Manual No. 350
Original
August 2014

Propeller Owner's Manual
and Logbook

WING-IN-GROUND-EFFECT CRAFT PROPELLERS

Lightweight Turbine Propellers
HM-D4N-3( )

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WARNING

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

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

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

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

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

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

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

REVISION HIGHLIGHTS

Original, dated August, 2014, incorporates the following:

- This manual is a new issue, and has been issued in its entirety.

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REVISION HIGHLIGHTS

1. Introduction
   A. General

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

   B. Components

      (1) Revision No. indicates the revisions incorporated in this manual.

      (2) Issue Date is the date of the revision.

      (3) Comments indicates the level of the revision.

         (a) New Issue is a new manual distribution. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.

         (b) Reissue is a revision to an existing manual that includes major content and/or major format changes. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.

         (c) Major Revision is a revision to an existing manual that includes major content or minor content changes over a large portion of the manual. The manual is distributed in its entirety. All the page revision dates are the same, but change bars are used to indicate the changes incorporated in the latest revision of the manual.

         (d) Minor Revision is a revision to an existing manual that includes minor content changes to the manual. Only the revised pages of the manual are distributed. Each page retains the date and the change bars associated with the last revision to that page.

Revision No.	Issue Date	Comments
Original	Aug/14	New Issue

RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By
Original	Aug/14	Aug/14	HPI

RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By

RECORD OF TEMPORARY REVISIONS

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

RECORD OF TEMPORARY REVISIONS

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

SERVICE DOCUMENTS LIST

CAUTION 1: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF 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 DOCUMENTS LIST

Service Document Number	Incorporation Rev/Date

OPERATIONAL LIMITATIONS

Rev. No.	Description of Revision

OPERATIONAL LIMITATIONS

1. Replacement Time (Life Limits)
   A. The applicable certification agency may establish specific life limits for certain component parts, as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.
   B. The following data summarizes all current information concerning Hartzell Propeller Inc. life limited parts as related to propeller models affected by this manual. These parts are not life limited on other installations; however, time accumulated toward life limit accrues when first operated on craft/engine/propeller combinations listed, and continues regardless of subsequent installations (which may or may not be life limited).
      (1) Propeller models affected by this manual currently do not have any life limited parts.

LIST OF EFFECTIVE PAGES

Chapter	Page	Revision	Date
Cover and Inside Cover		Original	Aug/14
Message	1 and 2	Original	Aug/14
Revision Highlights	3 thru 6	Original	Aug/14
Record of Revisions	7 and 8	Original	Aug/14
Record of Temporary Revisions	9 and 10	Original	Aug/14
Service Documents List	11 and 12	Original	Aug/14
Operational Limitations	13 and 14	Original	Aug/14
List of Effective Pages	15 and 16	Original	Aug/14
Table of Contents	17 thru 24	Original	Aug/14
Introduction	1-1 thru 1-16	Original	Aug/14
Description and Operation	2-1 thru 2-12	Original	Aug/14
Installation and Removal	3-1 thru 3-26	Original	Aug/14
Testing and Troubleshooting	4-1 thru 4-12	Original	Aug/14
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INTRODUCTION - CONTENTS

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1. Purpose

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

A. This manual supports constant speed feathering and reversing lightweight turbine propellers with aluminum blades installed on Wing-In-Ground-effect (WIG) craft.

(1) The purpose of this manual is to enable qualified personnel to install, operate, and maintain a Hartzell Propeller Inc. Constant Speed Feathering and Reversing Lightweight Turbine Propeller. Separate manuals are available concerning overhaul procedures and specifications for the propeller.

(2) A sample propeller and blade model designation is included in the Description and Operation chapter of this manual.

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

(b) Definitions of propeller model designations and further details of letters that may be present are shown in the Description and Operation chapter of this manual.

2. Craft or Engine Modifications

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

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

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

3. Restrictions and Placards

   A. The propellers included in this manual may have a restricted operating range that requires a cockpit placard.

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

      (2) Review the applicable certification agency information and operating handbook for specific information.

   WARNING: STABILIZED GROUND OPERATION WITHIN THE PROPELLER RESTRICTED RPM RANGE CAN GENERATE HIGH PROPELLER STRESSES AND RESULT IN FATIGUE DAMAGE TO THE PROPELLER. THIS DAMAGE CAN LEAD TO A REDUCED PROPELLER FATIGUE LIFE, PROPELLER FAILURE, AND LOSS OF CONTROL OF THE CRAFT. THE PROPELLER RESTRICTED RPM RANGE IS DEFINED IN THE CRAFT OPERATION MANUAL.

   B. The propeller operating restrictions or limitations are found in the craft manufacturer's manuals.

   C. If a propeller RPM operating restriction or limitation is violated, refer to the Special Inspections section in the Inspection and Check chapter of this manual for corrective actions.

4. General
   A. Personnel Requirements
      (1) Inspection, Repair, and Overhaul
         (a) Compliance to regulatory requirements established by the applicable certification agency is mandatory for anyone performing or accepting responsibility for any inspection and/or repair and/or overhaul of any Hartzell Propeller Inc. product.
         (b) Personnel performing maintenance are expected to have sufficient training and certifications (when required by the applicable certification agency) to accomplish the work required in a safe manner.
   B. Maintenance Practices
      (1) The propeller and its components are highly vulnerable to damage while they are removed from the engine. Properly protect all components until they are reinstalled on the engine.
      (2) Never attempt to move the craft by pulling on the propeller.
      (3) Avoid the use of blade paddles. If blade paddles must be used, use at least two paddles. Do not place the blade paddle in the area of the de-ice boot when applying torque to a blade assembly. Place the blade paddle in the thickest area of the blade, just outside of the de-ice boot. Use one blade paddle per blade.
      (4) Use only the approved consumables, e.g., cleaning agents, lubricants, etc.
      (5) Safe Handling of Paints and Chemicals
         (a) Always use caution when handling or being exposed to paints and/or chemicals during propeller overhaul and maintenance procedures.
         (b) Before using paint or chemicals, always read the manufacturer's label on the container and follow specified instructions and procedures for storage, preparation, mixing, and application.
         (c) Refer to the product's Material Safety Data Sheet (MSDS) for detailed information about physical properties, health, and physical hazards of any chemical.

(6) Observe applicable torque values during maintenance.

(7) Approved corrosion protection followed by approved paint must be applied to all aluminum blades. For information concerning the application of corrosion protection and paint, refer to the Maintenance Practices chapter of this manual. Operation of blades without the specified coatings and finishes, i.e., "polished blades", is not permitted.

(8) Before installing the propeller on the engine, the propeller must be static balanced. New propellers are statically balanced at Hartzell Propeller Inc.. Overhauled propellers must be statically balanced by the overhaul facility before return to service.

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

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

2 Additional procedures may be found in the applicable maintenance manual.

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

(10) 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.

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

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

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

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

(b) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection Component Maintenance Manual

(c) Hartzell Propeller Inc. Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

(d) Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

C. Propeller Critical Parts

(1) The following maintenance procedures may involve propeller critical parts. 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. Refer to the Illustrated Parts List chapter of the applicable maintenance manual for the applicable propeller model for the identification of specific Critical Parts.

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

5. Reference Publications

The following publications are referenced within this manual:

Active Hartzell Propeller Inc. Service Bulletins, Service Letters, Service Instructions, and Service Advisories

Hartzell Propeller Inc. Manual 127 (61-16-27) - Spinner Assembly Maintenance - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 133C (61-13-33) - Aluminum Propeller Blade Maintenance Manual

Hartzell Propeller Inc. Manual 159 (61-02-59) - Application Guide - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 165A (61-00-65) - Illustrated Tool and Equipment - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 180 (30-61-80) - Propeller Ice Protection System Manual - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection Component Maintenance Manual - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

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Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 202A (61-01-02) - Standard Practices Manual, Volumes 1 through 11 (Volume 7, Consumable Materials is available on the Hartzell Propeller Inc. website at www.hartzellprop.com)

6. Definitions

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.
Blade Angle	Measurement of blade airfoil location described as the angle between the blade airfoil and the surface described by propeller rotation.
Brinelling	A depression caused by failure of the material in compression.
Chord	A straight line between the leading and trailing edges of an airfoil.
Cold Rolling	Compressive rolling process for the retention area of single shoulder blades which provides improved strength and resistance to fatigue.
Constant Force	A force which is always present in some degree when the propeller is operating.
Constant Speed	A propeller system which employs a governing device to maintain a selected engine RPM.
Corrosion	Gradual material removal or deterioration due to chemical action.

Term	Definition
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface.
Depression	Surface area where the material has been compressed but not removed.
Distortion	Alteration of the original shape or size of a component.
Erosion	Gradual wearing away or deterioration due to action of the elements.
Exposure	Material open to action of the elements.
Feathering	A propeller with blades that may be positioned parallel to the relative wind, thus reducing aerodynamic drag.
Gouge	Surface area where material has been removed.
Hazardous Propeller Effect	Hazardous propeller effects are defined in Title 14 CFR section 35.15(g)(1) for Aviation Certified/ Experimental propellers and have been adapted for Non-Aviation Certified/Experimental propellers.
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 operation or on the ground.
Major Propeller Effect	Major propeller effects are defined in Title 14 CFR section 35.15(g)(2) for Aviation Certified/Experimental propellers and have been adapted for Non-Aviaiton Certified/ Experimental propellers.

Term	Definition
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, part number, or serial 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 lever and the actual engine (propeller) RPM are equal.
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain operability.
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control lever.
Overspeed Damage	Damage that occurs when the propeller hub assembly rotates at a speed greater than the maximum limit for which it is designed.

Term	Definition
Pitch	Same as "Blade Angle".
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear.
Propeller Critical Part	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by a safety analysis required by Title 14 CFR section 35.15
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up.
Scratch	Same as "Nick".
Single Acting	Hydraulically actuated propeller which utilizes a single oil supply for pitch control.
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine craft 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.
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.
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control lever.
Variable Force	A force which may be applied or removed during propeller operation.

