS ADJUSTED AT THE FACTORY AND MUST BE REINSTALLED IN THE SAME POSITION.

(g) Measure and record the distance from the end of the rod to the top surface of the self-locking nut to make sure that the hydraulic low pitch will be in the same blade angle when the piston and nut are reinstalled.

(h) Remove the hardware from each rod.

1 Model HC-A2(MV,V)20-3L: Self-locking low pitch nut (Table 3-1) and spacer. Refer to Figure 3-38.

2 Model HC-A3(MV,V)20-3L: Self-locking nut, rod end ring, check nut, self-locking low pitch nut, and spacer (Table 3-1). Refer to Figure 3-39.

(i) Slide the piston off the cylinder.

CAUTION: THE FEATHERING SPRING ASSEMBLY MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE FEATHERING SPRING ASSEMBLY HAS ALREADY BEEN REMOVED, PROCEED TO STEP (4) OF THIS PROCEDURE.

(3) Feathering spring assembly removal:
Refer to Figure 3-35.

WARNING: DO NOT FORCE THE FEATHERING SPRING TO RELEASE THE SPLIT RINGS IN THE CYLINDER. FORCING THE FEATHERING SPRING MAY CAUSE THE RELEASE OF THE SPLIT RING RETAINERS IN THE SPRING ASSEMBLY, RESULTING IN THE EXPLOSIVE RELEASE OF THE FEATHERING SPRINGS.

(a) Remove the safety wire (if installed) from the feathering stop screws.

(b) Remove the two screws from each of the two feathering stops on the front spring retainer.

(c) Remove the feathering stops.

(d) Remove the front spring retainer split rings by first pushing the feathering spring assembly into the cylinder about 0.25 inch (6.35 mm), allowing the split rings to fall out of the groove in the piston.

(e) Remove the feathering spring assembly from the cylinder.

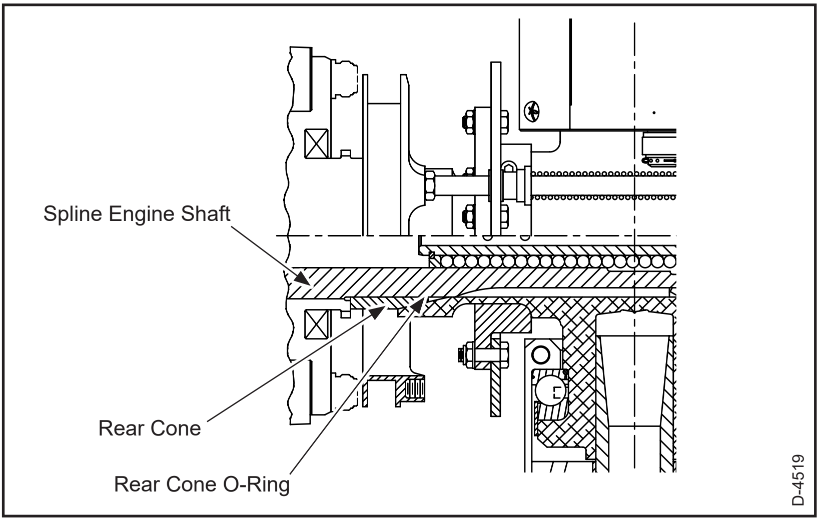
WARNING: CLEANING AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

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

(5) Slide the rear cone onto the shaft.

(6) Install the rear cone O-ring (Table 3-1) over the shaft and against the cone. Refer to Figure 3-40.

(7) Slide the propeller hub onto the engine and torque the propeller hub nut (Table 3-1) using tool BST-2910. Refer to Table 3-2 and Figure 3-1.1 to determine the proper torque value to which the torque wrench must be set.



Rear Hub Mounting Parts on HC-A(2,3)(MV,V)20-3L Propeller
Figure 3-40

(8) Safety the hub nut to the engine shaft using a hub lock safety pin (Table 3-1). Refer to Figure 3-28.

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

(9) Install the spring assembly. Refer to Figure 3-36 and Figure 3-37.

(a) Put the feathering spring assembly into the engine shaft, with the front spring retainer inside the cylinder.

(b) Install the front split retainer between the cylinder and the front spring retainer, sliding the split retainer into the recess in the cylinder.

(c) Pull the spring retainer tight against the front split retainer.

(d) Install the two feathering stops that secure the split retainer into place on the front of the spring retainer.

(e) Install the feathering stop retention screws and tighten them until they are snug.

(f) Safety the stop screws with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two per safety).

(10) 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 3-29.

(a) Using aviation grade reciprocating engine oil, lubricate the piston O-ring and carefully install it in the inner groove provided for it in the piston.

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

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

(c) Soak the felt dust seal material in aviation grade reciprocating engine oil until it is completely saturated.

(d) Squeeze the excess oil from the felt dust seal.

(e) Install the felt dust seal material in the outer groove provided for it in the piston.

(11) Install the pitch change 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, REINSTALL THE PISTON 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.

(12) Locate and match up the index numbers (1 and 2 on a two blade propeller, and 1, 2, and 3 on a three blade propeller) 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.

(13) Oil the surface of the cylinder and install the piston.

(14) Align the piston with the beta rods, and slide the piston onto the beta rods and cylinder.

(15) Connect the link arms to the piston. Refer to Figure 3-25.

(16) Install the link pin units.

(17) Install the link pin safety screws.

(18) Safety the link pin screws together with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. Refer to Figure 3-25.

(19) Carefully rotate the blades into feather position and fasten the piston to the pitch change rod with the piston nut (Table 3-1).

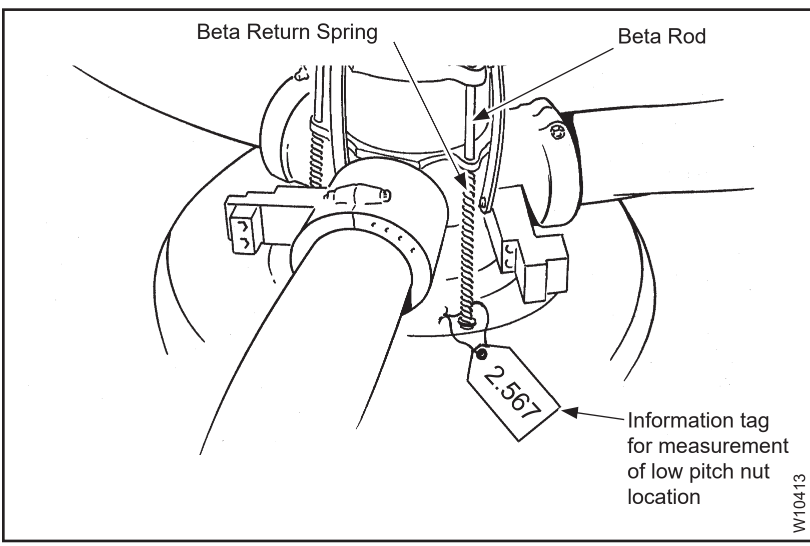
(20) Torque the piston nut in accordance with Table 3-2, "Torque Table".

(21) Install the spacer and self-locking low pitch nut (Table 3-1) on each beta rod.

WARNING: TO MAKE SURE OF PROPER LOW PITCH BLADE ANGLE, THE LOW PITCH NUTS MUST BE SET IN THE PROPER POSITION ON THE BETA RODS. OTHERWISE, POSSIBLE SERIOUS INJURY AND PROPELLER DAMAGE COULD RESULT.

(22) If the propeller was received with the piston already removed, there should be an information tag attached to each beta return spring (Figure 3-41) indicating the proper position for the self-locking low-pitch nut on the end of the beta rod.

(a) Adjust the position of each self-locking low pitch nut so that the distance from the top surface of the self-locking nut to the end of the beta rod is as indicated on the information tag attached to the corresponding beta return spring on the beta rod. Refer to Figure 3-41.



Information Tag on Beta Return Spring
Figure 3-41

(23) If it was necessary to remove the piston for installation of the propeller, and no information tags were found on the beta return springs:

(a) Refer to the distance measurements recorded in step (2)(g) in this procedure to insure that the low pitch nuts will be set at the same position as before removal of the piston.

(b) Refer to the Type Certificate Data sheet or Hartzell Propeller Application Guide Manual 159 (61-02-59) to verify the proper low pitch blade angle.

(24) On propeller model HC-A2MV20-3L only, install the check nut, rod end ring, and self-locking nut on each beta rod.

(25) Torque the self-locking nut against the rod end ring. Refer to Table 3-2, "Torque Table".

(26) Install the carbon block into the beta linkage lever, in accordance with 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 3-18.

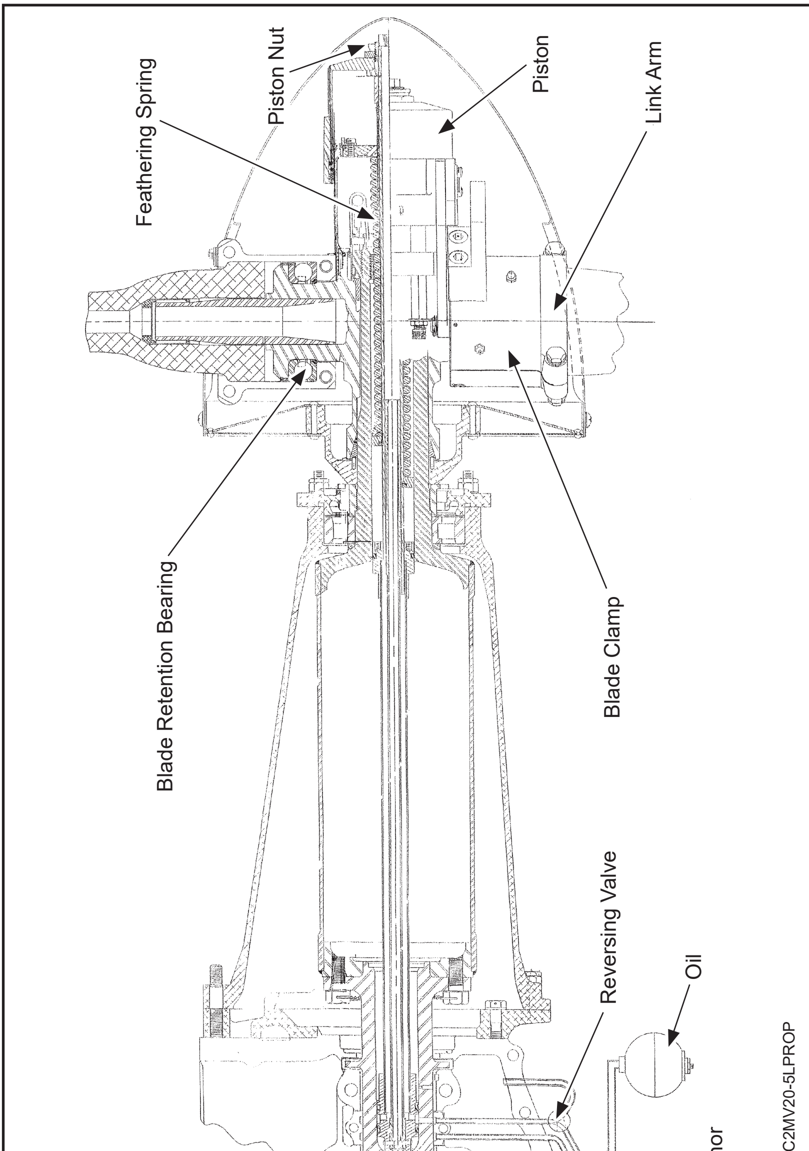
CAUTION 2: MAXIMUM SIDE CLEARANCE PERMITTED IS 0.010 INCH (0.25 mm) IN ACCORDANCE WITH THE CARBON BLOCK ASSEMBLIES SECTION IN THE MAINTENANCE PRACTICES CHAPTER OF THIS MANUAL.

(27) Install the carbon block assembly into the beta ring. Refer to Figure 3-19.

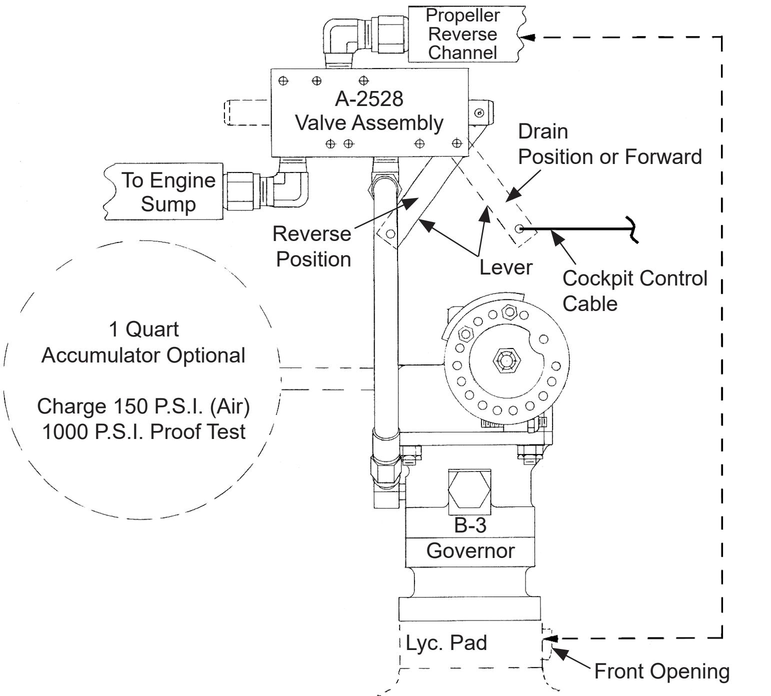
(28) Install, adjust and safety the beta linkage in accordance with the airframe manufacturer's instructions.

(29) Install the beta valve, governor, and linkage in accordance with the section, "Beta Valve Assembly, Governor, and Linkage Installation" in this chapter.

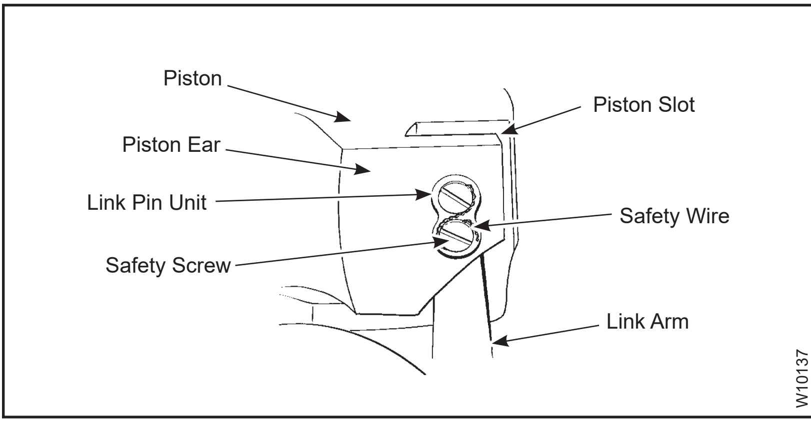
(30) Install the spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.