7. Abbreviations

Abbreviation	Term
AN	Air Force-Navy (or Army-Navy)
COG	Craft on Ground
Ft-Lb	Foot-Pound
ID	Inside Diameter
In-Lb	Inch-Pound
IPS	Inches Per Second
Lbs	Pounds
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection
MS	Military Standard
MSDS	Material Safety Data Sheet
NAS	National Aerospace Standards
NASM	National Aerospace Standards, Military
N•m	Newton-Meters
OD	Outside Diameter
PCP	Propeller Critical Part
POH	Pilot's Operating Handbook
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
STC	Supplemental Type Certificate
TBO	Time Between Overhaul
TSN	Time Since New
TSO	Time Since Overhaul

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

8. Hartzell Propeller Inc. Product Support

   Hartzell Propeller Inc. Propeller is ready to assist you with questions concerning your propeller system. Hartzell Propeller Inc. Product Support may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4379 or at (800) 942-7767, toll free from the United States and Canada. Hartzell Propeller Inc. Product Support can also be reached by fax at (937) 778-4391, and by e-mail at techsupport@hartzellprop.com. 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. A technical representative will contact you during normal business hours. Urgent AOG support is also available 24 hours per day, seven days per week via this message service.

   Additional information is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

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

9. Warranty Service

   If you believe you have a warranty claim, it is necessary to contact the Hartzell Propeller Inc. Warranty Administrator. The Warranty Administrator will provide a blank *Warranty Application* form. It is necessary to complete this form and return it to the Warranty Administrator for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the Warranty Administrator will provide instructions on how to proceed. Hartzell Propeller Inc. Warranty may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4380, or toll free from the United States and Canada at (800) 942-7767. Hartzell Propeller Inc. Warranty Administration can also be reached by fax, at (937) 778-4391, or by e-mail at warranty@hartzellprop.com.

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

10. Hartzell Propeller Inc. Recommended Facilities
    A. Hartzell Propeller Inc. recommends using Hartzell Propeller Inc. approved distributors and repair facilities for the purchase, repair and overhaul of Hartzell Propeller Inc. propeller assemblies or components.
    B. Information about the Hartzell Propeller Inc. worldwide network of aftermarket distributors and approved repair facilities is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

DESCRIPTION AND OPERATION - CONTENTS

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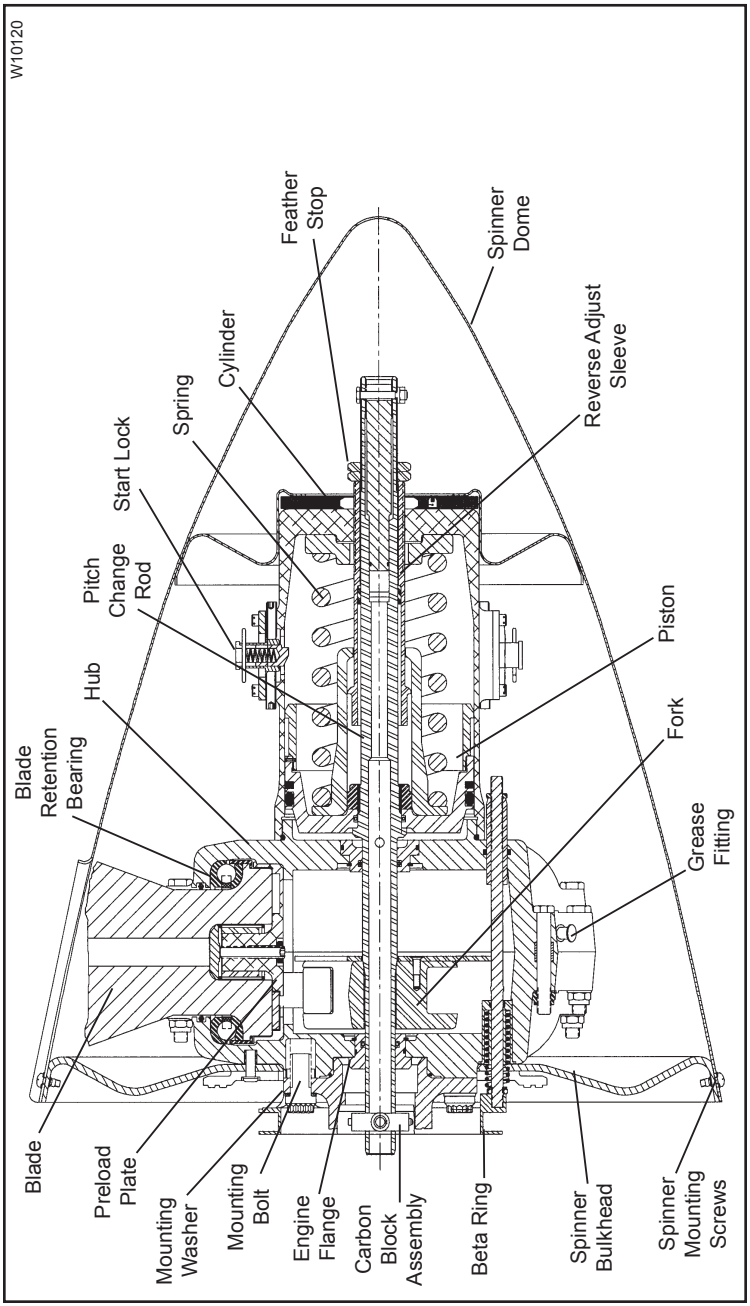


HM-D4N-3( ) Series Propeller with Start Locks
Figure 2-1

1. Functional Description of Constant Speed Propeller Types

   A. Feathering and Reversing Propellers
   HM-D4N-3( ) Series

   Refer to Figure 2-1. The propellers described in this section are constant speed, feathering and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. The propellers have four blades and are used primarily on Pratt & Whitney turbine engines.

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

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

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

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

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

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

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

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

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

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

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

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

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

2. Model Designation

   A. Hartzell Propeller Inc. uses a model designation to identify specific propeller and blade assemblies.

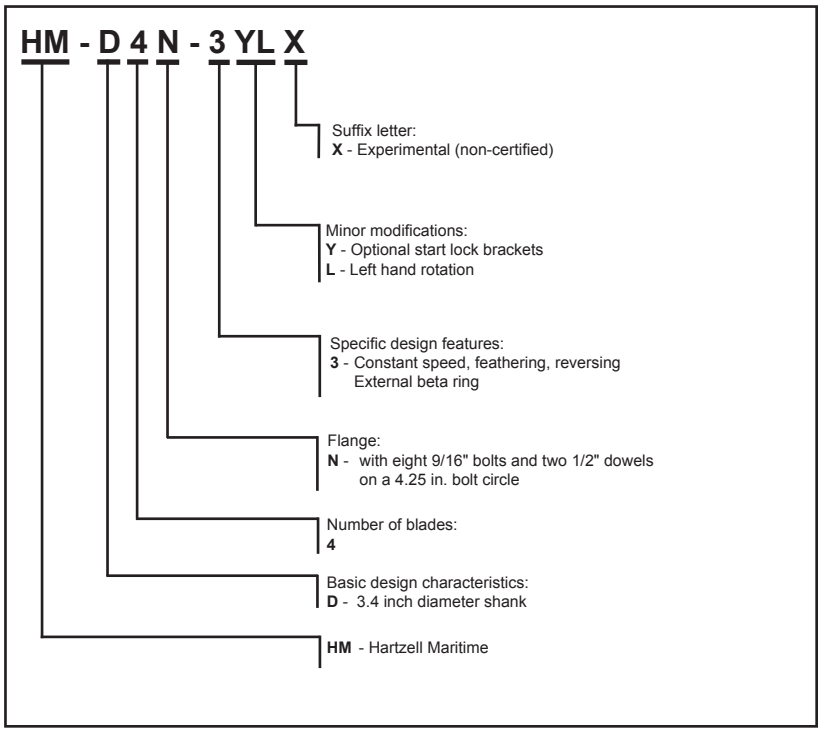
      (1) A slash mark separates the propeller model and blade designations. Example: HM-D4N-3YLX/L99M01X

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

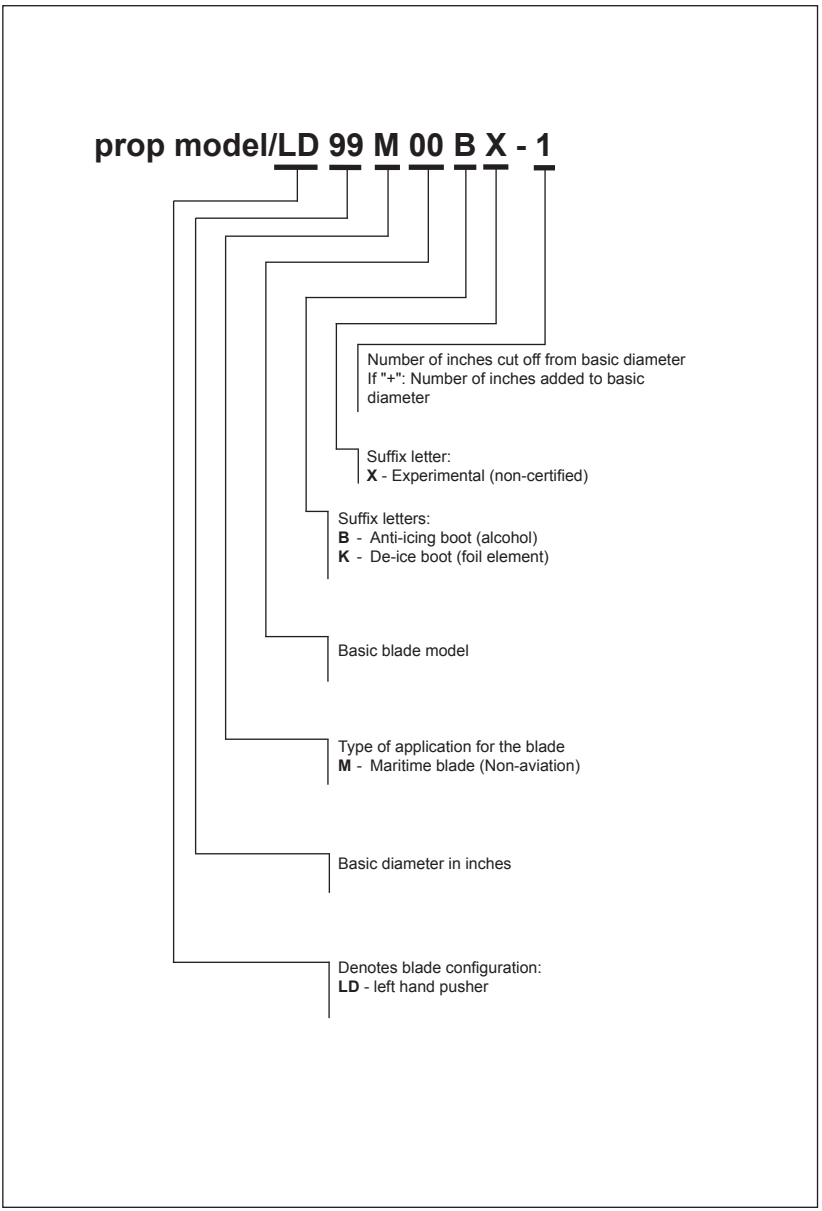
      (3) The blade desgination is impressioned stamped on the blade butt end (internal) and may be on a label or ink stamped on the blade camber side (external).