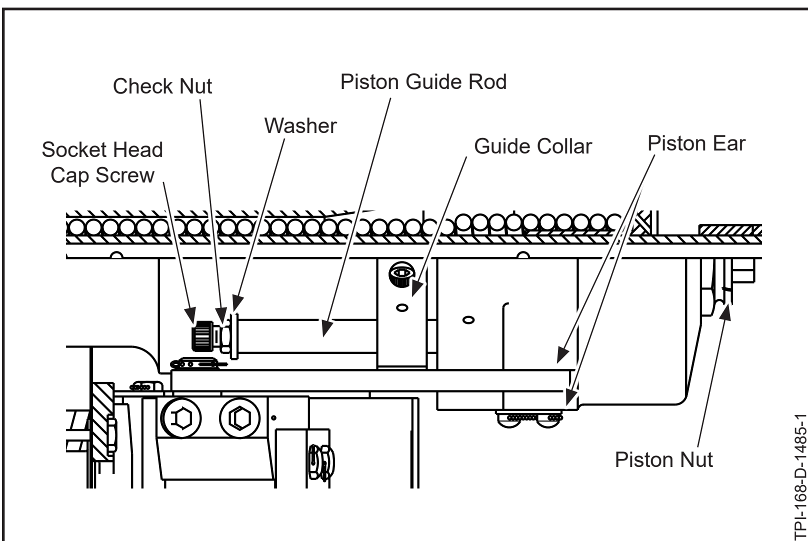
HC-A2(MV,V)20-5L Propeller Assembly
Figure 3-42



External Beta System
Figure 3-43



Piston-to-Link Arm Attachment Details
Figure 3-44



Piston Guide Rod Attachment Details
Figure 3-45

U. Installing Splined Propeller Models, HC-A2(MV,V)20-5L Refer to Figure 3-42 and Figure 3-43.

(1) Install the D-2006 reversing beta valve assembly inside the engine shaft. Refer to the airframe or engine manufacturer's instructions.

(a) For the reversing beta valve assembly location in the engine shaft and shaft extension, refer to Figure 3-42.

(2) Install the A-2528 external valve assembly. Refer to the airframe or engine manufacturer's instructions.

(a) For the A-2528 external valve assembly, the cockpit control cable, and the hydraulic connections, refer to Figure 3-43.

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: THE PISTON MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE PISTON HAS ALREADY BEEN REMOVED, PROCEED TO STEP (4) OF THIS PROCEDURE.

(3) Piston Removal

Refer to Figure 3-44 and Figure 3-45.

(a) Remove the piston nut.

(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 link arms should have corresponding index numbers (1 and 2) impression-stamped or marked with a felt-tipped pen. If they are not marked, number them with a felt-tipped pen.

NOTE: This will make sure 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, check nut, and washer from each piston guide rod. Refer to Figure 3-45.

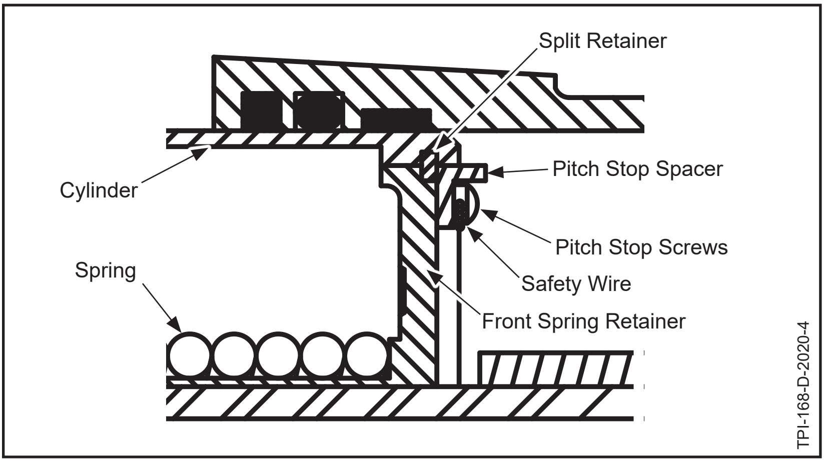
(h) Slide the piston off the cylinder.

CAUTION: THE 831-15 SPRING ASSEMBLY MUST BE REMOVED BEFORE INSTALLING THE PROPELLER ON THE AIRCRAFT. IF THE SPRING ASSEMBLY HAS ALREADY BEEN REMOVED, PROCEED TO STEP (5) OF THIS PROCEDURE.

(4) Spring assembly removal
Refer to Figure 3-46.

WARNING: DO NOT FORCE THE SPRING ASSEMBLY TO RELEASE THE SPLIT RINGS IN THE CYLINDER. FORCING THE SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE SPLIT RING RETAINERS AT THE OPPOSITE END OF THE SPRING ASSEMBLY, RESULTING IN THE EXPLOSIVE RELEASE OF THE SPRINGS.

(a) Remove the safety wire from the pitch stop spacer screws.



Spring Assembly-to-Cylinder Attachment Details
Figure 3-46

(b) Remove the two screws from each of the two pitch stop spacers on the front spring retainer.

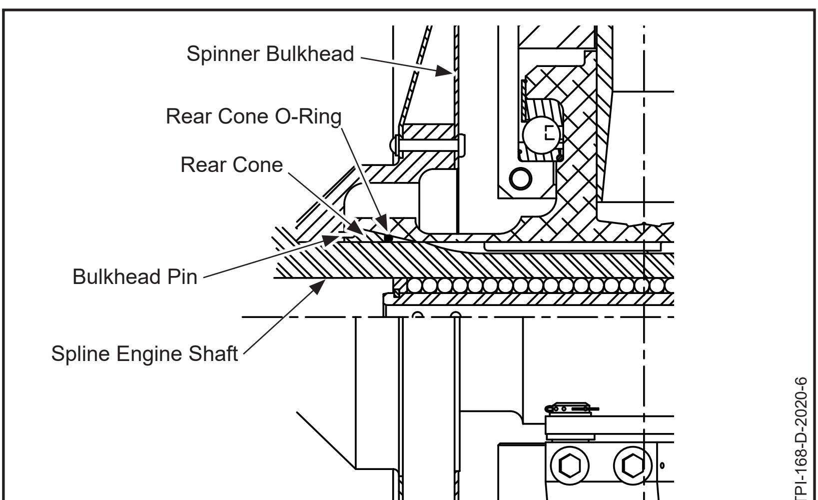
(c) Remove the pitch stop spacers.

(d) Remove the front spring retainer split rings by first pushing the spring assembly into the cylinder approximately 0.25 inch (6.35 mm), permitting the split rings to fall out of the groove in the cylinder.

(e) Remove the spring assembly from the cylinder.

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

(5) With an applicable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting shaft.



Rear Hub Mounting Parts on an HC-A2(MV,V)20-5L Propeller
Figure 3-47

<u>WARNING</u>: CLEANING AGENT MEK IS FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT. USE IN A WELL VENTILATED AREA.

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

(7) Slide the spinner bulkhead onto the shaft.

(8) Install the rear cone onto the bulkhead, aligning the holes in the cone with the pins in the bulkhead. Refer to Figure 3-47.

(9) Install the rear cone O-ring (Table 3-1) over the shaft. Refer to Figure 3-47.

(10) Slide the propeller hub onto the shaft and tighten the shaft nut until the rear bulkhead is snug, but not tight.

<u>CAUTION</u>: 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.

(11) Carefully slide the spinner dome over the installed propeller.

(12) To correctly position the rear bulkhead, temporarily install the spinner dome with at least four screws.

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

(14) Remove the spinner dome.

(15) Using a BST-2910 shaft nut wrench, torque the propeller shaft nut (Table 3-1). Refer to Table 3-2 and Figure 3-1.1 to determine the correct torque value that the torque wrench must be set.

(16) Safety the shaft nut to the engine shaft using a hub lock safety pin (Table 3-1). Refer to Figure 3-48.

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

(17) Spring assembly installation. Refer to Figure 3-46.

(a) Put the 831-15 spring assembly into the engine shaft, with the front spring retainer inside the cylinder.

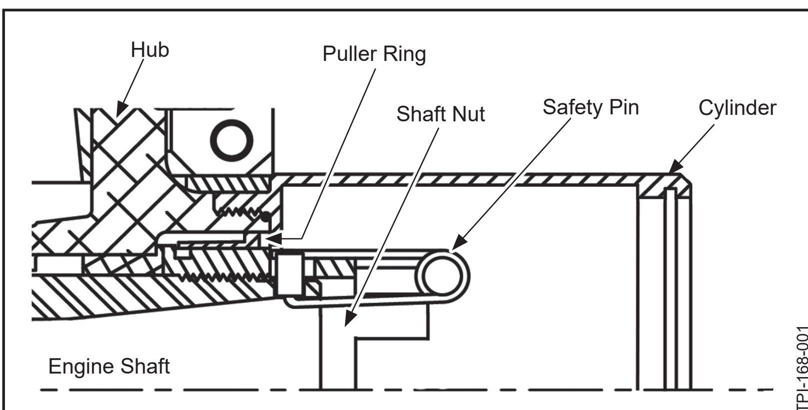
(b) Install the front split retainer between the cylinder and the front spring retainer, sliding the split retainer into the recess in the cylinder.

(c) Pull the front spring retainer tight against the front split retainer.

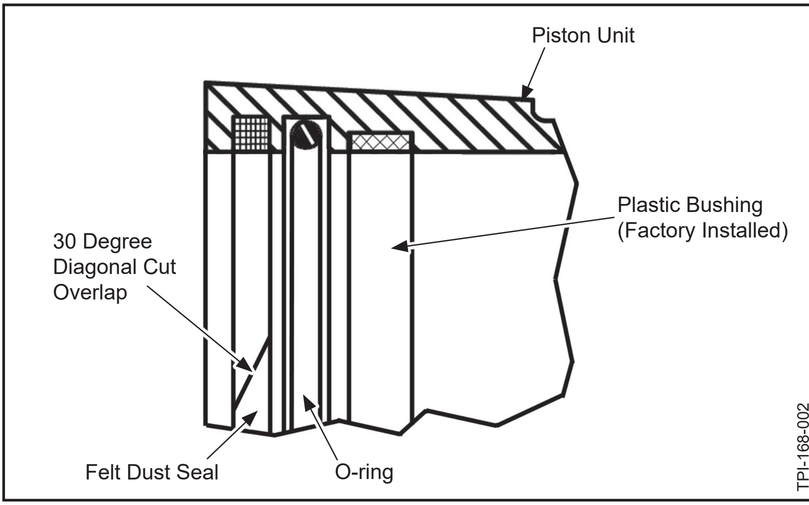
(d) Install the two pitch stop spacers that hold the split retainer in position.

(e) Install the pitch stop screws and tighten them until they are snug.

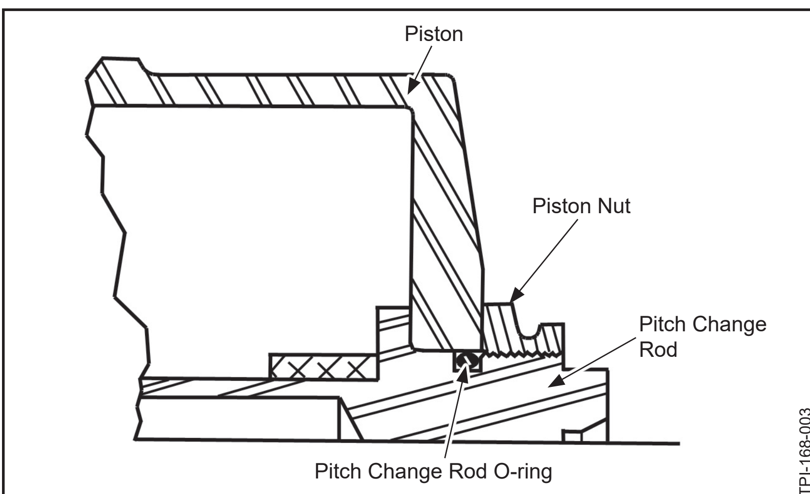
(f) Safety the stop screws with 0.032 inch (0.81 mm) minimum diameter stainless steel wire (two per safety).



Safety the Shaft Nut on the Propeller
Figure 3-48



O-ring and Dust Seal Installation in the Piston
Figure 3-49



Pitch Change Rod to Piston Interface
Figure 3-50

(18) If the piston O-ring (Table 3-1) and the felt dust seal are not already installed in the piston, complete the following steps. Refer to Figure 3-49.

(a) Using aviation grade reciprocating engine oil, lubricate the piston O-ring and carefully install it in the inner groove provided for it in the piston.

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

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

(c) Soak the felt dust seal material in aviation grade reciprocating engine oil until it is completely saturated.

(d) Squeeze the excess oil from the felt dust seal.

(e) Install the felt dust seal material in the outer groove provided for it in the piston.

(19) Install the pitch change rod O-ring (Table 3-1) in the groove at the end of the threaded portion of the pitch change rod. Refer to Figure 3-50.

CAUTION: TO MAINTAIN PROPER BLADE ANGLES, REINSTALL THE PISTON 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.

(20) Locate and match up the index numbers (1 and 2 on a 2-blade propeller) on the piston ears with the corresponding index numbers on the guide collar. Refer to Figure 3-44 and Figure 3-45.

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

(21) Oil the surface of the cylinder and install the piston.

(22) Slide the piston onto the cylinder and put the guide rods through the collar bushing. Refer to Figure 3-45.

(23) Install the washer, check nut, and socket head cap screw (Table 3-1) at the end of each guide rod. Refer to Figure 3-45.

(24) Connect the link arms to the piston. Refer to Figure 3-44 and Figure 3-45.

(25) Install the link pin units. Refer to Figure 3-44.

(26) Install the link pin safety screws. Refer to Figure 3-44.

(27) Safety the two link pin screws together with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. Refer to Figure 3-44.

(28) Carefully rotate the blades into high pitch position and fasten the piston to the pitch change rod with the piston nut. Refer to Table 3-1 and Figure 3-50.

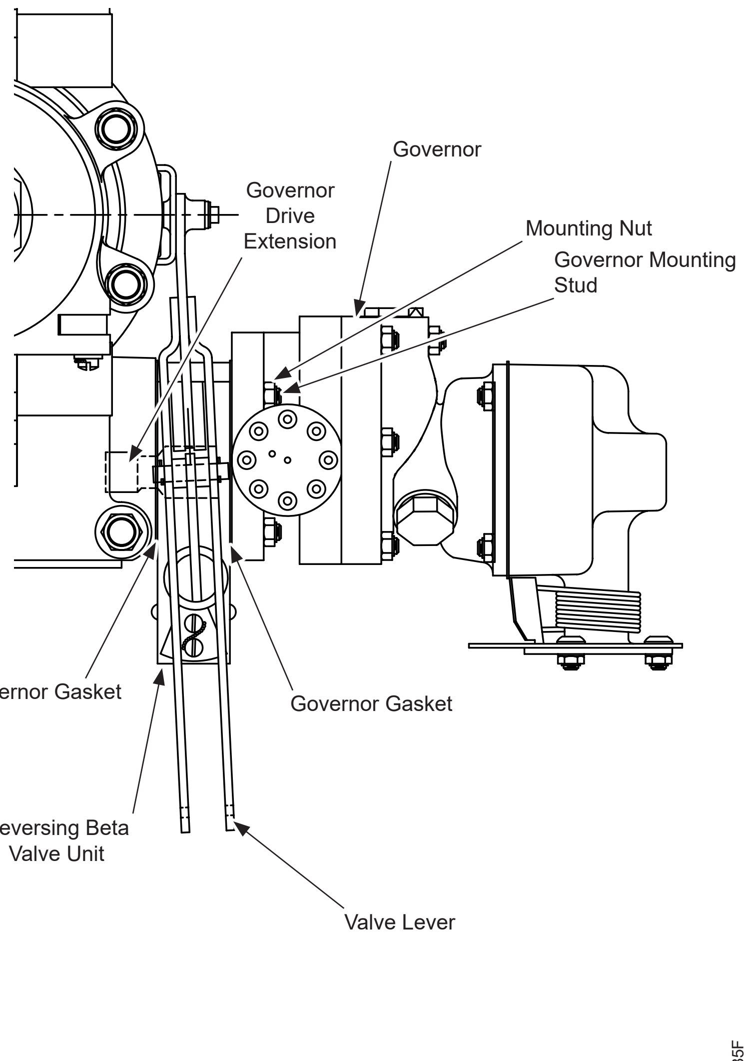
(29) Torque the piston nut in accordance with Table 3-2 and Figure 3-50.

(30) Torque the check nut against the guide rod in accordance with Table 3-2 and Figure 3-9.

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

Part	Propeller Model	Part No.
Beta Feedback Block Assembly	BHC-A2(MV,V)F-3 HC-A3(MV,V)F-3L (P)HC-A3(MV,V)F-5R HC-A(2,3)(MV,V)20-3L	A-3044 A-3044 A-3044 A-3044
Beta Valve Unit	BHC-A2(MV,V)F-3 HC-A3(MV,V)(F,20)-3L (P)HC-A3(MV,V)F-5R HC-A2(MV,V)20-3L	A-4123 A-4117 A-4117 A-4117 [GO-480-( ) engine] A-4123 [GO-435-( ) engine]
Governor Base Adapter	HC-A2(MV,V)20-3L	B-4112 [GO-435-( ) engine]
Governor Drive Extension	BHC-A2(MV,V)F-3 HC-A3(MV,V)F-3L (P)HC-A3(MV,V)F-5R HC-A(2,3)(MV,V)20-3L	A-3144 A-3144 A-3144 A-3144
Governor Gasket	BHC-A2(MV,V)F-3 HC-A3(MV,V)F-3L (P)HC-A3(MV,V)F-5R HC-A(2,3)(MV,V)20-3L	B-1104 B-1104 B-1104 B-1104
Governor Mounting Nut	BHC-A2(MV,V)F-3 HC-A3(MV,V)F-3L (P)HC-A3(MV,V)F-5R HC-A(2,3)(MV,V)20-3L	B-3808-5 B-3808-5 B-3808-5 B-3808-5
Governor Mounting Stud	BHC-A2(MV,V)F-3 HC-A3(MV,V)(F,20)-3L (P)HC-A3(MV,V)F-5R HC-A2(MV,V)20-3L	A-3147 A-3147-3 (Hartzell double capacity governors) A-3147-2 (Woodward governors) A-3147-2 A-3147-3

Governor Mounting Parts/Hardware
Table 3-3



Installation of Beta Valve, Governor, and Linkage
Figure 3-51

6. Beta Valve, Governor, and Linkage Installation

A. Installation Procedure (Refer to Figure 3-51)

NOTE: If only a governor was previously installed, the existing studs in the engine governor pad will be too short to accommodate both a governor and a beta valve assembly. These studs must be replaced with longer length studs. Refer to Table 3-3.

CAUTION: GOVERNOR PAD STUD REPLACEMENT MUST BE PERFORMED BY AN APPROPRIATE LICENSED MECHANIC.

(1) Install the governor gasket against the face of the engine pad. Refer to Table 3-3.

(2) Install the beta valve unit as shown in Figure 3-51.

(3) For HC-A2(MV,V)20-3L propellers installed on a GO-435-( ) engine with a T-drive configuration, install a governor base adapter against the T-drive governor mounting pad. Refer to Table 3-3.

(a) Connect all oil lines.

NOTE: Follow the applicable airframe manufacturer's instructions or the supplemental type certificate holder's instructions for connecting the oil lines.

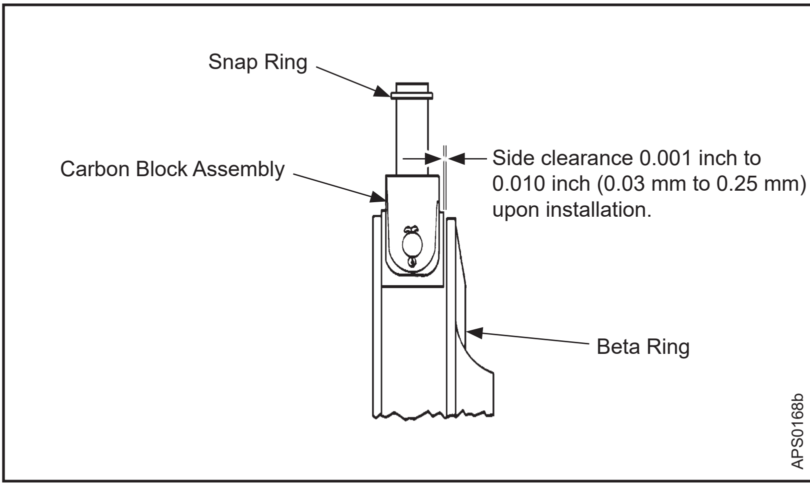
(4) Install a governor gasket against the governor base adapter. Refer to Table 3-3.

(5) Install the governor drive extension into the female splines of the engine governor drive shaft. Refer to Table 3-3.

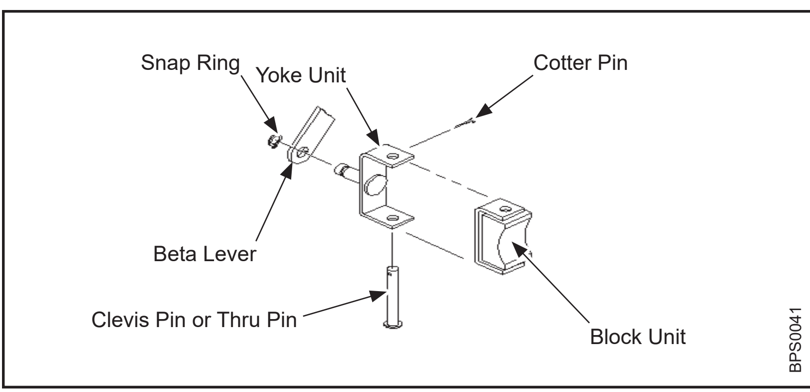
(6) Install the governor and secure it with nuts. Refer to Table 3-3 for the applicable governor mounting nut part number.

NOTE: Follow the applicable airframe manufacturer's instructions or the supplemental type certificate holder's instructions for the rigging of the governor control cable.

(7) Torque the governor mounting nuts in accordance with Table 3-2, "Torque Table".



Carbon Block and Beta Ring Clearance
Figure 3-52



Carbon Block Assembly
Figure 3-53

(8) 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 3-52.

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.

(9) Install the carbon block assembly into the beta ring. Refer to Figure 3-53.

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

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

NOTE: If airframe manufacturer's or supplemental type certificate holder's instructions are unavailable, then adjust in accordance with the section, "Propeller Reverse Control System Adjustment" in this chapter.

(12) Secure the housing of the push-pull control to a bracket.

7. Propeller Reverse Control System Adjustment

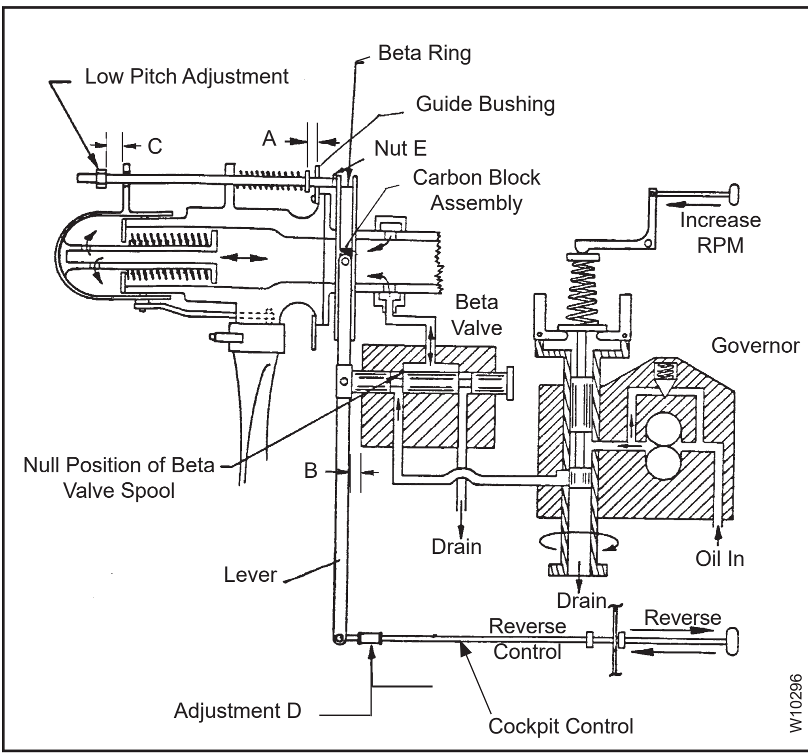
A. Adjustment Procedure (Refer to Figure 3-54)

NOTE: Follow these instructions only if the airframe manufacturer's or the supplemental type certificate holder's instructions for reverse control system adjustment are unavailable.

(1) Set the reverse control in forward position.

(2) 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.



Adjusting Propeller Reverse Control System
Figure 3-54

(3) 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 section, "Propeller Low Pitch Settings" in the Maintenance Practices Chapter of this manual for adjustment information.

CAUTION: TO PREVENT ENGINE OVERSPEED, DO NOT ALLOW THE RPM TO REACH THE RPM SET BY THE GOVERNOR. THIS WILL ALLOW THE GOVERNOR TO OVERRIDE THE REVERSE PITCH CONTROL AND CAUSE THE PITCH TO COME OUT OF REVERSE, RESULTING IN DAMAGE TO THE REVERSING MECHANISM.

(4) Check the RPM during reverse pitch operation.

(a) Set the propeller governor control for maximum RPM.

(b) While the engine is idling, set the pitch control for maximum reverse pitch.

(c) Gradually open the throttle until the RPM reaches the maximum value, or until the RPM reaches approximately 80% to 90% of the engine rating.

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

(5) If the RPM exceeds the desired value for reverse pitch, check to be sure the reverse push-pull control (Figure 3-54) has enough travel to move the piston up against its internal stop. To accomplish this:

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 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 3-54) is 3/16 inch (4.8 mm) or less.

(b) While in full reverse, check for clearance between nut "E" (Figure 3-54) and the guide bushing. There should be a positive clearance.

(6) Secure the housing of the push-pull control to a bracket.

8. Spinner Dome Installation (Rev. 3)

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

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

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

NOTE 2: The B-3845-8 screws supplied with metal spinner assemblies are 0.500 inch (12.70 mm) in length. If correct thread engagement cannot be achieved when installing the spinner dome, B-3845-9 screws may be used. The B-3845-9 screws are 0.562 inch (14.27 mm) in length.

A. Installation Procedure

(1) Install the spinner dome.

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

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

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

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

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

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

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

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

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

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

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

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

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

Spinner Dome/Cap	Washer	Screw
Metal Dome	A-1020 Washer, Fiber	B-3845-8 10-32, Truss Head

Spinner Dome and Spinner Cap Mounting Hardware
Table 3-4

9. Post-Installation Checks

A. Important Information

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

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

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

10. Propeller Removal

A. Removing Propeller Models, (B)HC-A2(MV,V)F-1( ) Refer to Figure 3-3.

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 to the spinner bulkhead.

(b) Remove the spinner dome.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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) 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: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

<u>CAUTION</u>: DISCARD THE PROPELLER MOUNTING BOLTS AND WASHERS IF THEY ARE DAMAGED OR CORRODED, OR IF THE PROPELLER IS REMOVED FOR OVERHAUL.

(4) Unthread the propeller mounting bolts from the engine flange.

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

<u>CAUTION</u>: 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 spinner bulkhead.

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

B. Removing Propeller Models, HC-A2(MV,V)(K,L)-1( ) and HC-A2(MV,V)L-6F
Refer to Figure 3-3.

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 to the spinner adapter ring.

(b) Remove the spinner dome.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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) 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: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

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

(4) Remove the propeller mounting bolts from the engine flange.

(5) Remove two propeller mounting bolts and washers.

NOTE 1: Four of the propeller mounting bolts and washers cannot be removed from the propeller hub due to interference with other propeller parts.

NOTE 2: 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.

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

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

(8) Remove the shim.

(9) If the spinner was manufactured by Hartzell Propeller:

(a) Do not remove the spinner adapter ring.

(b) Visually inspect the spinner adapter ring for cracks.

(c) If cracks are found in the spinner adapter ring, remove it from the engine starter ring gear and replace it.

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

C. Removing Propeller Models, HC-A2(MV,V)F-2( )
Refer to Figure 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 to the spinner bulkhead.

(b) Remove the spinner dome.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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: USE CAUTION DURING PROPELLER REMOVAL WHEN THE START LOCKS ARE ENGAGED. IF THE BLADES ARE RELEASED SUDDENLY, THE EXTREME FORCE CAN CAUSE SERIOUS INJURY AND DAMAGE TO THE PROPELLER.

(2) Routine propeller engine shutdown will engage the start lock units, preventing the propeller from feathering. To allow access to the of the spinner mounting bolts, the start locks should remain engaged during the removal of the propeller.

(3) 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: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

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

(5) 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.

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

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

(8) Put the propeller, with spinner bulkhead and start locks attached, on a suitable cart for transportation.

D. Removing Propeller Models, HC-A2(MV,V)(K,L)-2( )
Refer to Figure 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 to the spinner adapter ring.

(b) Remove the spinner dome.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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 lock units, 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 start lock plates from the start lock units.

(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 allow the blades to rotate to high/feather pitch.

(3) 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: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

(5) Record the position of each start lock in relation to its matching blade.

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

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

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

(7) Remove the propeller mounting bolts from the engine flange.

(8) Remove four propeller mounting bolts and washers.

NOTE 1: Two of the propeller mounting bolts and washers cannot be removed from the propeller hub due to interference with other propeller parts.

NOTE 2: 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.

(9) Remove and discard the shaft O-ring.

(10) Remove the shim.

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

(12) If the spinner was manufactured by Hartzell Propeller:

(a) Do not remove the spinner adapter ring.

(b) Visually inspect the spinner adapter ring for cracks.

(c) If cracks are found in the spinner adapter ring, remove it from the engine starter ring gear and replace it.

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

E. Removing Propeller Models, (E,P)HC-A3(MV,V)F-2( ) That Do Not Use a Spacer
Refer to Figure 3-11.

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.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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: USE CAUTION DURING PROPELLER REMOVAL WHEN THE START LOCKS ARE ENGAGED. IF THE BLADES ARE RELEASED SUDDENLY, THE EXTREME FORCE CAN CAUSE SERIOUS INJURY AND DAMAGE TO THE PROPELLER.

(2) Routine propeller engine shutdown will engage the start lock units, preventing the propeller from feathering. To allow access to the of the spinner mounting bolts, the start locks should remain engaged during the removal of the propeller.

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: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS AND WASHERS 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 and discard the shaft O-ring.

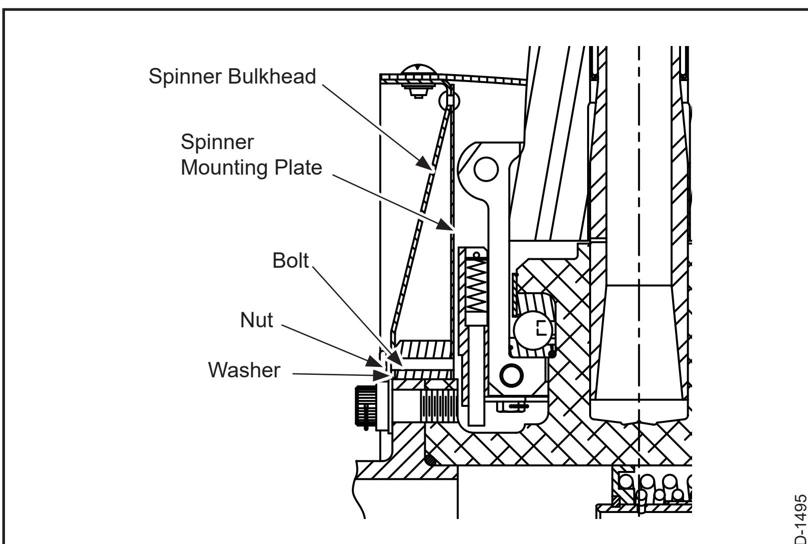
(7) Put the propeller, with spinner bulkhead and start locks attached, on a suitable cart for transportation.