   B. For propeller model identification, refer to Table 2-1.

   C. For aluminum blade model identification, refer to Table 2-2.



Propeller Model Identification
Table 2-1



Aluminum Blade Model Identification
Table 2-2

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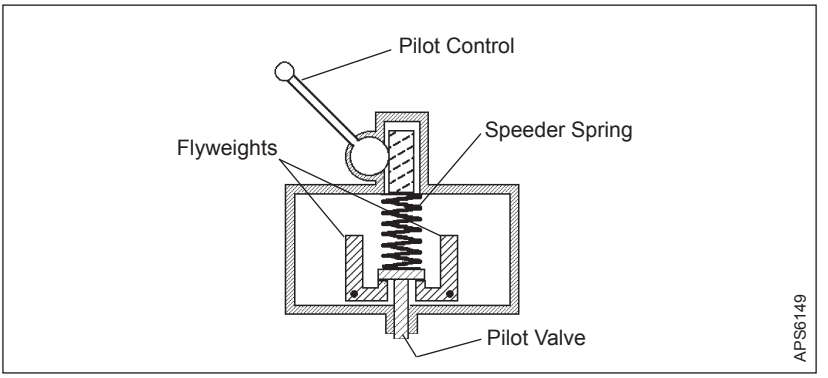
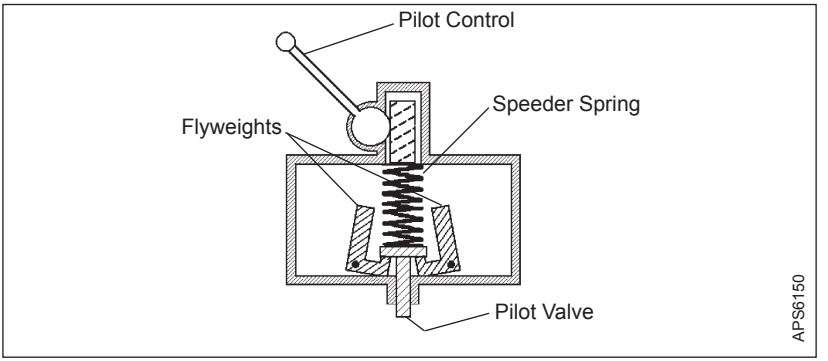
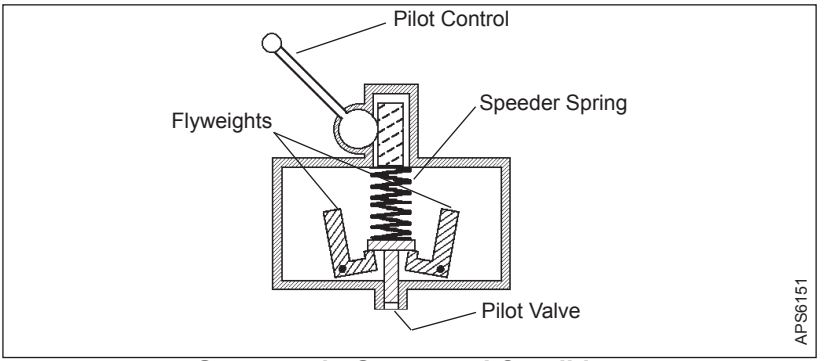


Governor in Onspeed Condition
Figure 2-2



Governor in Underspeed Condition
Figure 2-3



Governor in Overspeed Condition
Figure 2-4

3. Governors

A. Theory of Operation

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

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

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

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

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

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

4. Propeller Ice Protection Systems

A. Some Hartzell Propeller Inc. compact propellers may be equipped with an anti-ice or a de-ice system. Refer to the Anti-ice and De-ice Systems chapter of this manual for a description of each of these systems.

INSTALLATION AND REMOVAL - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Tools, Consumables, and Expendables

   A. General

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

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

   B. Tooling

      N Flange

      • Safety wire pliers (Alternate: Safety cable tool)
      • Torque wrench
      • Torque wrench adapter
        (Hartzell Propeller Inc. P/N AST-2877)

   C. Consumables

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

   D. Expendables

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

Flange	O-ring	Mounting Bolt	Washer
N	C-3317-230	B-3339-1	A-2048-2

Propeller/Engine Flange O-rings and Mounting Hardware
Table 3-1

2. Pre-Installation

A. Inspection of Shipping Package

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

B. Uncrating

(1) Put the propeller on a firm support.

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

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

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

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

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

C. Inspection after Shipment

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

D. Reassembly of a Propeller Disassembled for Shipment

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

WARNING 1: ANY PART IDENTIFIED IN THIS MANUAL AS AN EXPERIMENTAL OR NON-AVIATION PART MUST NOT BE USED IN AN FAA OR INTERNATIONAL EQUIVALENT TYPE CERTIFICATED PROPELLER. A PART IDENTIFIED AS EXPERIMENTAL OR NON-AVIATION DOES NOT HAVE FAA OR INTERNATIONAL EQUIVALENT APPROVAL EVEN THOUGH IT MAY STILL SHOW AN AVIATION TC OR PC NUMBER STAMP. USE ONLY THE APPROVED ILLUSTRATED PARTS LIST PROVIDED IN THE APPLICABLE OVERHAUL MANUAL OR ADDITIONAL PARTS APPROVED BY AN FAA ACCEPTED DOCUMENT FOR ASSEMBLY OF A PROPELLER. THE OPERATOR ASSUMES ALL RISK ASSOCIATED WITH THE USE OF EXPERIMENTAL PARTS. USE OF EXPERIMENTAL PARTS ON AN AIRCRAFT MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

WARNING 2: FAILURE TO FOLLOW THESE INSTALLATION INSTRUCTIONS MAY LEAD TO PROPELLER DAMAGE, ENGINE DAMAGE, OR PROPELLER FAILURE, WHICH MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. UNUSUAL OR ABNORMAL VIBRATION DEMANDS IMMEDIATE INSPECTION FOR IMPROPER PROPELLER INSTALLATION. PROPELLER SEPARATION MAY OR MAY NOT BE PROCEEDED BY VIBRATION.

3. Propeller Assembly Installation

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. Precautions

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

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

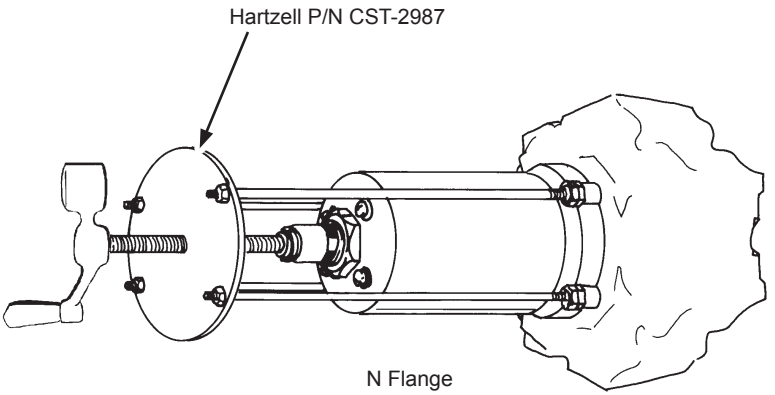
CAUTION: AVOID THE USE OF BLADE PADDLES. DO NOT PUT THE BLADE PADDLE IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BLADE PADDLE IN THE THICKEST AREA OF THE BLADE, JUST OUTSIDE OF THE DE-ICE BOOT. USE ONE BLADE PADDLE PER BLADE.

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

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

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

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



W10115

Tool for Decompressing HM-D4N-3( ) Series
External Beta System
Figure 3-1

B. Installation of HM-D4N-3( ) Propellers

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

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

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

CAUTION 2: WHEN INSTALLING THE PROPELLER ON THE CRAFT, 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 engine mounting flange on the craft.

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

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

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

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

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

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

(7) Slide the propeller onto the engine flange.

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

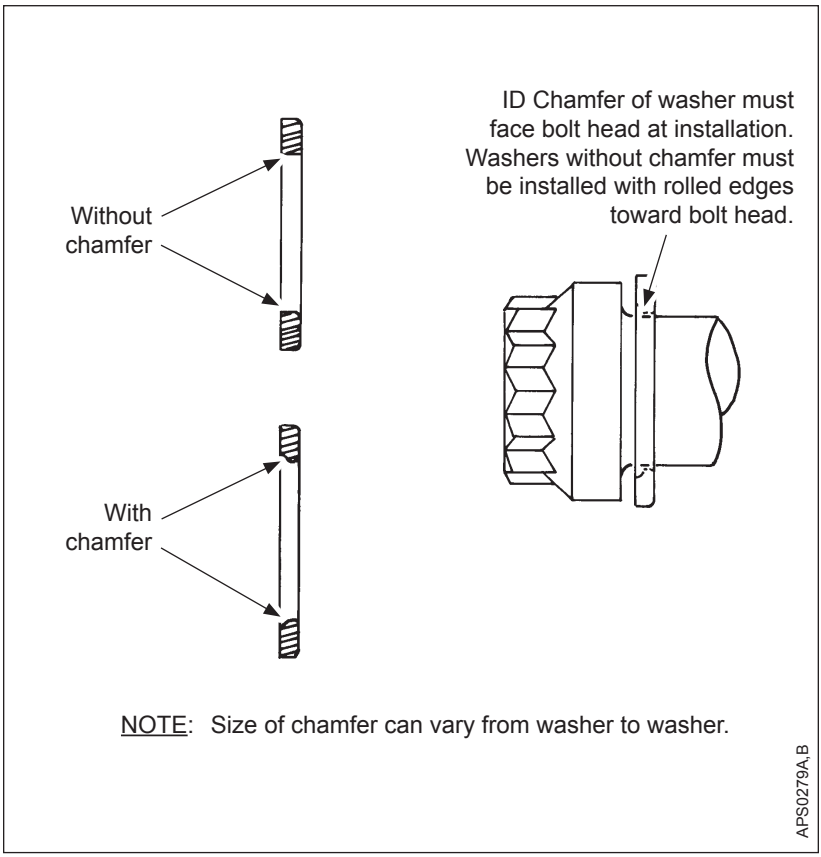
CAUTION 2: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