(8) If spinner assembly 837-16 is installed, refer to Figure 3-55 and perform the following steps for the spinner bulkhead removal.

(a) Record the position of each start lock in relation to its matching blade.

(b) Remove the bolts, nuts, and washers that attach the bulkhead to a ring and spinner mounting plate.

(c) Remove the two-piece spinner mounting plate, spinner bulkhead, and ring from the engine flange.



Spinner Bulkhead Removal
Figure 3-55

F. Removing Propeller Models EHC-A3(MV,V)F-2B That Use a Spacer

Installed on, but not limited to, the Beech 95-55, -A55, -B55, Colemill Baron Aircraft Engines, and Aero Commander Aircraft. Refer to Figure 3-11 and Figure 3-12.

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 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.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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.

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

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(3) Support the propeller assembly with a sling.

(4) Remove and discard the lock nut and washer from the end of each mounting stud.

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 propeller mounting O-ring.

(7) Put the propeller, with attached spacer, on a suitable cart for transportation. Refer to Figure 3-13.

G. Removing Propeller Models, HC-A3(MV,V)K-2( )( )
Refer to Figure 3-14.

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.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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 lock units, 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 start lock plates from the start lock units.

(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 allow the blades to rotate to high/feather pitch.

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.

(4) Remove the safety wire on the propeller mounting bolts.

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

(5) Record the position of each start lock in relation to its matching blade.

(6) Remove the start locks to gain access to the mounting bolts.

(7) Unthread the propeller mounting bolts from the engine.

(8) Remove three of the propeller mounting bolts and washers.

NOTE 1: Three of the propeller mounting bolts and washers cannot be removed from the propeller hub due to interference with other propeller parts.

NOTE 2: 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.

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

(10) Remove and discard the shaft O-ring.

(11) Remove the shim.

(12) If the spinner was manufactured by Hartzell Propeller:

(a) Do not remove the spinner adapter ring.

(b) Visually inspect the spinner adapter ring for cracks.

(c) If cracks are found in the spinner adapter ring, remove it from the engine starter ring gear and replace it.

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

H. Removing Propeller Models, BHC-A2(MV,V)F-3
Refer to Figure 3-15.

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

(2) Disconnect the propeller beta ring from the carbon block assembly and lever. Refer to Figure 3-15.
   (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 THE HARTZELL PROPELLER OVERHAUL MANUAL.

(3) Remove the safety wire on the propeller mounting bolts.

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(4) Support the propeller assembly with a sling.

NOTE 1: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but one mounting bolt and washer has been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

(5) 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.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS AND WASHERS IF THEY ARE DAMAGED OR CORRODED, WHEN 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 engine flange O-ring.

(9) Decompress and remove the beta system puller.

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

(11) Governor, beta valve, and stud removal
Refer to Figure 3-16.

(a) Loosen the four nuts that hold the governor onto the beta valve and engine.

(b) Lift the governor off the beta valve and engine.

(c) Remove the governor shaft extension from the engine accessory drive shaft.

(d) Remove and discard the governor gasket.

(e) Slide the beta valve off the engine and studs.

(f) Remove and discard the governor gasket.

(g) Do not remove the four studs from the engine case unless they are damaged or corroded.

NOTE: Studs must be removed only by a certified mechanic in accordance with the engine manufacturer's requirements.

I. Removing Propeller Models, HC-A3(MV,V)F-3L
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.

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 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.
   (c) Remove layers of masking or duct tape from each blade shank, if applicable.
(2) Disconnect the propeller beta ring from the carbon block assembly and lever. Refer to Figure 3-17.
   (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 THE HARTZELL PROPELLER OVERHAUL MANUAL.

(3) Remove the safety wire on the propeller mounting nuts.

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(4) Support the propeller assembly with a sling.

NOTE 1: To allow rotation of the propeller for ease of mounting nut removal, supporting the propeller with a sling may be delayed until all but two mounting nuts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

(5) 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 and washers.

(6) Remove and discard the elastic nut and washer from the end of each mounting stud.

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.

NOTE: The spacer between the engine and propeller should stay on the propeller studs during the propeller removal.

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

(9) Decompress and remove the beta system puller.

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

J. Removing Propeller Models, (E,P)HC-A3(MV,V)F-4( )
Refer to Figure 3-20.

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

NOTE: Propeller model EHC-A3(MV,V)F-4 does not have a spinner installed.

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

(b) Remove the spinner dome.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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) Remove the safety wire on the propeller mounting bolts.

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(3) Support the propeller assembly with a sling.

NOTE 1: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS AND WASHERS 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.

(5) If the spinner assembly is installed, perform the following steps for spinner bulkhead removal. Refer to Figure 3-55.

(a) Remove the bolts, nuts and washers that attach the bulkhead to a ring and spinner mounting plate.

(b) Remove the two-piece spinner mounting plate, spinner bulkhead, and ring from the engine flange.

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 shaft O-ring.

(8) Put the propeller and spinner dome on a suitable cart for transportation.

K. Removing Propeller Models, HC-A3(MV,V)K-4
Refer to Figure 3-20.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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) Remove the safety wire on the propeller mounting bolts.

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(3) Support the propeller assembly with a sling.

NOTE 1: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting bolts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

(4) Remove the propeller mounting bolts from the engine flange.

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

(5) Remove the propeller mounting bolts and washers.

NOTE 1: Three propeller mounting bolts and washers cannot be removed from the propeller hub due to interference with other propeller parts.

NOTE 2: 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.

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

(7) Remove the shim.

(8) Remove and discard the shaft O-ring.

(9) If the spinner was manufactured by Hartzell Propeller:

(a) Do not remove the spinner adapter ring.

(b) Visually inspect the spinner adapter ring for cracks.

(c) If cracks are found in the spinner adapter ring, remove it from the engine starter ring gear and replace it.

(10) Put the propeller and spinner dome on a suitable cart for transportation.

L. Removing Propeller Models, HC-A3(MV,V)F-5A(L)
Refer to Figure 3-21.

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

(1) Remove the spinner dome

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

(b) Remove the spinner dome

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

CAUTION: THE BETA TUBE MUST BE REMOVED BEFORE THE PROPELLER ASSEMBLY IS REMOVED FROM THE AIRCRAFT. REFER TO THE AIRCRAFT MAINTENANCE INSTRUCTION MANUAL.

(2) Remove the beta adjust anti-rotation hardware.

(3) Remove the beta adjust screw.

(4) Remove the beta tube.

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 114C (61-10-14).

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

(5) Routine propeller engine shutdown will engage the start lock units, 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 start lock plates from the start lock units.

(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 allow the blades to rotate to high/feather pitch.

(6) Remove the safety wire on the propeller mounting bolts.

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(7) Support the propeller assembly with a sling.

NOTE 1: To allow rotation of the propeller for ease of bolt removal, supporting the propeller with a sling may be delayed until all but two mounting nuts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

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

(8) Remove the propeller mounting bolts and washers.

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

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

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

(10) Remove and discard propeller mounting O-ring.

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

M. Removing Propeller Models, (P)HC-A3(MV,V)F-5R
Refer to Figure 3-22.

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 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.
   (c) Remove layers of masking or duct tape from each blade shank, if applicable.
(2) Disconnect the propeller beta ring from the carbon block assembly and lever. Refer to Figure 3-22.
   (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 THE HARTZELL PROPELLER OVERHAUL MANUAL.

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

(3) Routine propeller engine shutdown will engage the start lock units, 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 start lock plates from the start lock units.

(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 allow the blades to rotate to high/feather pitch.

(4) Remove the safety wire on the propeller mounting nuts.

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 POUNDS (362.99 KG.) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(5) Support the propeller assembly with a sling.

NOTE 1: To allow rotation of the propeller for ease of nut removal, supporting the propeller with a sling may be delayed until all but two mounting nuts and washers have been removed.

NOTE 2: If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark (with a felt-tipped pen only) on the propeller hub and a matching mark on the engine flange to ensure proper positioning of the propeller during reinstallation. This will prevent dynamic imbalance.

(6) 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 and washers.

(7) Remove and discard the mounting nut and washer from the end of each mounting stud.

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

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

(10) Decompress and remove the beta system puller.

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

N. Removing Splined Propeller Models, HA-A2(MV,V)20-1B Refer to Figure 3-24.

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.

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

(1) Piston Removal (Refer to Figure 3-24 and Figure 3-25).

(a) Remove the piston nut.

(b) Remove the safety wire 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 and 2) 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) Slide the piston off the cylinder.

(2) Pitch adjustment assembly removal

(a) Remove the ring retention plate screw safety wire.

(b) Remove the ring retention plate screws.

(c) Remove the plate.

(d) Remove the split retainer from the recess in the cylinder.

(e) Remove the pitch adjustment assembly from the cylinder.

(3) Remove the hub lock safety pin. Refer to Figure 3-28.

(4) Support the propeller assembly with a sling.

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

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

(6) Using the support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.

(7) Remove and discard the rear cone O-ring. Refer to Figure 3-27.

(8) Remove the rear cone. Refer to Figure 3-27.

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

O. Removing Splined Propeller Models, HC-A2(MV,V)20-1A
Refer to Figure 3-30.

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.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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: OIL WILL FLOW OUT OF THE PROPELLER WHEN THE PISTON IS REMOVED. PUT A DRIP PAN UNDER THE PROPELLER TO CATCH THE EXCESS OIL.

(2) Piston Removal
Refer to Figure 3-25

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

(b) Remove the washer from each piston rod.

(c) Loosen the set screw in each fork.

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

NOTE: This will insure that the components are reassembled in their original location.

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

(f) Rotate the piston to move the forks away from the clamp, link screws, and pitch change blocks.

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

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

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

NOTE: This will insure that the components are reassembled in their original location.

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

(3) Remove the hub lock safety pin. Refer to Figure 3-28.

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

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

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) Remove the rear cone from the engine shaft.

(8) Remove the spinner bulkhead from the engine shaft.

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

P. Removing Splined Propeller Models, HC-A3(MV,V)20-1( )
Refer to Figure 3-31.

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 to the spinner bulkhead.

(b) Remove the spinner dome.

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

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER'S 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: OIL WILL FLOW OUT OF THE PROPELLER WHEN THE PISTON IS REMOVED. PUT A DRIP PAN UNDER THE PROPELLER TO CATCH THE EXCESS OIL.

(2) Piston Removal
Refer to Figure 3-25.

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

(b) Remove the washer from each piston rod.

(c) Loosen the set screw in each fork.

(d) Slide the piston away from the hub and to the low pitch position, until the piston rods clear the bulkhead.

(e) Rotate the piston and forks away from the clamp link screws.

(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 and remove it from the propeller.

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

(i) The pitch change blocks should have index numbers (1, 2, and 3) marked with a felt-tipped pen to correspond to the numbers on the piston ears, forks, counterweights, and guide collar. If they are not marked, number them with a felt-tipped pen.

NOTE: This will insure that the components are reassembled in their original location.

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

(3) Remove the hub lock safety pin. Refer to Figure 3-28.

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

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

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

(5) Support the propeller assembly with a sling.

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, slide the propeller from the engine splined shaft and lift the propeller from the engine.

(7) Remove and discard the rear cone O-ring. Refer to Figure 3-32.

(8) Remove the rear cone from the engine shaft. Refer to Figure 3-32.

(9) Remove the rear spinner bulkhead from the engine shaft. Refer to Figure 3-32.

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

Q. Removing Splined Propeller Models, HC-A2(MV,V)20-2 and HC-A3(MV,V)20-2( )

Refer to Figure 3-33 and Figure 3-34.

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

CAUTION 2: 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 lock units, preventing the propeller from feathering. For purposes of propeller removal, the propeller should be placed 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 start lock plates from the start lock units.

(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 allow the blades to rotate to high/feather pitch.

(3) Piston removal (Refer to Figure 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 and 2 for a 2-blade propeller; 1, 2, and 3 for a 3-blade propeller) 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) Remove the socket head cap screw, jam nut, and washer from each piston guide rod.

(g) Slide the piston off the cylinder.

(4) Feathering spring assembly removal: Refer to Figure 3-35.

WARNING: DO NOT FORCE THE FEATHERING SPRING TO RELEASE THE SPLIT RINGS IN THE CYLINDER. FORCING THE FEATHERING SPRING MAY CAUSE THE RELEASE OF THE SPLIT RING RETAINERS IN THE SPRING ASSEMBLY, RESULTING IN THE EXPLOSIVE RELEASE OF THE FEATHERING SPRINGS.

(a) Remove the safety wire (if installed) from the ring retention plate screws.

(b) Remove the ring retention plate screws.

(c) Remove the front spring retainer split rings by first pushing the feathering spring assembly into the cylinder about 0.25 inch (6.35 mm), allowing the split rings to fall out of the groove in the piston.

(d) Remove the feathering spring assembly from the cylinder.

(5) Remove the hub lock safety pin.

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

(6) Support the propeller assembly with a sling.

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

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

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) Using the support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.

(9) Remove and discard the rear cone O-ring on the engine splined shaft. Refer to Figure 3-36.

(10) If necessary, remove the rear cone. Refer to Figure 3-36.

(11) If necessary, remove the rear spinner bulkhead.

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

R. Removing Splined Propeller Models, HC-A2(MV,V)20-3L and HC-A3(MV,V)20-3L

Refer to Figure 3-38 and Figure 3-39.

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.

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.

(1) HC-A3(MV,V)20-3L propeller models

(a) Remove the elastic nut from the end of each beta rod.

(b) Remove the ring that connects all beta rods together.

(c) From each beta rod, remove the check nut that was used to secure the ring in place.

NOTE: One lock nut should still be installed on each beta rod. Do not remove the nut at this time.

(2) Make sure the piston is located at the highest blade pitch attainable.

WARNING: WHEN THE PROPELLER IS REINSTALLED, THE PROPELLER BLADE LOW PITCH ANGLE MUST BE MAINTAINED.

CAUTION: TO REESTABLISH THE LOCATION OF LOW PITCH WHEN THE PROPELLER IS REASSEMBLED, A PRECISE LOCATION OF THE LOW PITCH SELF-LOCKING NUT MUST BE ESTABLISHED. MEASUREMENT WITH A RULER IS NOT SUFFICIENT.

(3) Using a dial caliper, measure the distance from the inboard surface of each self-locking low pitch nut to the end of the corresponding beta rod.

(4) Using a separate information tag for each low pitch nut measurement, write the distance measured from the inboard surface of the self-locking low pitch nut to the end of the beta rod.

(5) Securely attach each information tag to its corresponding beta return spring on the beta rod.

(6) Remove the spacer and self-locking low pitch nut from each beta rod.

(7) Piston removal (Refer to Figure 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 and 2 for a 2-blade propeller; 1, 2, and 3 for a 3-blade propeller 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) Slide the piston off the cylinder.

(8) Feathering spring assembly removal:
Refer to Figure 3-35.

WARNING: DO NOT FORCE THE FEATHERING SPRING TO RELEASE THE SPLIT RINGS IN THE CYLINDER. FORCING THE FEATHERING SPRING MAY CAUSE THE RELEASE OF THE SPLIT RING RETAINERS IN THE SPRING ASSEMBLY, RESULTING IN THE EXPLOSIVE RELEASE OF THE FEATHERING SPRINGS.

(a) Remove the safety wire (if installed) from the feathering stop screws.

(b) Remove the two screws from each of the two feathering stops on the front spring retainer.

(c) Remove the feathering stops.

(d) Remove the front spring retainer split rings by first pushing the feathering spring assembly into the cylinder about 0.25 inch (6.35 mm), allowing the split rings to fall out of the groove in the piston.

(e) Remove the feathering spring assembly from the cylinder.

(9) Remove the shaft nut lock.

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

(10) Support the propeller assembly with a sling.

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

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

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

(12) Using the support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.

(13) Remove and discard the rear cone O-ring. Refer to Figure 3-40.

(14) Remove the rear cone. Refer to Figure 3-40.

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

S. Removing Splined Propeller Models, HC-A2(MV,V)20-5L Refer to Figure 3-42 and Figure 3-43.

CAUTION 1: WHEN REMOVING THE PROPELLER FROM THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: 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.

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) Spinner dome removal

(a) Remove the screws and washers that attach 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: THE PISTON, SPRING ASSEMBLY, AND SAFETY PIN MUST BE REMOVED BEFORE REMOVING THE PROPELLER FROM THE AIRCRAFT.

(2) Piston Removal
Refer to Figure 3-44 and Figure 3-45.

(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 must have corresponding index numbers (1 and 2 for a 2-blade propeller) impression-stamped or marked with a felt-tipped pen.

1 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) Slide the link arms out of the piston slots.

(g) Remove the socket head cap screw, check nut, and washer from each piston guide rod.

(h) Slide the piston off the cylinder.

(3) 831-15 spring assembly removal:
Refer to Figure 3-46.

WARNING: DO NOT FORCE THE SPRING ASSEMBLY TO RELEASE THE SPLIT RINGS IN THE CYLINDER. FORCING THE SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE SPLIT RING RETAINERS AT THE OPPOSITE END OF THE SPRING ASSEMBLY, RESULTING IN THE EXPLOSIVE RELEASE OF THE SPRINGS.

(a) Remove the safety wire from the pitch stop spacer screws.

(b) Remove the two screws from each of the two pitch stop spacers on the front spring retainer.

(c) Remove the front spring retainer split rings by pushing the spring assembly into the cylinder approximately 0.25 inch (6.35 mm), permitting the split rings to fall out of the groove in the cylinder.

(d) Remove the spring assembly from the cylinder.

(4) Remove the hub lock safety pin. Refer to Figure 3-48.

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

(5) Support the propeller assembly with an appropriate crane hoist and sling.

(6) Using a BST-2910 shaft nut wrench, loosen the shaft nut from the engine shaft threads.

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

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

(7) Using the crane hoist and support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.

(8) Remove and discard the rear cone O-ring on the engine splined shaft. Refer to Figure 3-47.

(9) If necessary, remove the rear cone. Refer to Figure 3-47.

(10) If necessary, remove the rear spinner bulkhead.

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

(12) To remove the D-2006 reversing beta valve assembly from inside the engine shaft, refer to the airframe or engine manufacturer's instructions.

NOTE: For the reversing beta valve assembly location in the engine extension and engine shaft, refer to Figure 3-42.

(13) To remove the external beta valve assembly, refer to the airframe or engine manufacturer's instructions.

NOTE: For the reversing valve assembly, the cockpit control cable, and the hydraulic connections, refer to Figure 3-43.

TESTING AND TROUBLESHOOTING - CONTENTS

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1. Operational Checks (Rev. 1)

   A. Operational Checks

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

2. Propeller Ice Protection Systems (Rev. 2)

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

   A. Operational Checks and Troubleshooting

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

3. Troubleshooting

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

A. Hunting and Surging (Rev. 2)

(1) General

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

(b) If propeller is hunting, a certified airframe and powerplant mechanic with the appropriate rating or a certified propeller repair station with the appropriate rating should check:

1 Governor

2 Fuel control

3 Synchrophaser, or synchronizer (if applicable)

(2) If propeller is surging:

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

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

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

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

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

(c) For reversing propeller models ( )HC-A( )( )( )-2( ) and ( )HC-A( )( )( )-5R when operating at or near low pitch may be caused by excessive side clearance between the beta ring and the carbon block assembly. Refer to the section, "Carbon Block Assemblies" in the Maintenance Practices chapter of this manual.

B. Engine Speed Varies with Airspeed

NOTE: This section does not apply to propeller model HA-A2MV20-1B, since it is not constant speed and does not change blade pitch in flight. For this model, engine speed will increase with increasing airspeed and will decrease with decreasing airspeed.

(1) Constant speed propeller models ( )HC-A( )( )( )-1( ), -2( ), -3( ), -4( ), -5( ), and -6( ) 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-A3( )( )-4( ), and HC-A2(MV,V)L-6F 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) ( )HC-A( )( )( )-1( ), -2( ), -3( ) and -5( ) 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 - ( )HC-A( )( )( )-1( ), ( )HC-A3( )( )-2( ), HC-A2(MV,V)20-2, HC-A3(MV,V)F-5A(L), and HC-A2(MV,V)20-5L propellers only.

(3) Decrease in engine speed while increasing airspeed:

(a) ( )HC-A3( )( )-4( ) and HC-A2(MV,V)L-6F propeller models:

1 Governor pilot valve is stuck and is excessively increasing oil volume.

(b) ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) 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-A( )( )( )-2, ( )HC-A3(MV,V)F-5A(L), and ( )HC-A3( )F-5R propeller models only.

(4) Increase in engine speed while decreasing airspeed:

(a) (HC-A3( )( )-4( ) and HC-A2(MV,V)L-6F propeller models:

1 Governor pilot valve is stuck and is excessively decreasing oil volume in the propeller.

(b) ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) propeller models:

1 Governor pilot valve is stuck and is excessively increasing oil volume.

(5) Decrease in engine speed while decreasing airspeed:

(a) ( )HC-A3( )( )-4( ) and HC-A2(MV,V)L-6F propeller models:

1 Governor is not reducing oil volume in the propeller.

2 Excessive friction in the blade bearings or pitch change mechanism.

(b) ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) 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.

C. Loss of Propeller Control

(1) For ( )HC-A3( )( )-4( ) and HC-A2(MV,V)L-6F propeller models:

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

1 Loss of oil pressure - check:

a Governor pressure relief valve for proper operation.

b Governor pilot valve sticking.

c Governor drive for damage.

d Adequate engine oil supply.

e Engine oil transfer bearing for excessive leakage.

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

1 Governor pilot valve sticking.

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

1 Excessive friction in blade bearings or pitch change mechanism.

2 Misalignment between the guide collar and piston rods.

3 Engine oil transfer bearing is leaking excessively.

4 Governor is not increasing oil volume in the propeller.

(2) For ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) propeller models:

(a) Propeller goes to uncommanded high pitch (or feather)

1 Loss of propeller oil pressure - check:

a Governor pressure relief valve for proper operation.

b Governor drive for damage.

c Adequate engine oil supply.

d Engine oil transfer bearing for excessive leakage.

2 Start Lock not engaging - ( )HC-A( )( )( )-2( ), ( )HC-A( )( )( )-5( ), ( )HC-A3(MV,V)F-5A(L), and ( )HC-A3( )F-5R propeller models only

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

1 governor pilot valve sticking.

(c) RPM increases with power and airspeed. Propeller RPM control has little or no effect.

1 Excessive friction in blade bearings or pitch change mechanism.

2 Excessive friction in misalignment between the guide collar and the piston rods - ( )HC-A( )( )( )-1( ), ( )HC-A3( )( )-2( ), HC-A2(MV,V)20-2, and HC-A3(MV,V)F-5A(L) propeller models only.

3 Broken spring (applies to ( )HC-A( )( )( )-2( ), ( )HC-A( )( )( )-3( ), and ( )HC-A( )( )( )-5( ) propeller models)

4 Governor is not reducing oil volume in the propeller.

D. Failure to Feather (or Feathers Slowly) (Rev. 1)
Propeller Models: ( )HC-A( )( )( )-2( ), ( )HC-A3(MV,V)F-5A(L), and ( )HC-A3( )F-5R

(1) Broken feathering spring (if applicable).

(2) Check for proper function and rigging of propeller/governor control linkage.

(3) Check the governor function.

(4) The propeller must be inspected for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction.

(a) This inspection must be performed by a certified propeller repair station with the appropriate rating.

E. Failure to Unfeather (Rev. 1)
Propeller Models: ( )HC-A( )( )( )-2( ), ( )HC-A3(MV,V)F-5A(L), and ( )HC-A3( )F-5R

(1) Check for proper function and rigging of the propeller control linkage.

(2) Check the governor function.

(3) Check for excessive oil leakage at the engine transfer bearing.

(4) The propeller must be inspected for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction.

(a) This inspection must be accomplished by a certified propeller repair station with the appropriate rating.

F. Start Locks Fail to Latch
Propeller Models: ( )HC-A( )( )( )-2, ( )HC-A3(MV,V)F-5A(L), and ( )HC-A3( )F-5R

(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 auto high pitch stop 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.

(a) 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.

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

(4) Excessive governor pump leakage.

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

(5) Broken start locks.

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

G. Vibration (Rev. 1)

CAUTION 1: ANY VIBRATION THAT CAN BE DESCRIBED AS APPEARING SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE LEAKAGE, SHOULD BE INVESTIGATED IMMEDIATELY, BEFORE FURTHER FLIGHT.

CAUTION 2: VIBRATION PROBLEMS BECAUSE OF PROPELLER SYSTEM IMBALANCE ARE NORMALLY FELT THROUGHOUT THE RPM RANGE, WITH THE INTENSITY OF VIBRATION INCREASING WITH RPM. VIBRATION PROBLEMS THAT OCCUR IN A NARROW RPM RANGE ARE A SYMPTOM OF RESONANCE THAT IS POTENTIALLY HARMFUL TO THE PROPELLER. AVOID OPERATION UNTIL THE PROPELLER CAN BE CHECKED BY A CERTIFIED REPAIR STATION WITH THE APPROPRIATE RATING.

(1) Check:
- (a) Control surfaces, cowl flaps, exhaust system, landing gear doors, etc. for excessive play that may be causing vibration that is unrelated to the propeller
- (b) Isolation of engine controls and lines
- (c) Engine mount wear
- (d) Uneven or over lubrication of the propeller
- (e) Proper engine/propeller flange mating
- (f) Blade track:
  - 1 Refer to the section, "Blade Track" in the Inspection and Check chapter of this manual.
- (g) Blade angles:
  - 1 Blade angles must be within specified tolerance between blades.
    - a Refer to a certified propeller repair station with the appropriate rating to check/adjust blade angles.

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

(i) Static balance

(j) Hub damage or cracking

(k) Grease or oil leakage

(l) Blade deformation

(2) Dynamic Balance

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

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

H. 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-A3( )( )-4( ) and HC-A2(MV,V)L-6F

1 Governor failure

2 Excessive leakage in the governor oil supply to the propeller.

(e) Broken spring causes momentary overspeed - ( )HC-A( )( )( )-2( ), ( )HC-A( )( )( )-3( ), and ( )HC-A( )( )( )-5( ) propeller models.

(f) Governor pilot valve jammed, supplying high pressure only - ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) propeller models.

I. Propeller Underspeed

(1) Check:

(a) Tachometer error.

(b) Excessive transfer bearing leakage - ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) propeller models.

(c) Governor oil pressure low - ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) propeller models.

(d) Governor oil passage clogged.

(e) Governor pilot valve jammed - ( )HC-A( )( )( )-1( ), -2( ), -3( ), and -5( ) propeller models.

J. 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.

1 Tighten the fitting.

(b) Defective lubrication fitting.

1 Replace the fitting.

(c) Incorrect O-ring between the blade clamp and the propeller hub.

1 Refer to a certified propeller repair station with the appropriate rating for replacement of the O-ring.

(d) Grease leaks past the blade clamp seal gaskets. Replace the gaskets.

(e) Grease leaks from between the blade clamp and the blade.

1 Refer to a certified propeller repair station with the appropriate rating for replacement of sealant.

(f) Grease leaks from the clamp in a static condition when the blade is pointed up. - Improper application of silicone sealant on the clamp radius of the bearing-to-clamp interface.

1 Refer to a certified propeller repair station with the appropriate rating for reapplication of silicone 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 a certified propeller repair station with the appropriate rating.
   (b) Faulty gasket between the governor and beta valve, or the beta valve and the engine. Replace the gasket.
   (c) Faulty O-rings between the beta valve body and the beta valve spool. Refer to a certified propeller repair station with the appropriate rating for replacement.

INSPECTION AND CHECK - CONTENTS

INSPECTION AND CHECK - CONTENTS, CONTINUED

LIST OF FIGURES

1. Pre-Flight Checks (Rev. 5)

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

A. Important Information

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

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

B. Propeller Blades

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

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

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

(3) At the tips of the blades, check for play (radial, in-and-out, and end play).

(a) Refer to the section, "Blade Tolerances" in this chapter for blade play limits.

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

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

C. Spinner Assembly and Blade Retention Components

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

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

D. Hardware

(1) Check for loose or missing hardware.

(a) Retighten or reinstall as necessary.

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

E. Grease/Oil Leakage

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

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

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

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

F. Initial Run-Up

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

G. Additional Information

(1) Refer to the airframe manufacturer's manual for additional pre-flight checks.

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

2. Operational Checks (Rev. 4)

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

A. Initial Run-Up

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

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

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

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

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

(a) Repeat this step at least three times.

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

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

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

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

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

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

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

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

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

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

B. Static RPM Check

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

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

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

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

(3) Start the engine.

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

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

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

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

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

(7) Stop the engine.

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

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

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

    1 If the governor is adjusted to the rated RPM with the maximum RPM stop screw, hold the maximum RPM stop screw in place and torque the maximum RPM stop locking nut in accordance with Table 3-2, "Torque Table" in this manual.

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

C. Post-Run Check

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

D. Propeller Ice Protection System

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

3. Required Periodic Inspection and Maintenance (Rev. 3)

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

A. Periodic Inspection

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

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

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

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

(2) Remove the spinner dome.

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

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

(4) Make an entry in this logbook about completion of these inspections.

B. Periodic Maintenance

(1) Lubricate the propeller assembly.

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

C. Airworthiness Limitations

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

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

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

D. Overhaul Periods

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

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

(3) To protect your safety, your investment, and to maximize the safe operating lifetime of your propeller, it is essential that a propeller be properly maintained and overhauled according to the recommended service procedures.

(a) For Hartzell propeller overhaul periods, refer to Hartzell Propeller Service Letter HC-SL-61-61Y.

4. Inspection Procedures

A. Blade Damage (Rev. 1)

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

B. Grease/Oil Leakage (Rev. 2)

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

(1) Important Information

(a) A new or newly overhauled propeller may leak slightly during the first several hours of operation. This leakage may be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. Leakage should cease within the first ten hours of operation.

(b) Leakage that persists beyond the first ten hours of operation on a new or newly overhauled propeller, or occurs on a propeller that has been in service for some time will require repair.

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

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

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

(c) Grease Leakage - probable causes:

1 Loose/defective lubrication fitting

2 Grease leaks between the blade clamp and the propeller hub

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

3 Grease leaks past the blade clamp seal gaskets

4 Grease leaks from between the blade clamp and the blade

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

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

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

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

(d) Oil Leakage - probable causes:

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

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

3 Displaced felt seal between the piston and the cylinder

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

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

(e) Beta Tube/Valve System Oil Leakage (if applicable) - probable causes:

1 Faulty O-rings between the beta tube/valve.

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

(2) Inspection Procedure

(a) Remove the spinner dome.

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

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

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

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

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

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

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

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

C. Vibration (Rev. 3)

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

(1) Important Information

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

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

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

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

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

(2) Inspection

(a) Remove the spinner dome.

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

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

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

(c) If cracks are suspected, additional inspections must be performed before further flight.