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

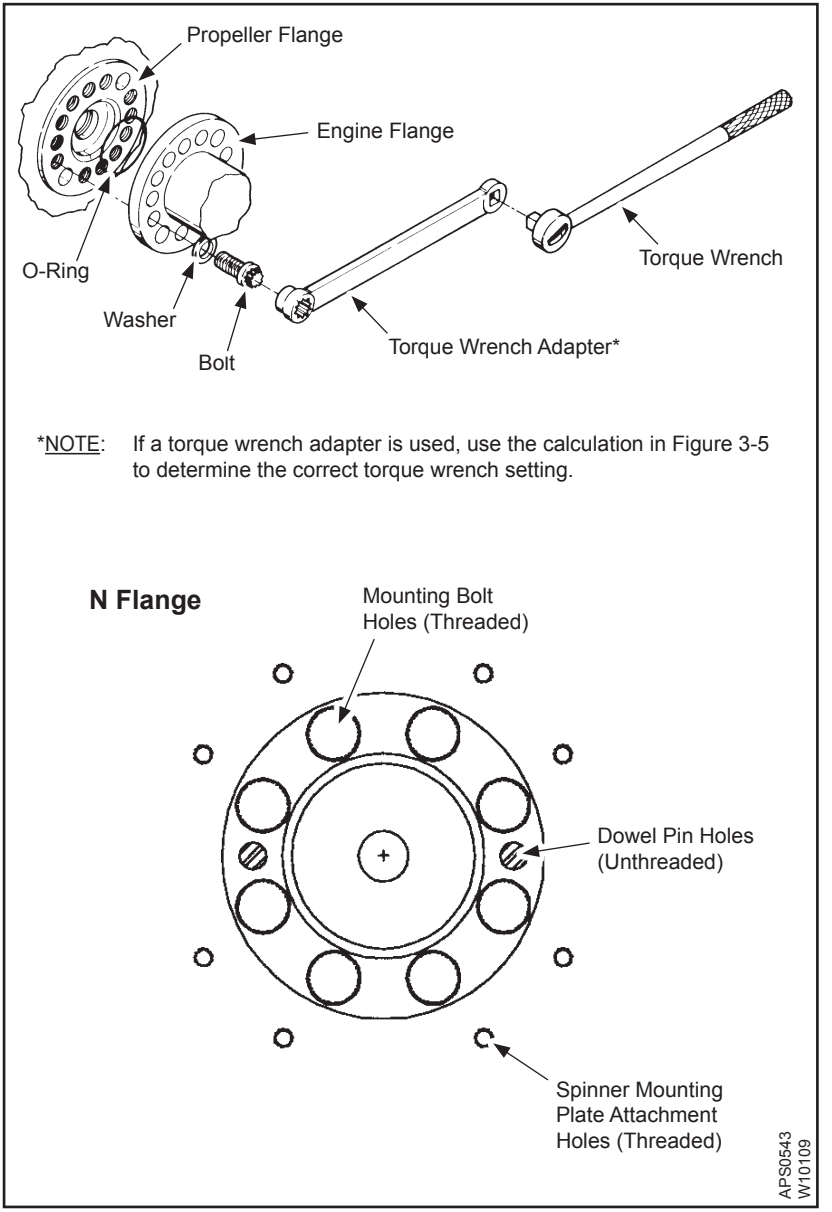
(a) If the propeller is removed between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

CAUTION: ID CHAMFER OF WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH ROLLED EDGES TOWARD THE BOLT HEAD. REFER TO FIGURE 3-2.

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



Mounting Bolt and Washer
Figure 3-2



Installing Propeller on Engine Flange
Figure 3-3

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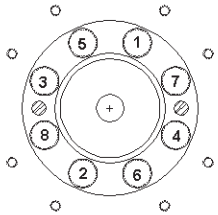
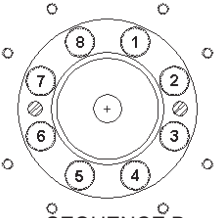
W10109c

N Flange



SEQUENCE A

Use Sequence A for steps one and two.



SEQUENCE B

Use Sequence B for step three.

Step 1 - Torque all bolts to 40 Ft-Lbs (54 N•m).
Step 2 - Torque all bolts to 80 Ft-Lbs (108 N•m).
Step 3 - Torque all bolts to Table 3-2.

Diagram of Torquing Sequence for Propeller Mounting Bolts
Figure 3-4

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

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

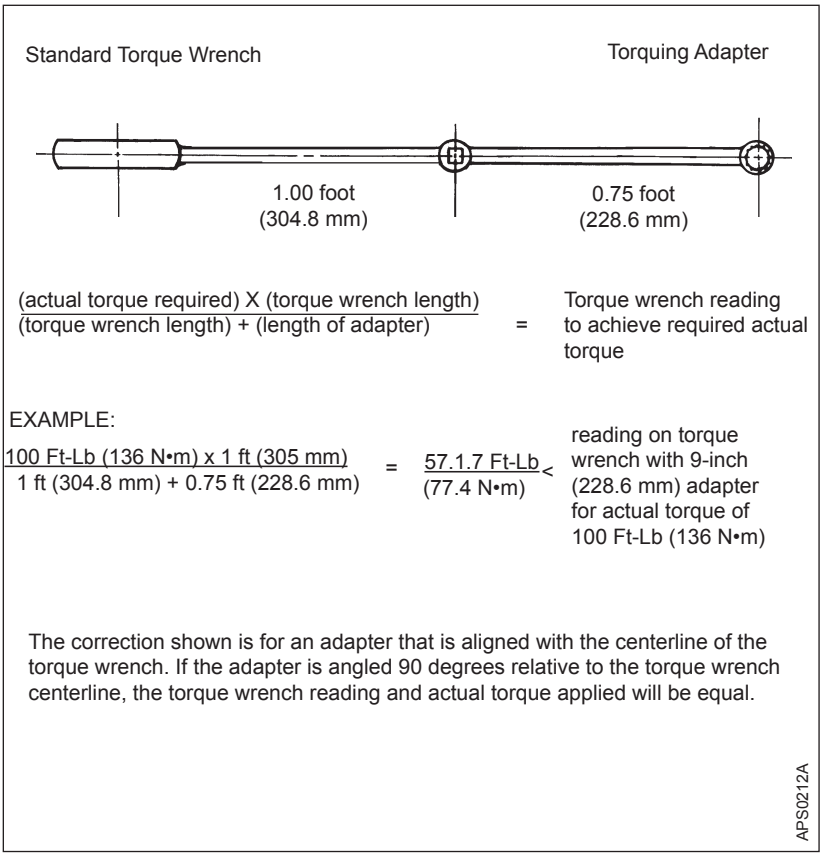
Description	Torque Value
N flange propeller mounting bolts	100-105 Ft-Lbs (136-142 N•m) Wet

Torque Table
Table 3-2

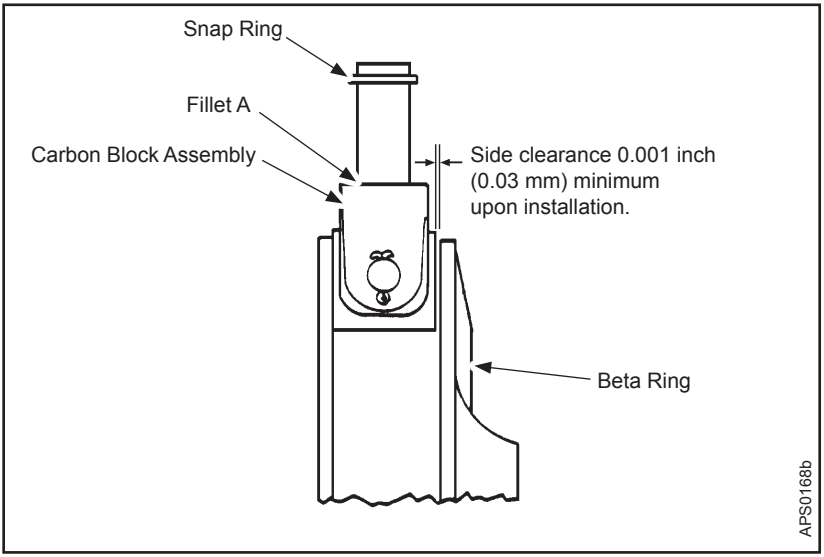
(10) Using a torque wrench and a torque wrench adapter Hartzell Propeller Inc. P/N AST-2877, torque all mounting bolts in sequences and steps shown in Figure 3-4. Refer to Table 3-2 and Figure 3-5 to determine the proper torque value.

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

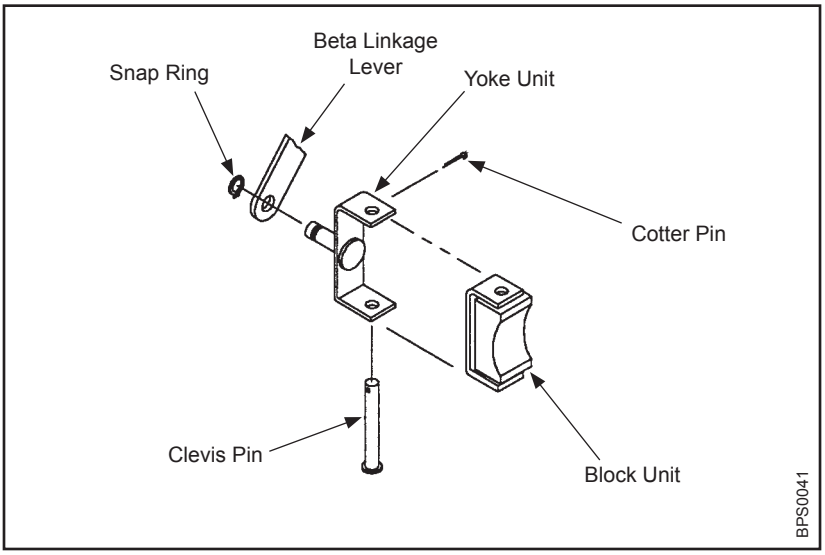
(12) Decompress the external beta system and remove the beta system puller.