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

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

(d) Inspect the play of the propeller blades in accordance with the section, "Blade Tolerances" in this chapter.

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

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

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

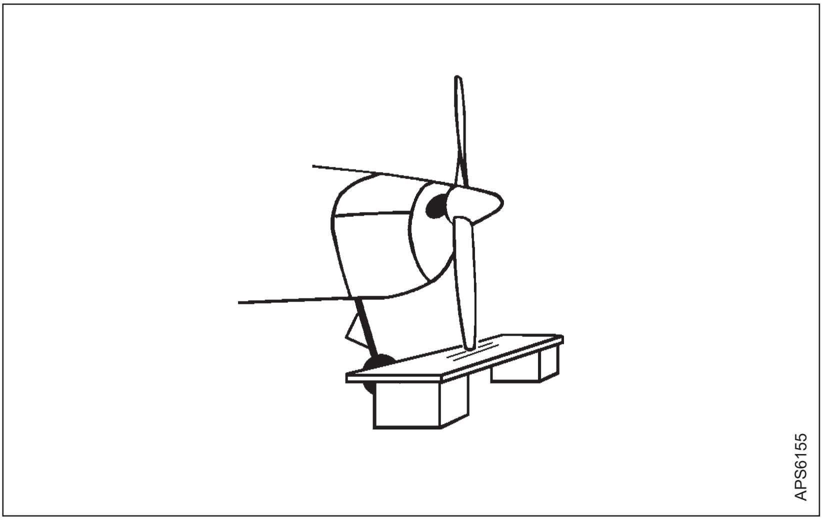
2 Visually check for damaged blades.

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

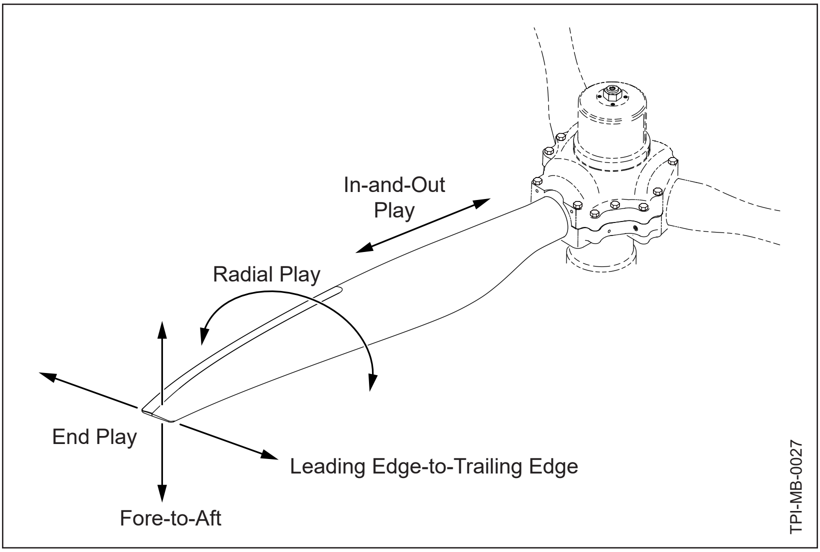
1 These inspections must be performed at a certified propeller repair station with the appropriate rating.

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

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



Checking Blade Track
Figure 5-1



Blade Play
Figure 5-2

D. Blade Track

(1) Check the blade track as follows:

(a) Chock the aircraft wheels securely.

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

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

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

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

(d) Repeat this procedure with the remaining blades.

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

(2) Possible Correction

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

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

E. Blade Tolerances (Rev. 4)

(1) Limits for blade play are as follows:
Refer to Figure 5-2.

(a) End Play:

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

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

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

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

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

F. Corrosion (Rev. 1)

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

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

G. Spinner Damage (Rev. 3)

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

(a) Metal Spinners

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

2 Contact the local airworthiness authority for repair approval.

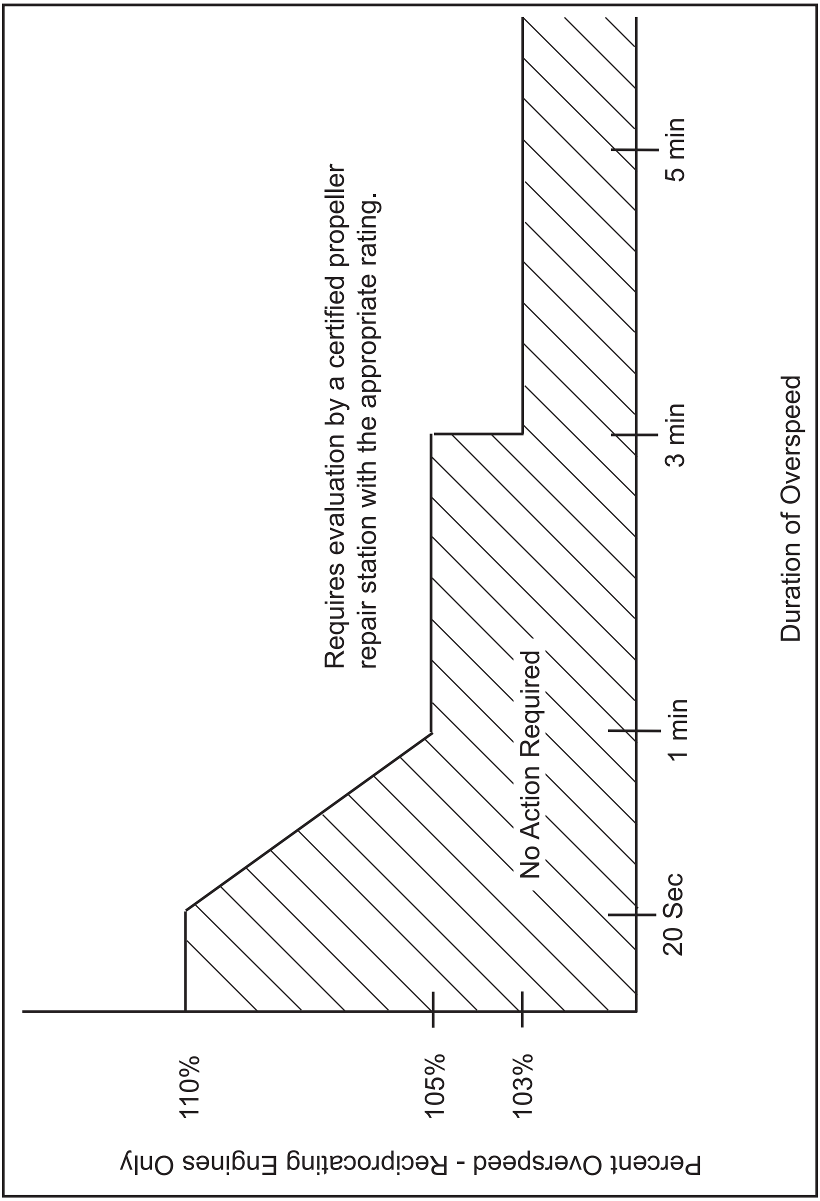
(b) Composite Spinners

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

2 Contact the local airworthiness authority for repair approval.

H. Propeller Ice Protection System (Rev. 1)

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



Reciprocating Engine Overspeed Limits
Figure 5-3

5. Special Inspections

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

A. Overspeed (Rev. 2)

(1) 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.

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

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

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

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

B. Lightning Strike (Rev. 1)

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

(1) General

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

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

(2) Temporary Operation Inspection

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

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

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

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

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

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

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

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

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

(1) General

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

1 A conservative approach in evaluating the damage is required because there may be hidden damage that is not readily apparent during an on-wing, visual inspection.

(b) A foreign object/ground strike is defined as:

1 Any incident, whether or not the engine is operating, that requires repair to the propeller other than minor dressing of the blades.

a Examples of foreign object/ground strike include situations where an aircraft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade(s).

b These cases should be handled as foreign object/ground strikes because of potentially severe side loading on the propeller hub, blades and retention bearings.

2 Any incident during engine operation in which the propeller impacts a solid object that causes a drop in revolutions per minute (RPM) and also requires structural repair of the propeller (incidents requiring only paint touch-up are not included). This is not restricted to propeller strikes against the ground.

3 A sudden RPM drop while impacting water, tall grass, or similar yielding medium, where propeller blade damage is not normally incurred.

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

(2) Inspection Procedure

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

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

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

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

a Refer to the section, "Blade Tolerances" in this chapter for the permitted limits of blade play.

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

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

5 Any blade diameter reduction

6 Bent, cracked, or failed engine shaft

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

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

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

(d) Engine mounted components - such as governors, pumps, etc. may be damaged by a foreign object strike, especially if the strike resulted in a sudden stoppage of the engine.

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

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

D. Fire/Heat Damage (Rev. 1)

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

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

E. Sudden Stoppage (Rev. 1)

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

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

F. Engine Oil Contamination (Rev. 1)

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

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

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

6. Long Term Storage (Rev. 1)

   A. Important Information

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

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

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

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MAINTENANCE PRACTICES - CONTENTS

MAINTENANCE PRACTICES - CONTENTS, CONTINUED

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1. Cleaning (Rev. 2)

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

CAUTION 2: BEFORE CLEANING THE PROPELLER, BE SURE THE PROPELLER HAS BEEN INSPECTED IN ACCORDANCE WITH THE REQUIRED PERIODIC INSPECTIONS SPECIFIED IN THIS MANUAL. CLEANING THE PROPELLER PRIOR TO INSPECTION MAY REMOVE EVIDENCE OF A CONDITION THAT REQUIRES CORRECTIVE ACTION.

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

A. General Cleaning

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

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

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

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

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

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

(a) Immediately dry the inside of the spinner dome using a clean dry cloth.

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

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

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

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

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

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

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

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

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

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

(9) Let the propeller dry.

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

B. Spinner Cleaning and Polishing

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

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

2. Lubrication (Rev. 6)

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

A. Lubrication Intervals

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

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

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

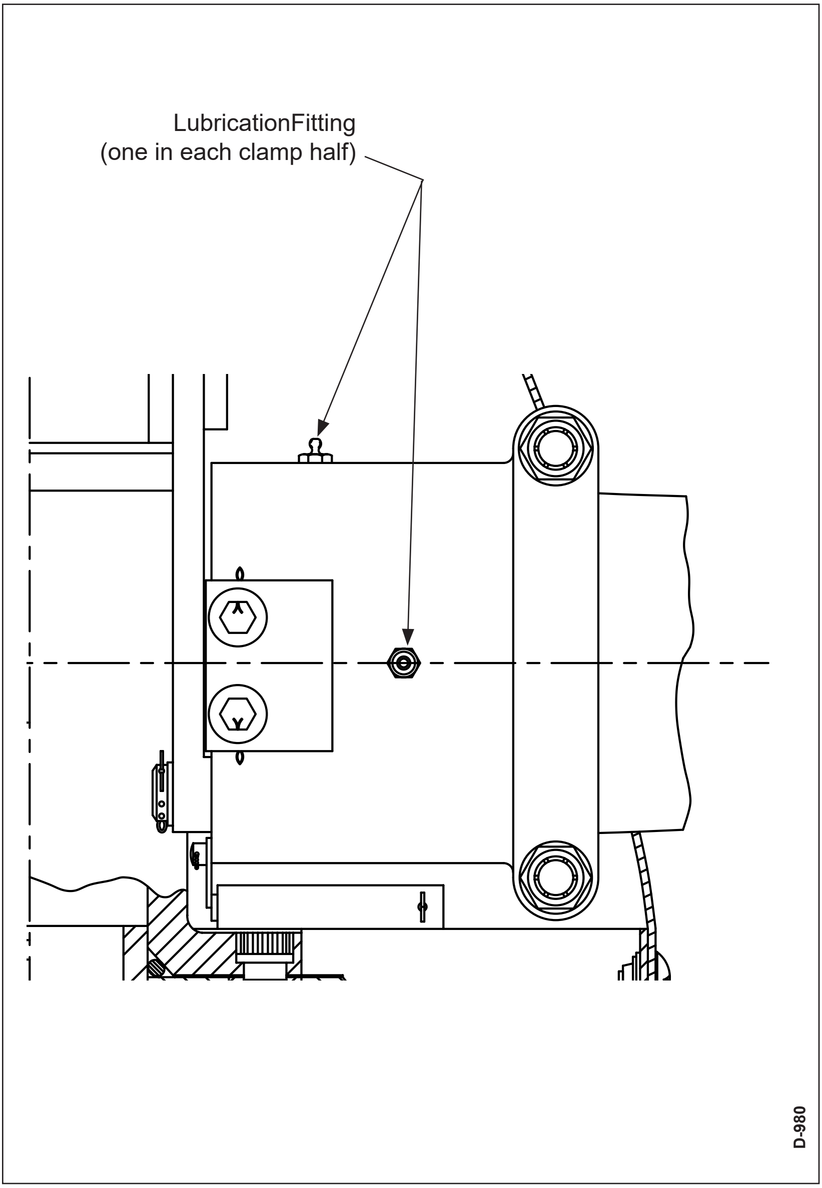
(b) If the aircraft is operated or stored under adverse atmospheric conditions, e.g. high humidity, salt air calendar lubrication intervals should be reduced to six months.

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

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

(3) Hartzell Propeller recommends that new or newly overhauled propellers be lubricated after approximately the first 10 hours of operation, because centrifugal loads will pack and redistribute grease which can result in a propeller imbalance. Redistribution of grease may also result in voids in the blade bearing area where moisture can collect.

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



Lubrication Fitting
Figure 6-1

B. Lubrication Procedure

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

(1) Remove the propeller spinner.

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

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

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

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

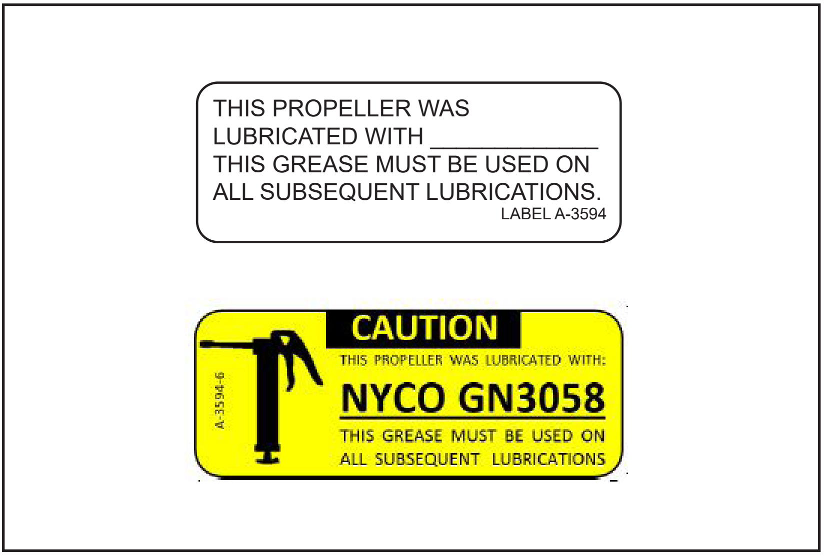
CAUTION: USE ONLY HARTZELL PROPELLER APPROVED GREASE. DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE EXCEPT AS NOTED IN THIS SECTION.

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

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

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

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



Lubrication Label
Figure 6-2

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

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

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

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

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

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

CAUTION 4: OVER LUBRICATING A STEEL HUB PROPELLER MAY CAUSE THE GREASE TO DISLODGE THE CLAMP GASKET OR SEAL, LEADING TO A POTENTIAL GREASE LEAK. THE CLAMP MUST THEN BE DISASSEMBLED TO REMOVE THE SEAL OR CLAMP GASKET.

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

(a) For blade clamps with two lubrication fittings:

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

a Repeat for each blade clamp assembly.

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

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

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

b Repeat for each blade clamp assembly.

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

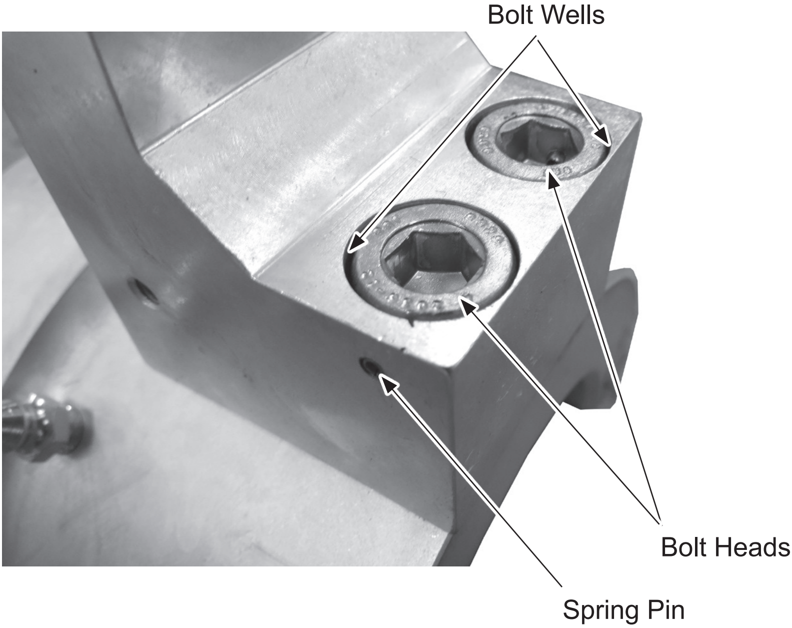
(8) Tighten the lubrication fittings until snug.

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

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

C. Approved Lubricants

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



NOTE: Non-painted clamp unit is shown.

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

Applying Corrosion Inhibitor CM352
Figure 6-3

3. Corrosion Inhibitor (Rev. 2)

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

A. Application Intervals

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

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

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

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

B. Application Procedure

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

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

(2) Spray the corrosion inhibitor CM352 into a cup or container, then use a soft bristled brush to apply the corrosion inhibitor CM352 to the bolt heads, spring pins, and bolt wells of the counterweight. Refer to Figure 6-3.

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

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

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

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

4. Beta Feedback Block Assemblies (Rev. 1)

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

A. Inspection

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

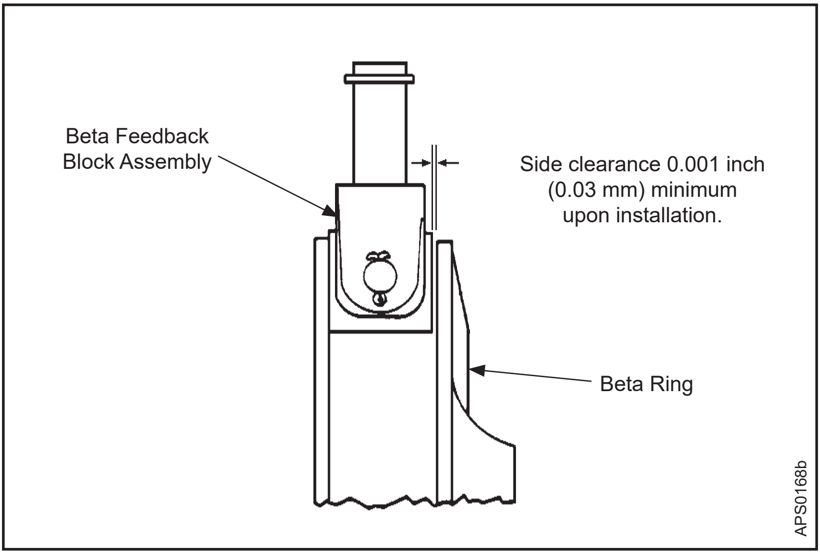
(2) Inspect the beta lever and beta feedback block assembly interface for free movement. If there is binding, do the following:

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

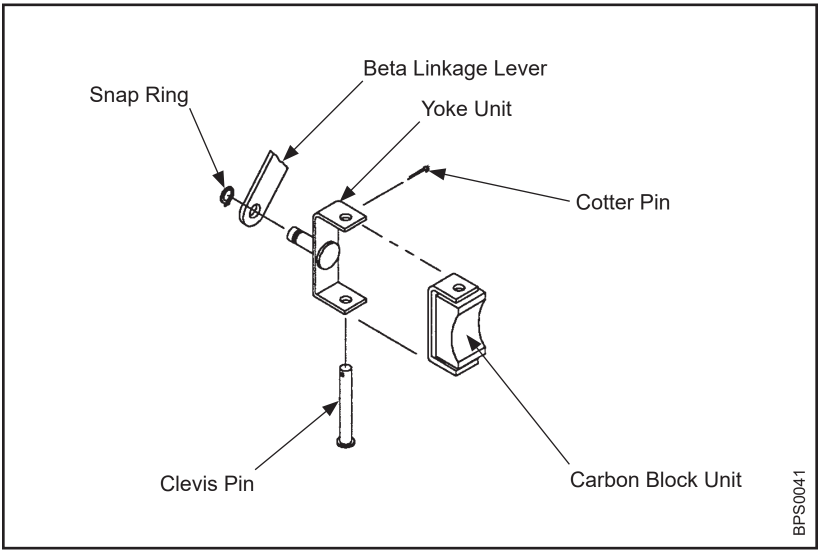
(b) Using an abrasive pad, lightly polish the yoke pin to provide adequate clearance and eliminate binding.

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

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



Beta Feedback Block Assembly and Beta Ring Clearance
Figure 6-4



Beta Feedback Block Assembly
Figure 6-5

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

(1) If the side clearance between the beta ring and the beta feedback block unit exceeds 0.010 inch (0.25 mm) - refer to Figure 6-4, replace the A-3026 carbon block unit in acordance with Figure 6-5 and the following steps:.

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

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

(c) Inspect the yoke for wear or cracks.

1 Replace the yoke, if necessary.

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

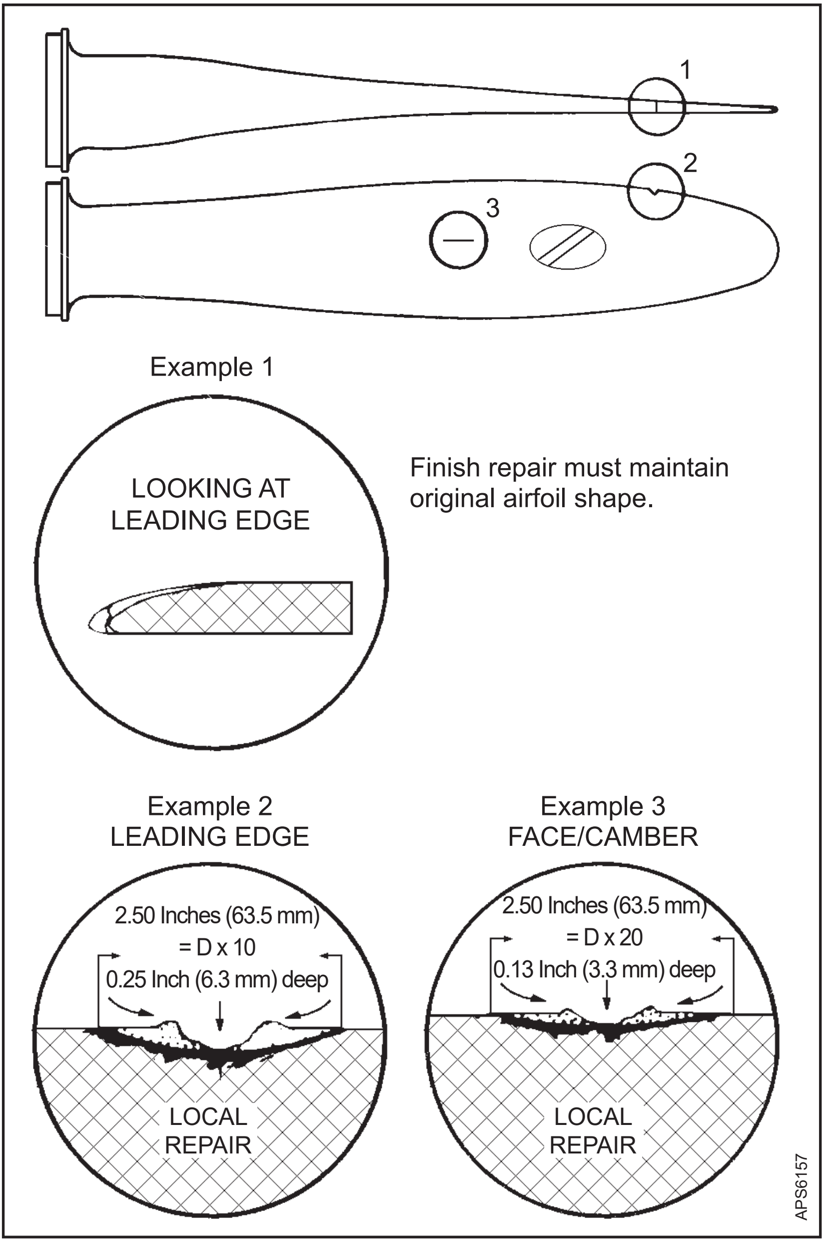
(e) Secure the clevis pin with a T-head cotter pin.

(f) Refit the carbon block in accordance with Figure 6-4.

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

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

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



Repair Limitations
Figure 6-6

5. Aluminum Blades (Rev. 6)

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

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

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

A. Important Information

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

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

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

B. Repair of Nicks and Gouges

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

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

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

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

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

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

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

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

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

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

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

(b) Repairs that form a continuous line across the blade section (chordwise) are unacceptable.

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

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

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

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

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

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

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

C. Repair of Bent Blades

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

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

Vendor	Color/Type	Vendor P/N	Hartzell Propeller P/N
Tempo	Epoxy Black	A-150	A-6741-145-2
Tempo	Epoxy Gray	A-151	A-6741-146-2
Tempo	Epoxy White (tip stripe)	A-152	A-6741-147-2
Tempo	Epoxy Red (tip stripe)	A-153	A-6741-149-2
Tempo	Epoxy Yellow (tip stripe)	A-154	A-6741-150-2
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1
Sherwin-Williams	Gray	F75KXA10445-4311	A-6741-146-1
Sherwin-Williams	Gray Metallic	F75KXM9754-4311	A-6741-148-1
Sherwin-Williams	White (tip stripe)	F75KXW10309-4311	A-6741-147-1
Sherwin-Williams	Red (tip stripe)	F75KXR12320-4311	A-6741-149-1
Sherwin-Williams	Yellow (tip stripe)	F75KXY11841-4311	A-6741-150-1
Sherwin-Williams	Silver Metallic	F63TXS30880-4311	A-6741-163-1
Sherwin-Williams	Silver	F75KXS13564-4311	A-6741-190-1
Sherwin-Williams	Bright Red	1326305 or F63TXR16285-4311	A-6741-200-5
Sherwin-Williams	Bright Yellow	1326313 or F63TXY16286-4311	A-6741-201-5
Sherwin-Williams	Bright Silver	1334259	A-6741-203-5
Sherwin-Williams	Prop Gold	F63TXS17221-4311	A-6741-204-5

Touch-up Paints
Table 6-1

6. Blade Paint Touch-Up (Rev. 3)

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

A. Important Information

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

(a) Aluminum Blades Only:

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

B. Paint

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

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

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

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

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

C. Procedure

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

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

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

(2) Permit the solvent to evaporate.

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

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

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

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

(5) Permit the solvent to evaporate.

(6) Aluminum Blades Only:

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

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

(7) Apply masking material to the erosion shield, anti-icing or de-ice boot, and tip stripes, as needed.

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

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

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

   (a) Re-coat before 30 minutes, or after 48 hours.

   (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.

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

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

   (a) Re-coat before 30 minutes, or after 48 hours.

   (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.

(11) Remove the masking material immediately from the anti-icing or de-ice boot and tip stripes, if applicable.

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

A-48 Weight Slug Limits on C-3-( ) and D-6831-( ) Clamps

C-3-( ) and D-6831-( ) clamps have only two locations for the A-48, A-48A, or A-1419 weight slugs (Figure 6-4). Clamps may have tapped holes on the inboard side of the clamp outboard bolt lugs providing an alternate mounting location if it is necessary to move the weight slugs to clear the spinner.

NOTE: A-48 (steel) weight slugs may be replaced with A-48A (lead) weight slugs although the most outboard slug must be an A-48 (steel) weight slug. The number limits for slugs still applies.

Aircraft Mfg.	Propeller Model	Spinner Assembly	Lead**	Trail*
Aero Commander	HC-A2(V,MV)F-2( )/(V,MV)8433( )-4	C-2530	3	4
Aero Commander	HC-A3(V,MV)20-2( )/(V,MV)9333( )	---	0	3-See Note 1
Beech	HC-A3(V,MV)20-2( )/(V,MV)9333( )-3	---	0	3
Riley	HC-A3(V,MV)K-2( )/(V,MV)7636( )	A-835-( )	4	2-See Note 2
Riley	HC-A3(V,MV)K-2( )/(V,MV)7636( )	C-2513-( )	4-See Note 3	4

** "Lead" and "Trail" refer to the weight location on the outboard bolt lugs of the C-3-( ) and the D-6831-( ) clamps as referenced to the blade lead and trail edges.

Maximum Number of Balance Weights for Non-Standard Installations
Table 6-2, page 1 of 3

Aircraft Mfg.	Propeller Model	Spinner Assembly	Lead**	Trail**
Beech	PHC-A3(V,MV)F-2( )/(V,MV)7636( )	A-836-36, -37	0	4-See Note 4
Beech / Colemill	EHC-A3(V,MV)F-2( )/(V,MV)7636( )	A-836-36	0	4-See Note 4
Colemill Commander	EHC-A3(V,MV)F-2( )/(V,MV)7636( )	A-836-25	0	4
Excaliber	HC-A3(V,MV)K-2( )/(V,MV)8433( )-2R	---	0	4
Beech	HC-A3(V,MV)K-2( )/(V,MV)9333( )-3	---	0	3-See Note 1
Cessna 411	HC-A3(V,MV)F-2( )/(V,MV)8833( )	---	4	0
Beagle	HC-A3(V,MV)F-2( )/(V,MV)8833( )	---	0	3
Beech	HC-A3(V,MV)F-4/(V,MV)8433( )-4R	---	See Note 5	
Piper	HC-A3(V,MV)F-4/(V,MV)8433( )-7	---	See Note 5	
Prinair	EHC-A3(V,MV)F-2( )/(V,MV)7636( )	---	See Note 6	
Beech	HC-A2(V,MV)20-4( )/(V,MV)8833( )-4	---	See Note 6	

** "Lead" and "Trail" refer to the weight location on the outboard bolt lugs of the C-3-( ) and the D-6831-( ) clamps as referenced to the blade lead and trail edges.

Maximum Number of Balance Weights for Non-Standard Installations
Table 6-2, page 2 of 3

Aircraft Mfg.	Propeller Model	Spinner Assembly	Lead**	Trail**
Beech	HC-A2(V,MV)20-4( )/(V,MV)8433( )	---	See Note 6	
Navion	HC-A2(V,MV)20-4( )/(V,MV)8433( )	---	See Note 6	

** "Lead" and "Trail" refer to the weight location on the outboard bolt lugs of the C-3-( ) and the D-6831-( ) clamps as referenced to the blade lead and trail edges.

Note 1: Three A-48 weight slugs or two A-1419 weight slugs.