Determining Torque Value When Using Torquing Adapter
Figure 3-5



Carbon Block and Beta Ring Clearance
Figure 3-6



Carbon Block Assembly
Figure 3-7

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

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

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

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

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

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

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

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

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

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

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

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

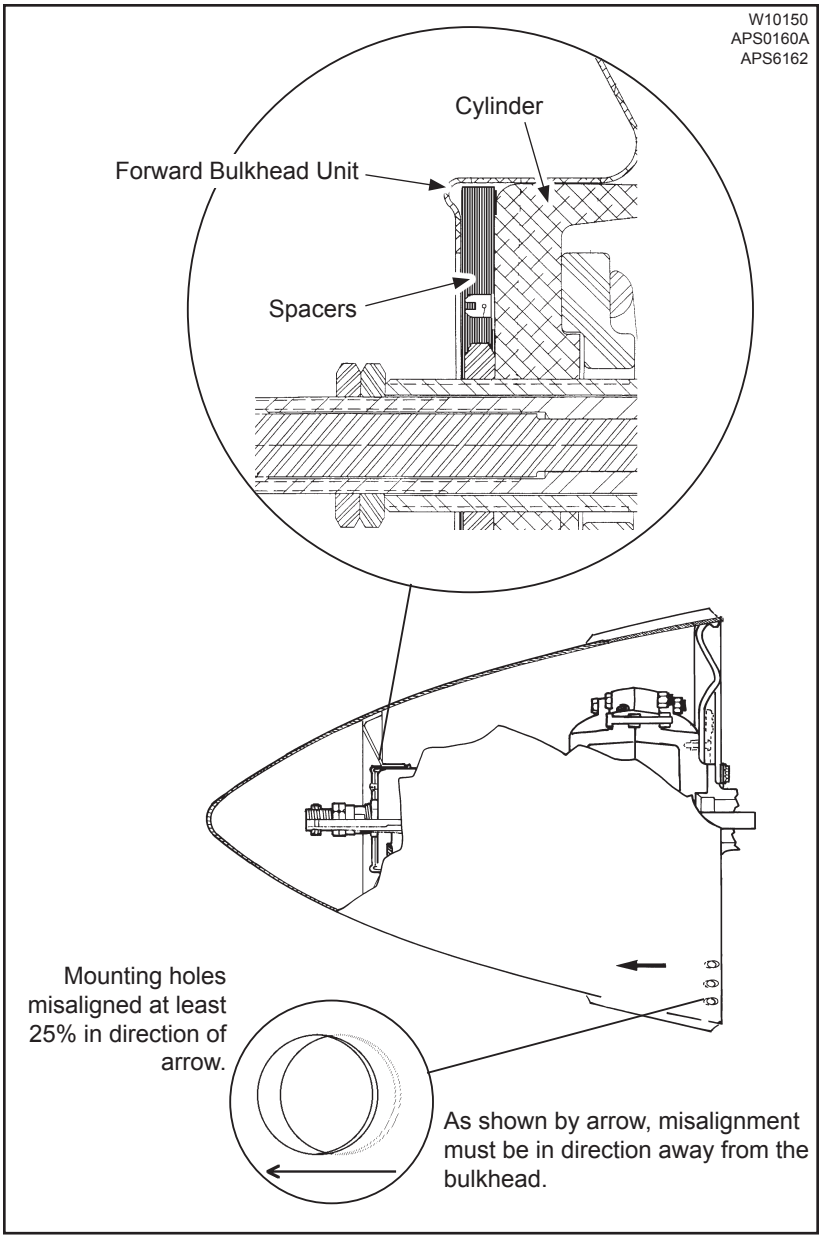
(b) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection Component Maintenance Manual

(c) Hartzell Propeller Inc. Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

(d) Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

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

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



Spinner Reassembly Procedures
Figure 3-8

4. Spinner Dome Installation

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

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

A. General

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

B. Propeller Models HM-D4N-3( )That Use a One-piece Spinner Dome and Forward Bulkhead

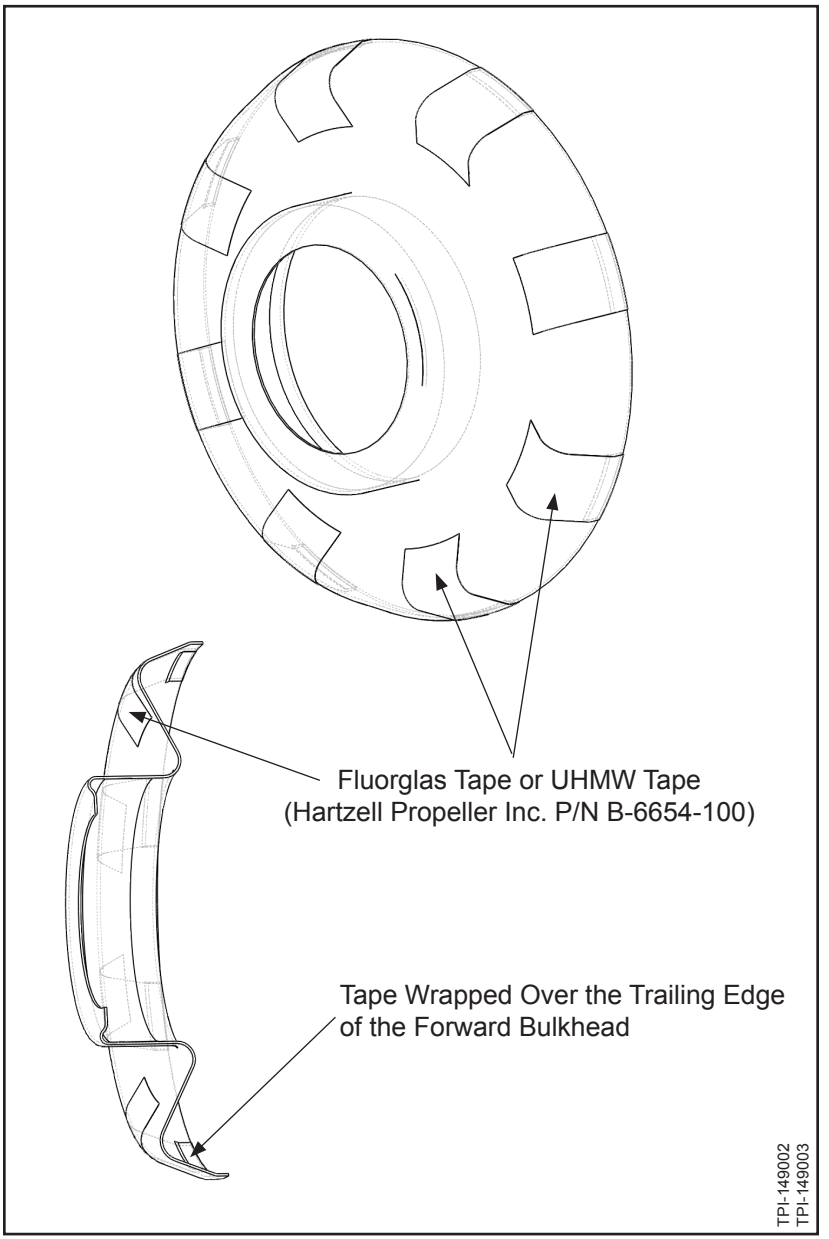
(1) The spinner dome is supported by a forward bulkhead unit that encircles the propeller cylinder. Refer to Figure 3-8.

(a) If the forward bulkhead unit does not fit snugly on the cylinder, the cylinder may need to be wrapped with one or more layers of fluoroglas or UHMW tape (Hartzell Propeller Inc. P/N B-6654-100).

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

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

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



Optional Tape on the Spinner Forward Bulkhead
Figure 3-9

(2) Optionally for a spinner dome that has a removable forward bulkhead, apply a layer of fluorglas tape or UHMW tape (Hartzell Propeller Inc. P/N B-6654-100) on the outboard flange of the forward bulkhead to prevent contact between the forward bulkhead and the spinner dome.

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

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

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

(c) Apply the pieces of tape in equally spaced locations on the forward bulkhead as shown in Figure 3-9.

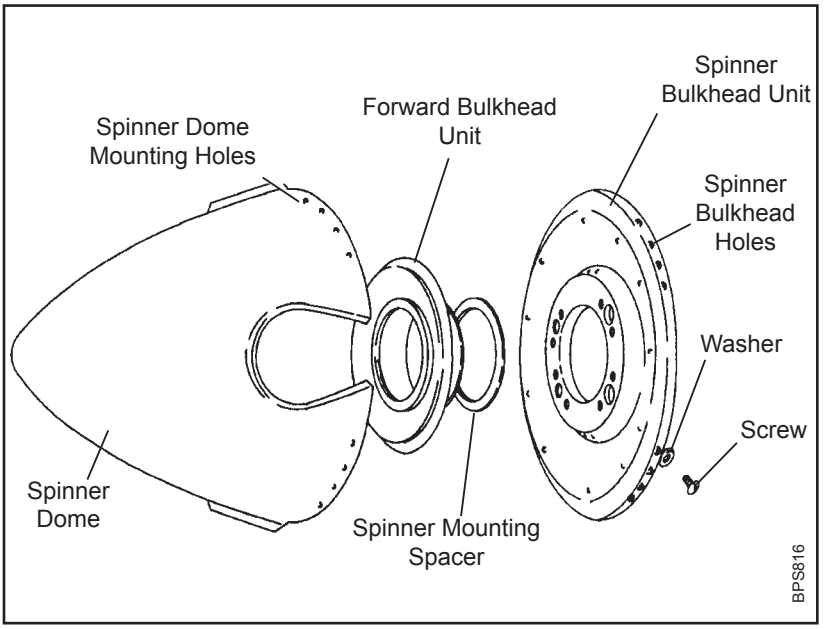
(d) Tape may be wrapped over the trailing edge of the forward bulkhead as necessary.