Note 2: Two A-48 weight slugs or one A-1419 weight slugs.

Note 3: Four A-48 weight slugs or two A-1419 weight slugs.

Note 4: Four A-48 weight slugs or two A-1419 weight slugs and one A-48 weight slug.

Note 5: Four A-48 weight slugs on counterweight and five A-48 weight slugs on clamp on inboard side of outboard clamp bolt shoulder of clamp.

Note 6: A-48 weight slugs are only attached to the nut plates mounted on the spinner bulkhead. Maximum of (4) per location.

Maximum Number of Balance Weights for Non-Standard Installations
Table 6-2, page 3 of 3

7. Dynamic Balance

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.

A. Overview

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

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

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

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

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

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

B. Inspection Procedures Before Balancing

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

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

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

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

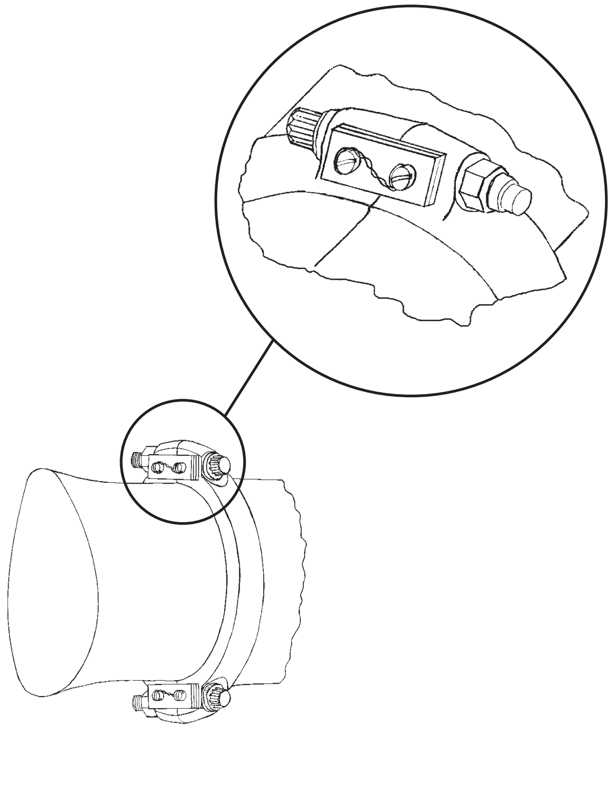
(c) Visually inspect the inner surface of the spinner dome for evidence of grease leakage.

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

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

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

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



Location of Balance Weights
Figure 6-7

C. Placement of Balance Weights for Dynamic Balance

(1) The preferred method of attachment of dynamic balance weights is to add the weights to the spinner bulkhead; however, the configuration of the spinner bulkhead on many of the propeller models covered in this manual makes it impractical to mount dynamic balance weights in this manner. Dynamic balance must be accomplished through the removal or addition and/or the relocation of the static balance weights located on the blade clamps.

(a) Each blade clamp has four balance weight locations on the outboard circular surface of the clamp (Figure 6-7).

(b) Maximum number of balance weights per location

1 For standard installations, the maximum number of balance weights per location is four (4).

NOTE: For propellers with a de-ice system using a blade clamp-mounted lead strap restraint, a maximum of three weights may be attached to the clamp with the de-ice lead strap restraint.

2 For nonstandard installations, refer to Table 6-2 for balance weight information.

CAUTION 1: BEFORE DYNAMIC BALANCE, RECORD THE NUMBER AND LOCATION OF ALL STATIC BALANCE WEIGHTS.

CAUTION 2: USE ONLY BALANCE WEIGHTS A-48, A-48A, OR A-1419.

CAUTION 3: DO NOT EXCEED THE MAXIMUM NUMBER OF BALANCE WEIGHTS PER LOCATION.

(c) Alter the number and/or location of static balance weights as necessary to achieve dynamic balance.

(2) If reflective tape is used for dynamic balancing, remove the tape immediately upon completion of dynamic balancing.

(3) Record the number and location of static balance weights, if they have been reconfigured, in the logbook.

8. Propeller Low Pitch Stop Setting

NOTE: The information contained in this section does not apply to ground adjustable propeller model HA-A2MV20-1B.

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 on All Propeller Models

(1) The propeller low pitch stop is normally set by Hartzell Propeller in accordance with the aircraft manufacturer’s requirements, and should not require any additional adjustment.

(a) The airframe manufacturer provides the required low pitch stop blade angle and may also provide the acceptable RPM range for a maximum power static condition.

NOTE: The airframe manufacturer 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-A3( )( )-2( )

CAUTION: PLACE 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.

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 HC-A2( )( )-2( ) and ( )HC-A( )( )( )-5A(L)

(1) Low pitch measurement must be performed at an appropriately licensed propeller repair facility or at the Hartzell factory.

D. Low Pitch Measurement on Propeller Models ( )HC-A( )( )( )-1( ), ( )HC-A( )( )( )-4( ), and ( )HC-A( )( )( )-6( )

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

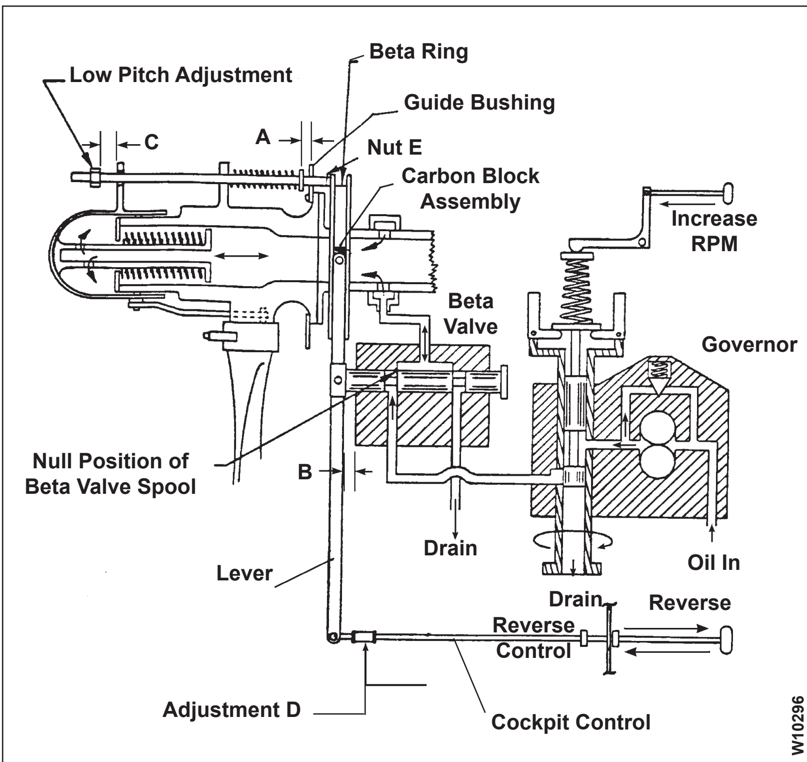
(2) With the blade in a horizontal position, measure the low pitch blade angle.

(3) If the blade angle requires adjustment, have the low pitch stop adjusted by an appropriately licensed propeller repair facility or by the Hartzell factory.

E. Low Pitch Measurement on Propeller Models BHC-A2( )F-3( ), HC-A3( )F-3L, and ( )HC-A3( )F-5R

<u>CAUTION</u>: PLACE 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.



Adjusting Low Pitch
Figure 6-8

(2) Rotate the blades by hand to move the blades and piston to low pitch.

NOTE: Low pitch is reached when the piston ears contact the self-locking nut on each rod, and when distance "C" is zero. Refer to Figure 3-19.

(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 - Propeller models BHC-A2( )F-3( ), HC-A3( )F-3L, and ( )HC-A3( )F-5R in this chapter.

F. Low Pitch Measurement on Propeller Models ( )HC-A2(MV,V)20-5L

(1) Low pitch measurement must be performed at an appropriately licensed propeller repair facility or at the Hartzell Propeller factory.

G. Adjusting Low Pitch on Propeller Models BHC-A2( )F-3( ), HC-A3( )F-3L, and ( )HC-A3( )F-5R

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:

(a) The low pitch adjustment “C” (Figure 6-8) 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 four nuts, as shown in Figure 6-8, 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 the maximum 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 0.0625 inch (1.587 mm) to 0.1875 inch (4.762 mm) during run-up of the engine for proper adjustment of the governor.

(c) The beta ring run-out can be checked 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 run-out to within 0.010 inch (0.25 mm) total indicator reading.

(d) Torque nut “E” in accordance with Table 3-2, "Torque Table".

(e) Make sure the four low pitch adjusting nuts contact the piston bosses at the same time.

NOTE: This will insure that the beta ring runs true during pitch change reversal.

To accomplish this:

1 Equalize “C” (Figure 6-8) for all four rods by means of accurate measurements.

2 Adjust the nuts if necessary.

H. Setting Low Pitch Angle on Propeller Models HC-A( )( )(20)-3( )

(1) The low pitch blade angle is normally set at the factory or propeller overhaul facility in accordance with the aircraft manufacturer's requirements.

(2) Information tags that specify the proper dimensional position for the low pitch nuts are normally attached to each reverse return spring (on the beta rod).

(3) If the blade angle requires adjustment, have the low pitch stop adjusted at an appropriately licensed propeller repair facility or at the Hartzell factory.

9. Propeller High Pitch Setting (Rev. 2)

A. High Pitch (Minimum RPM) Stop Adjustment
Propeller Models: ( )HC-A( )( )( )-1( ), ( )HC-A( )( )( )-3( ), ( )HC-A( )( )( )-4( ), ( )HC-A2(MV,V)20-5L, and ( )HC-A( )( )( )-6( )

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

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

10. Feathering Pitch Stop Setting (Rev. 2)

A. Feathering Pitch Stop Adjustment
Propeller Models: ( )HC-A( )( )( )-2( ), ( )HC-A( )( )( )-5A(L), and ( )HC-A3( )F-5R

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

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

11. Start Lock Setting (Rev. 2)

A. Start Lock Adjustment
Propeller Models: ( )HC-A( )( )( )-2( ), ( )HC-A( )( )( )-5A(L), and ( )HC-A3( )F-5R

(1) The start locks are set by Hartzell Propeller in accordance with the aircraft manufacturer's recommendations.

(2) Start locks can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

12. Propeller Ice Protection Systems (Rev. 1)

A. Maintenance Information

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

13. Tachometer Calibration (Rev. 2)

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

A. Important Information

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

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

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

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

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

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

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

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

(c) Continuous operation in a restricted RPM range subjects the propeller to stresses that are higher than the design limits.

(d) Stresses that are higher than the design limits will shorten the life of the propeller and could cause a catastrophic failure.

B. Tachometer Calibration

(1) Hartzell Propeller recommends that propeller owners/ operators calibrate the engine tachometer in accordance with the National Institute of Standards and Technology (NIST) or similar national standard (traceable).

(2) Contact Hartzell Propeller if the propeller was operated in a restricted RPM range because of a tachometer error.

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ANTI-ICE AND DE-ICE SYSTEMS - CONTENTS

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1. Anti-ice System Description (Rev. 1)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

NOTE: There are many configurations of anti-ice systems. This section provides a general overview of system operation. Consult the airframe manufacturer's manual for a description of your specific anti-ice system and controls.

A. Overview of an Anti-ice System

(1) A propeller anti-ice system prevents formation of ice on the propeller blades. The system dispenses a liquid (usually isopropyl alcohol) onto the propeller blades. This liquid mixes with moisture on the blades and lowers the freezing point of the water, allowing the water/alcohol mixture to flow off the blades before it forms ice.

(a) Anti-ice systems must be in use before ice forms. This system is not effective for removing ice after it has formed.

B. Components of an Anti-ice System

(1) A typical anti-ice system includes the following components:

(a) Fluid tank, pump, slinger ring, blade mounted anti-icing boots, and fluid dispensing tubes located at each blade mounted anti-icing boot.

C. Anti-ice System Operation

(1) The anti-ice system is typically controlled by the pilot using a cockpit mounted rheostat. This rheostat controls the pump and the flow of anti-ice fluid from the fluid tank.

(2) The anti-ice fluid is pumped through airframe mounted distribution tubing and into a rotating slinger ring that is mounted on the rear of the propeller hub.

(3) From the slinger ring, centrifugal force pushes the anti-icing fluid through the fluid dispensing tubes onto the blade mounted anti-icing boots.

(4) The anti-icing boots evenly distribute the fluid along the leading edge of the propeller blade to prevent ice from forming.

2. De-ice System Description (Rev. 1)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

NOTE: There are many configurations of de-ice systems. This section provides a general overview of system operation. Consult the airframe manufacturer's manual for a description of your specific de-ice system and controls.

A. Overview of a De-ice System

(1) A propeller de-ice system removes ice after it forms on the propeller blades. The system uses electrical heating elements to melt the ice layer next to the blade permitting the ice to be thrown from the blade by centrifugal force.

B. Components of a De-ice System

(1) A typical de-ice system includes the following components:

(a) ON/OFF switch(es), ammeter, timer or cycling unit, slip ring, brush blocks, and blade mounted de-ice boots.

C. De-ice System Operation

(1) The de-ice system is controlled by the pilot using a cockpit control switch. When the switch is ON, electrical power is supplied to the de-ice system.

(a) Some systems may have additional controls to adjust for different icing conditions.

1 A mode selector switch lets the pilot set the cycling speed for heavy or light icing conditions.

2 For twin engine aircraft, a full de-ice mode switch lets the pilot de-ice both propellers simultaneously. This switch is used when ice builds up on the propeller before the system is turned on and may only be used for short periods.

(2) The ammeter indicates current draw by the system. It is typically located near the de-ice system switches. The ammeter may indicate total system load, or in twin engine aircraft, a separate ammeter may be supplied for each propeller.

(3) The timer or cycling unit is controlled by the pilot using a cockpit control switch. When the timer/cycling unit is ON, power is supplied to each de-ice boot (or boot segment) in a sequential order for a preset amount of time. This heating interval evenly de-ices the propeller.

(4) The brush block supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The brush block is typically mounted on the engine just aft of the propeller. The slip ring rotates with the propeller and is normally mounted on the spinner bulkhead.

(5) The de-ice boots contain internal heating elements that melt the ice layer from the blades when electrical current is applied. De-ice boots are attached to the leading edge of each blade using adhesive.

3. Operational Checks (Rev. 2)

   A. De-ice and Anti-ice Systems

      (1) Perform the applicable Operational Check procedure(s) in accordance with the Check chapter in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) and/or the Aircraft Maintenance Manual.

4. Troubleshooting (Rev. 2)

   A. De-ice and Anti-ice Systems

      (1) Refer to the applicable chapter(s) in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) to troubleshoot malfunctions in Hartzell de-ice and anti-ice systems.

         (a) Part numbers for components used in Hartzell de-ice and anti-ice systems are found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

5. Periodic Inspections (Rev. 2)

   A. De-ice and Anti-ice Systems

      (1) Refer to the Check chapter in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) for detailed information about inspection intervals and procedures.

RECORDS - CONTENTS

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1. Record Keeping (Rev. 2)

A. General

(1) Federal Aviation Regulations require that a record be kept of any repairs, adjustments, maintenance, or required inspections performed on a propeller or propeller system.

B. Information to be Recorded

(1) Refer to Title 14 Code of Federal Regulations (CFR) Part 43 for a list of information that must be recorded.

(2) The logbook may also be used to record:

(a) Propeller position (on aircraft)

(b) Propeller model

(c) Propeller serial number

(d) Blade design number

(e) Blade serial numbers

(f) Spinner assembly part number

(g) Propeller pitch range

(h) Aircraft information (aircraft type, model, serial number and registration number)

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