(3) Carefully slide the spinner dome over the propeller and forward bulkhead to check for proper positioning of the spinner dome mounting holes. Add or remove spacers to obtain the spinner dome mounting hole and spinner bulkhead hole misalignment. Refer to Figure 3-10.

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

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

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



Spinner Assembly for HM-D4N-3( ) Series Propellers
Figure 3-10

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

6. Spinner Dome Removal

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

   A. Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
   B. Remove the spinner dome.

7. Propeller Assembly Removal

A. Removal of HM-D4N-3( ) Propellers

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

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

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

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

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

(b) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection Component Maintenance Manual

(c) Hartzell Propeller Inc. Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

(d) Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

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

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

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

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

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

(8) Using the beta system puller, CST-2987, compress the beta system and pull the beta ring forward to expose the propeller mounting bolts and washers. Refer to Figure 3-1.

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

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

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

(9) Support the propeller assembly with a sling.

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

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

(11) Remove the propeller mounting bolts and washers.

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

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

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

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

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

(15) Decompress and remove the beta system puller.

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

TESTING AND TROUBLESHOOTING - CONTENTS

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1. Operational Tests

   Following propeller installation the propeller system must be purged of air, and correct operation verified.

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

   CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

   A. Initial Run-Up
      (1) Perform engine start and warm-up per the Pilot's Operating Handbook (POH).
      (2) Cycle the propeller control throughout its operating blade angle range from reverse or low, to high (or as directed by the POH).
      (3) Repeat this procedure at least three times to purge air from the propeller hydraulic system and to introduce warmed oil to the cylinder.
      (4) Verify proper operation from reverse or low pitch, to high pitch and throughout operating range.
      (5) Shut down engine in accordance with the POH.
         (a) Air trapped within the propeller hydraulic cylinder will cause pitch control to be imprecise and may result in propeller surging.

   B. Post-Run Check
      (1) After engine shutdown, check propeller for signs of engine oil leakage.

C. Maximum RPM (Static) Hydraulic Low Pitch Stop Check
   (1) The Maximum RPM (hydraulic low pitch stop) is normally set at the factory per the craft manufacturer's requirements, and should not require any additional adjustment. Adjustments may be required after maintenance or because of specific craft variances.
   (2) Adjustments must be done in accordance with the craft manufacturer's specification found in the craft manufacturer's manual.

D. Reverse Pitch Stop Adjustment
   (1) The reverse pitch stop adjustment is set at the factory per the craft manufacturer's recommendations. This stop is adjustable only by a certified propeller repair station, craft manufacturer, or the Hartzell Propeller Inc. factory.

E. Feathering Pitch Stop Adjustment
   (1) The feathering pitch stop is set at the factory per the craft manufacturer's recommendations. This stop is adjustable only by a certified propeller repair station, craft manufacturer, or the Hartzell Propeller Inc. factory.

F. Start Lock Adjustment
   (1) The start locks are set at the factory per manufacturer's recommendations. These stops are adjustable only by a certified propeller repair station, craft manufacturer, or the Hartzell Propeller Inc. factory.

G. Propeller Ice Protection System
   (1) Electric De-ice System
      (a) Consult the Pilot Operating Handbook (POH) (including all supplements) regarding operation in conditions of known icing. The craft may not be certificated for operation in known icing conditions, even though propeller de-ice equipment is installed.
      (b) Refer to the Anti-ice and De-ice Systems chapter of this manual for functional tests of the de-ice system.

(2) Anti-ice System

(a) Consult the Pilot Operating Handbook (including all supplements) regarding operation in conditions of known icing. The craft may not be certificated for operation in known icing conditions, even though propeller anti-ice equipment is installed.

(b) Refer to the Anti-ice and De-ice Systems chapter of this manual for functional tests of the anti-ice system.

2. Troubleshooting

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. Hunting and Surging

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

(1) If propeller is hunting, a repair facility should check:

(a) Governor

(b) Fuel control

(c) Synchrophaser or synchronizer

(2) If propeller is surging:

(a) Perform the steps 1.A.(1) through 1.A.(5) under Operational Tests section in this chapter to release trapped air from the propeller. If surging recurs, it is most likely due to a faulty governor.

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

1 Test the propeller on a test bench at a propeller repair facility to isolate these faults.

B. Engine Speed Varies with Airspeed
   (1) Small variances in engine speed are normal and are no cause for concern.
   (2) Increase in engine speed while increasing airspeed:
      (a) Governor is not reducing oil volume.
      (b) Friction in propeller.
   (3) Decrease in engine speed while increasing airspeed:
      (a) Governor pilot valve is stuck and is excessively decreasing oil volume.
      (b) Feathering command engaged on propeller pitch control.
   (4) Increase in engine speed while decreasing airspeed:
      (a) Governor pilot valve is stuck and is excessively increasing oil volume.
   (5) Decrease in engine speed while decreasing airspeed:
      (a) Governor is not increasing oil volume in the propeller.
      (b) Engine oil transfer system leaking excessively.
      (c) Friction in propeller.

C. Loss of Propeller Control
   (1) Propeller goes to uncommanded high pitch (or feather).
      (a) Loss of propeller oil pressure - check:
         1 Governor pressure relief valve.
         2 Governor drive.
         3 Engine oil supply.
      (b) Start locks not engaging.
   (2) Propeller goes to uncommanded low pitch (high RPM).
      (a) Governor pilot valve sticking.
   (3) RPM increases with power and airspeed, propeller RPM control has little or no effect.
      (a) Excessive friction in blade bearings or pitch changing mechanism.
      (b) Broken feathering spring.
   (4) RPM control sluggish (especially on reducing RPM).
      (a) Broken feathering spring.

D. Failure to Feather (or Feathers Slowly)
   (1) Broken feathering spring.
   (2) Check for proper function and rigging of propeller/ governor control linkage.
   (3) Check governor drain function.
   (4) Propeller must be checked for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction. This must be accomplished at a propeller repair facility.

E. Failure to Unfeather
   (1) Check for proper function and rigging of propeller control linkage.
   (2) Check governor function.
   (3) Propeller must be checked for misadjustment or internal corrosion (usually in blade bearings or pitch change mechanism) that results in excessive friction. This must be accomplished at a propeller repair facility.

F. Start Locks (Anti-feather Latches) Fail to Latch on Shutdown
   (1) Propeller was feathered before shutdown.
   (2) Shutdown occurred at high RPM with propeller control off the low pitch stop.

   The problem may be solved by restarting the engine, placing the propeller control in the proper shutdown position, and then shutting down the engine.
   (3) Excessive governor pump leakage.

   The problem should be referred to an authorized engine repair facility.
   (4) Broken start lock.

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

G. Vibration

CAUTION 1: ANY VIBRATION WHICH CAN BE DESCRIBED AS APPEARING SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE LEAKAGE, SHOULD BE INVESTIGATED IMMEDIATELY BY AN AUTHORIZED REPAIR STATION, BEFORE THE NEXT OPERATION.

CAUTION 2: VIBRATION PROBLEMS DUE TO PROPELLER SYSTEM IMBALANCE ARE NORMALLY FELT THROUGHOUT THE RPM RANGE, WITH THE INTENSITY OF VIBRATION INCREASING WITH RPM. VIBRATION PROBLEMS THAT OCCUR IN A NARROW RPM RANGE ARE A SYMPTOM OF RESONANCE, AND ARE POTENTIALLY HARMFUL TO THE PROPELLER. AVOID OPERATION IN THAT RPM RANGE UNTIL THE PROPELLER CAN BE CHECKED BY AN AUTHORIZED REPAIR STATION.

(1) Check:

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

(b) Uneven lubrication of propeller.

(c) Proper engine/propeller flange mating.

(d) Blade track. (Refer to the Inspection and Check chapter of this manual for procedure.)

(e) Blade angles: Blade angle must be within tolerance between blades and on the propeller as a whole. Refer to the applicable propeller overhaul manual for the blade angle check procedure.

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

(g) Static balance.

(h) Airfoil profile identical between blades (after overhaul or rework for nicks - verify at propeller repair station).

(i) Hub or blade for damage or cracking.

(j) Grease or oil leakage from a seemingly solid surface of the hub or blade.

(k) Blade deformation.

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

H. Propeller Overspeed

(1) Check:

(a) Low pitch stop adjustment.

(b) Governor Maximum RPM set too high.

(c) Broken feathering spring.

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

(e) Tachometer error.

I. Propeller Underspeed

(1) Check:

(a) Governor oil pressure low.

(b) Governor oil passage clogged.

(c) Tachometer error.

J. Oil or Grease Leakage

(1) General

(a) A new propeller may leak slightly during the first several hours of operation. This leakage may be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. Such leakage should cease within the first ten hours of operation.

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

(2) Grease Leakage - Probable Cause:

(a) Improperly torqued or loose lubrication fitting. (Tighten the fitting).

(b) Defective lubrication fitting. (Replace the fitting).

(c) Faulty seal at the blade socket between the blade hub. (Refer to a certified propeller repair station with the appropriate rating for replacement of the seal).

(d) Leakage from the hub and beta rod interface.

1 Over greased hub. (Refer to a certified propeller repair station with the appropriate rating for removal of excess grease.)

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

(e) Cracked hub. A cracked hub is often indicated by grease emerging from a seemingly solid surface, especially in the blade arm. (Refer to a certified propeller repair station with the appropriate rating.)

(3) Oil Leakage - Probable Cause

(a) Leaks between the hub and engine - Faulty or missing seal between the propeller hub and the engine flange.

(b) Leaks between the hub and cylinder - Faulty or missing seal between the hub and the cylinder.

Refer seal replacement to an approved repair facility.

(c) Leaks between the hub halves, beta rod and hub, and lubrication fittings - Faulty seal(s) between hub and the pitch change rod.

Refer seal replacement to an approved repair facility.

(d) Leaks from the front of the cylinder or through start locks - Faulty seal(s) between the piston and cylinder or piston and pitch change rod.

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

INSPECTION AND CHECK - CONTENTS

FIGURES

1. Pre-Operational Checks

   Follow propeller pre-operation inspection procedures as specified in the Pilot Operating Handbook (POH). In addition, perform the following 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.

   A. Blades

      (1) Visually inspect the entire blade (lead, trail, face, and camber sides) for nicks, gouges, and cracks. Refer to the Maintenance Practices chapter of this manual, for blade repair information.

      (2) Visually inspect the blades for lightning strike. Refer to Lightning Strike Damage information in the Special Inspections section of this chapter.

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

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

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

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

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

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

G. Check the propeller speed control and operation from reverse or low pitch to high pitch, using the procedure specified in the Pilot Operating Handbook (POH) for the craft.

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

H. Perform initial run-up as outlined in Operational Tests section of the Testing and Troubleshooting chapter of this manual.

I. Check for any abnormal vibration during this run-up. If vibration occurs, shut the engine down, determine the cause, and correct it before further operation. Refer to the Vibration section in the Testing and Troubleshooting chapter of this manual.

J. Refer to Inspection Procedures section of this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of pre-operational checks.

2. Operational Checks

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. Following propeller installation or as required, perform initial run-up in accordance with the Operational Tests section in the Testing and Troubleshooting chapter of this manual.

B. Check the propeller speed control and operation from reverse or low pitch to high pitch, using the procedure specified in the Pilot Operating Handbook (POH) for the craft.

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

C. Check for any abnormal vibration during this run-up. If vibration occurs, shut the engine down, determine the cause, and correct it before further operation. Refer to the Vibration section in the Testing and Troubleshooting chapter of this manual.

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

E. Refer to the craft manufacturer's manual for additional operational checks.

3. Post-Operational Checks

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. General

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

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

B. Requirements

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

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

(a) Blade Cleaning

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

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

4. Required Periodic Inspections and Maintenance

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. Periodic Inspections

(1) Perform the following inspection procedures at 100 hour intervals, not to exceed six (6) months.

(a) Inspection and maintenance specified by a craft manufacturer's maintenance program and approved by the applicable certification agency may not coincide with the inspection time interval specified. In this situation the craft manufacturer's schedule may be applied with the exception that the calendar limit for the inspection interval may not exceed six (6) calendar months.

(b) Refer to the Inspection Procedures section in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of the Periodic Inspection.

(2) Remove the spinner dome.

(3) Visually inspect the blades for nicks and cracks. If any damage is discovered, refer to the Blade Repairs section in the Maintenance Practices chapter of this manual for additional information.

(a) For propellers used in a "pusher" configuration:

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

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

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

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

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

3 Visually examine the condition of the paint and any corrosion indications.

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

a Any of the underlying aluminum blade is exposed.

b There are any indications of corrosion, such as pitting or pinpoint "blisters".

5 All corrosion indications require repair and subsequent repainting.

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

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

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

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

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

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

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

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

B. Periodic Maintenance

(1) Lubricate the propeller assembly. Refer to the Lubrication section in the Maintenances Practices chapter of this manual for intervals and procedures.

C. Operational Limitations

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

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

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

D. Overhaul Periods

(1) General

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

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

(c) To protect your safety and your investment, and to maximize the safe operating lifetime of your propeller, it is essential that a propeller be properly maintained and overhauled according to the recommended service procedures.

(d) This section contains the overhaul limits for Hartzell Propeller Inc. lightweight propellers installed on turbine engines.

CAUTION 1: OVERHAUL PERIODS LISTED BELOW, ALTHOUGH CURRENT AT THE TIME OF PUBLICATION, ARE FOR REFERENCE PURPOSES ONLY. OVERHAUL PERIODS MAY BE INCREASED OR DECREASED AS A RESULT OF ENGINEERING EVALUATION.

CAUTION 2: CHECK THE LATEST REVISION OF HARTZELL PROPELLER INC. SERVICE LETTER HM-SL-001 FOR THE MOST CURRENT INFORMATION.

(2) HM-D4N-3( ) series propellers installed on Wing-In-Ground-effect craft must be overhauled at 2400 hours of operation or 24 calendar months, whichever occurs first.

5. Inspection Procedures

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.

The inspections detailed below are made on a regular basis, either before operation, or if a problem is noted. Possible corrections to problems discovered during inspections, additional inspections, and limits are detailed in the following inspection procedures.

A. Blade Damage

Refer to Blade Repairs section in the Maintenance Practices chapter of this manual for information regarding blade damage.

B. Grease or Oil Leakage

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

NOTE: A new or newly overhauled propeller may leak slightly during the first several hours of operation. This leakage may be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. Such leakage should cease within the first ten hours of operation.

Leakage that persists beyond the first ten hours of operation on a new or newly overhauled propeller, or that occurs on a propeller that has been in service for some time will require repair. A determination should be made as to the source of the leak. The only leakage that is field repairable is the removal and replacement of the O-ring seal between the engine and propeller flange. All other leakage repairs should be referred to an authorized propeller repair station. An instance of abnormal grease leakage should be inspected following the procedure below:

(1) 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 DIFFICULT TO DETECT.

(2) Perform a visual inspection for cracks in the hub. A crack may be readily visible, or may be indicated by grease leaking from a seemingly solid surface. Extra attention should be given to the blade retention area of the hub.

(3) Perform a visual inspection of the hub, blades and blade retention areas to locate the origin of leakage. If the origin of the grease leakage is determined to be a noncritical part, such as an O-ring, gasket or sealant, repairs can be accomplished during scheduled maintenance.

(4) If cracks are suspected, additional inspections must be performed before further operation. These inspections must be performed by qualified personnel at a certified propeller repair station with the appropriate rating to verify the condition. Such inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.

(5) If cracks or failing components are found, these parts must be replaced before further operation. Report such occurrences to the applicable authorities and to Hartzell Propeller Inc. Product Support.

C. Vibration

Instances of abnormal vibration should be investigated immediately. If the cause of the vibration is not readily apparent, the propeller may be inspected in accordance with the procedure below:

NOTE: It may sometimes be difficult to readily identify the cause of abnormal vibration. Vibrations may originate in the engine, propeller, or the craft. Troubleshooting procedures typically begin with an investigation of the engine. Craft components, such as engine mounts or loose landing gear doors, can also be the source of vibration. When investigating an abnormal vibration, the possibility of a failing blade or blade retention component should be considered as a potential source of the problem.

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

(2) Refer to the Vibration section in the Testing and Troubleshooting chapter of this manual. Perform the checks to determine possible causes of the vibration. If no cause is found, proceed with steps 4.C.(3) through 4.C.(8).

(3) Remove the spinner dome.

(4) Perform a visual inspection for cracks in the hub and blades.

(a) Pay particular attention to the blade retention areas of the hub.

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

(5) If cracks are suspected, additional inspections must be performed before further operation. These inspections must be performed by qualified personnel at a certified propeller repair station with the appropriate rating to verify the condition. Such inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.

(6) Check the blades and compare blade to blade differences:

(a) Inspect the propeller blades for unusual looseness or movement. Refer to Loose Blades in this section.

(b) Check blade track. Refer to Blade Track in this section.

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

(c) Manually (by hand) attempt to turn the blades (change pitch). Do not use a blade paddles.

(d) Visually check for damaged blades.

(7) If abnormal blade conditions or damage are found, additional inspections must be performed before further operation. These inspections must be performed by qualified personnel at a certified propeller repair station with the appropriate rating to evaluate the condition. Refer to the Blade Repairs section in the Maintenance Practices chapter of this manual.

(8) If cracks or failing components are found, these parts must be replaced before further operation. Report such occurrences to the applicable authorities and Hartzell Propeller Inc. Product Support.

D. Tachometer Inspection

WARNING: OPERATION WITH AN INACCURATE TACHOMETER MAY RESULT IN OPERATION AT A RESTRICTED RPM AND DAMAGING HIGH STRESSES. BLADE LIFE WILL BE SHORTENED AND COULD RESULT IN CATASTROPHIC FAILURE.

NOTE: A certified propeller repair station with the appropriate rating may also be able to perform an engine tachometer inspection.

(1) For installations that use a mechanical tachometer, perform the following tachometer inspection.

(a) Use a hand held tachometer to verify the accuracy of the engine tachometer at 100 hour intervals or at annual inspection, whichever occurs first.

(b) Hartzell Propeller Inc. recommends using a tachometer that is accurate within +/- 10 RPM, has NIST calibration (traceable), and has an appropriate calibration schedule.

E. Blade Track

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

(2) Move the propeller to low pitch.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(3) Check blade track as follows:

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

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

(b) Refer to Figure 5-1. Place a fixed reference point beneath the propeller, within 0.250 inch (6.35 mm) of the lowest point of the propeller arc.

NOTE: This reference point may be a flat board with a sheet of paper attached to it. The board may then be blocked up to within 0.250 inch (6.35 mm) of the propeller arc.

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

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

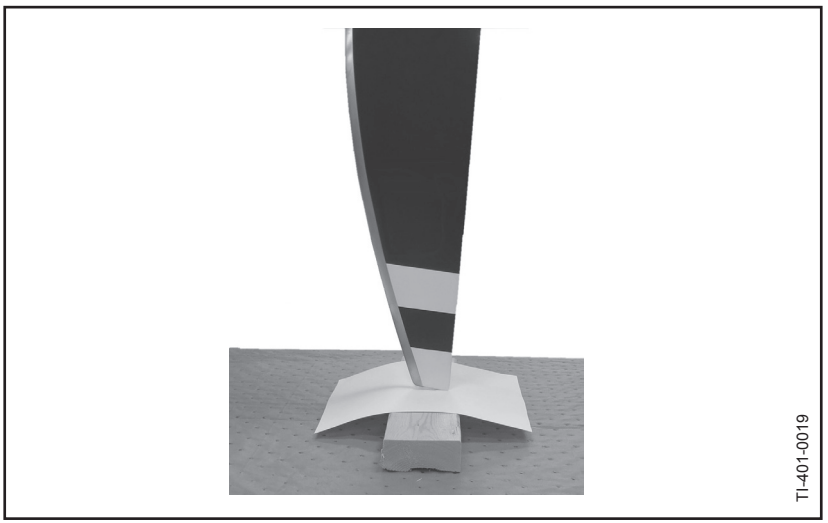
(e) Repeat this procedure with the remaining blades.

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

(4) Possible Correction

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

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



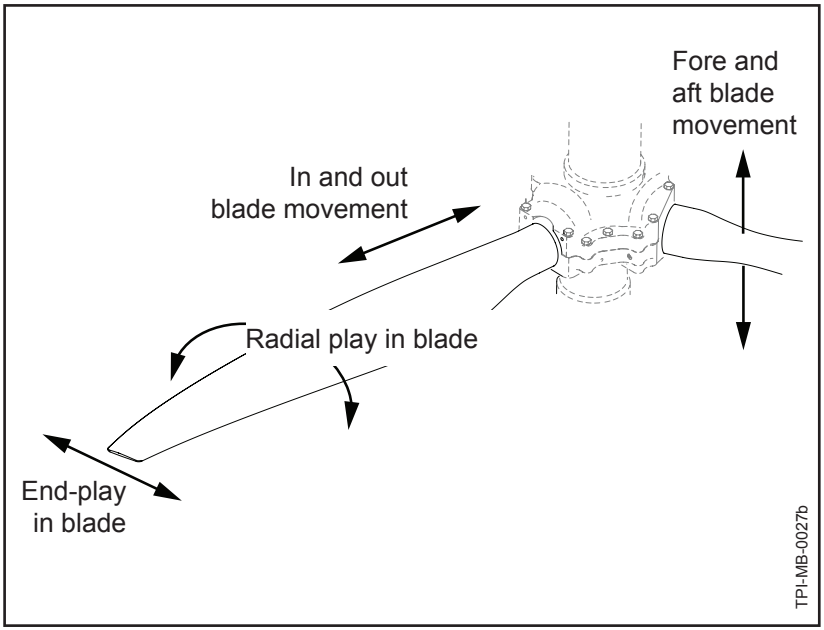
Checking Blade Track
Figure 5-1

F. Loose Blades

Refer to Figure 5-2. Limits for blade looseness are as follows:

End Play	See Note Below
Fore & Aft Play	See Note Below
In & Out	None
Radial Play (pitch change)	± 0.5 degree (1 degree total)

NOTE: Blades are intended to be tight in the propeller, however slight movement is acceptable if the blade returns to its original position when released. Blades with excessive movement, or that do not return to their original position when released may indicate internal wear or damage that should be referred to an authorized propeller repair station.



Blade Play
Figure 5-2

G. Corrosion

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.

H. Spinner Damage

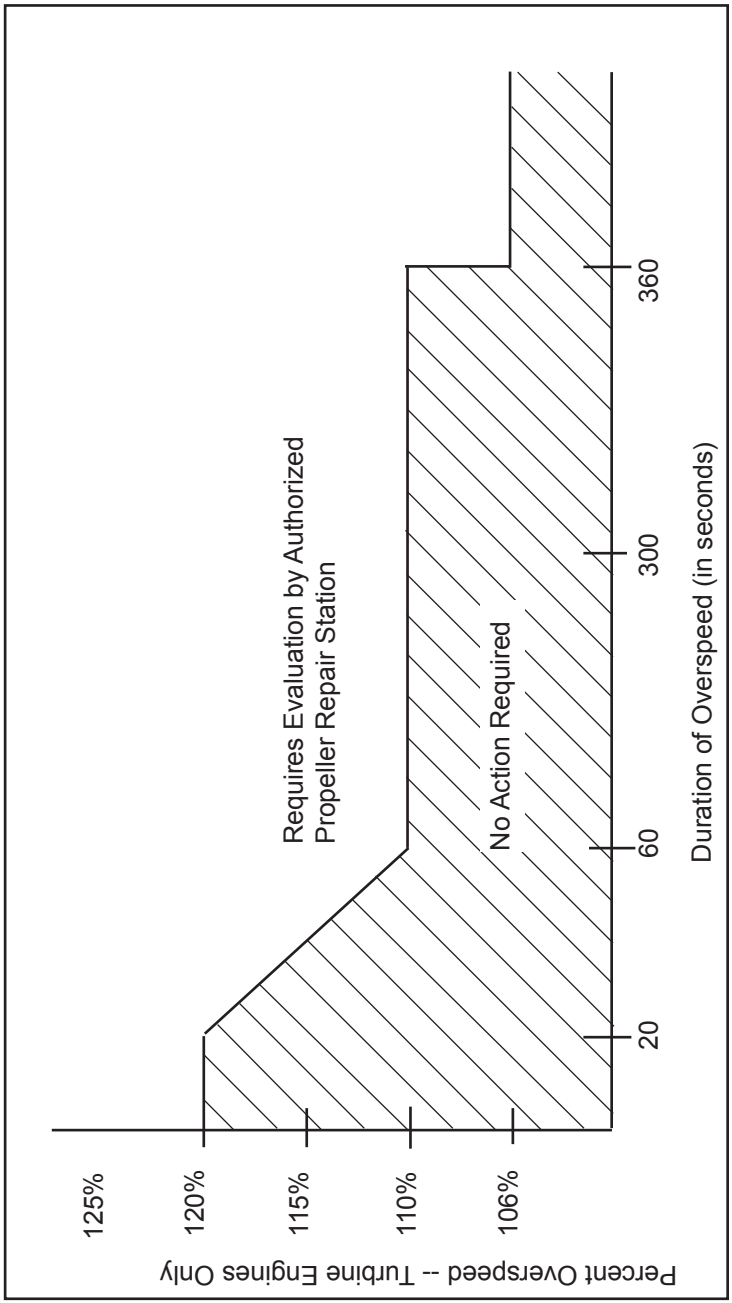
(1) Inspect the spinner for cracks, missing hardware, or other damage. Refer to Hartzell Propeller Inc. Manual 127 (61-16-27) or an appropriately licensed propeller repair facility for spinner damage acceptance and repair information. Contact the applicable authority for repair approval.

I. Electric De-ice System

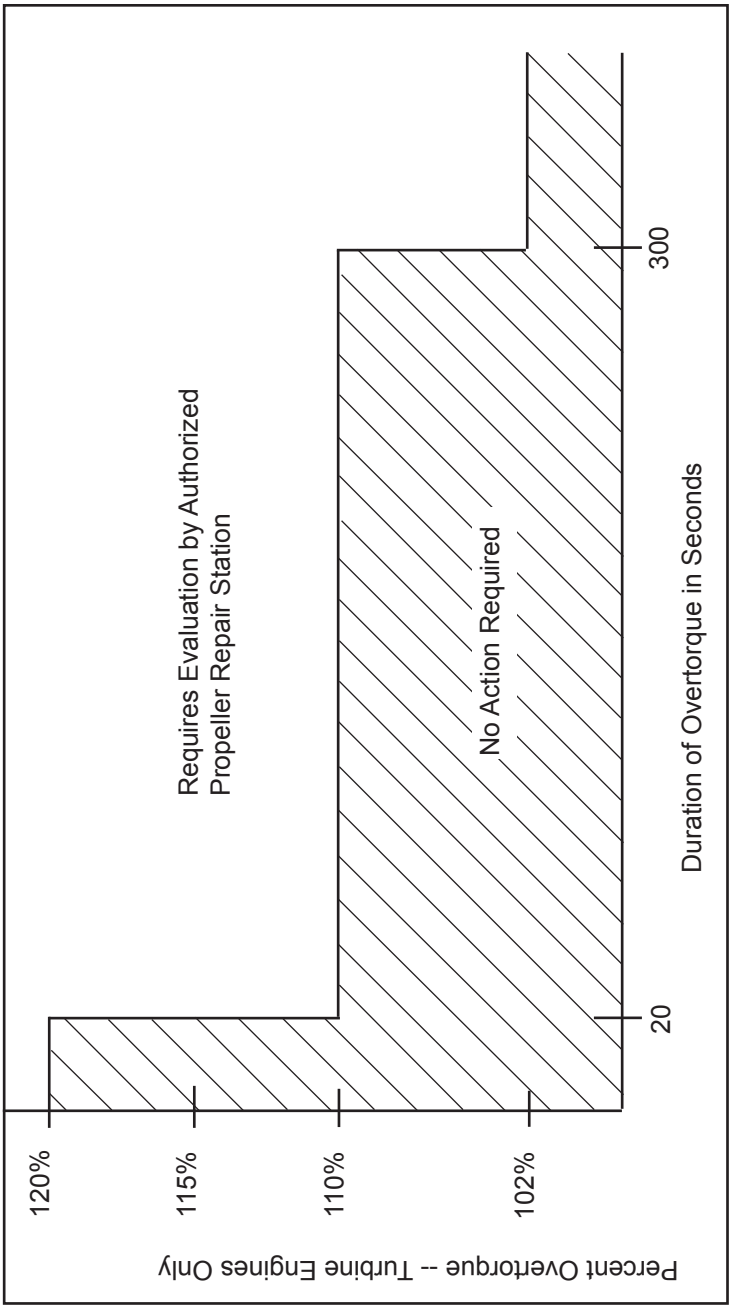
(1) Refer to the Anti-ice and De-ice Systems chapter of this manual for inspection procedures.

J. Anti-ice System

(1) Refer to the Anti-ice and De-ice Systems chapter of this manual for inspection procedures.



Turbine Engine Overspeed Limits
Figure 5-3



Turbine Engine Overtorque Limits
Figure 5-4

6. 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.

A. Overspeed/Overtorque

An overspeed occurrs when the propeller RPM exceeds the maximum RPM stated in the Propeller Installation Data Sheet (IDS) listed in Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59). An overtorque condition occurs when the engine load exceeds the limits established by the engine, propeller, or craft manufacturer. The duration of time at overspeed/overtorque for a single event determines the corrective action that must be taken to make sure no damage to the propeller has occurred.

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

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

(2) When a propeller installed on a turbine engine has an overtorque event, refer to the Turbine Engine Overtorque Limits in Figure 5-4 to determine the corrective action to be taken.

(a) Some craft installations have torque indicator values indicating 100 percent torque that are less than the maximum certified torque for the specific propeller model as listed in the propeller type certificate data sheet. If an overtorque occurs that requires propeller repair station evaluation, contact Hartzell Propeller Inc. Product Support to confirm actual overtorque percentage.

(3) Make an entry in the propeller logbook about the overspeed/overtorque event.

B. Propeller Ground Idle Operating Restrictions

WARNING: STABILIZED GROUND OPERATION WITHIN THE PROPELLER RESTRICTED RPM RANGE CAN GENERATE HIGH PROPELLER STRESSES AND RESULT IN FATIGUE DAMAGE TO THE PROPELLER. THIS DAMAGE CAN LEAD TO A REDUCED PROPELLER FATIGUE LIFE, PROPELLER FAILURE, AND LOSS OF CONTROL OF THE CRAFT. THE PROPELLER RESTRICTED RPM RANGE IS DEFINED IN THE PILOT OPERATING HANDBOOK (POH).

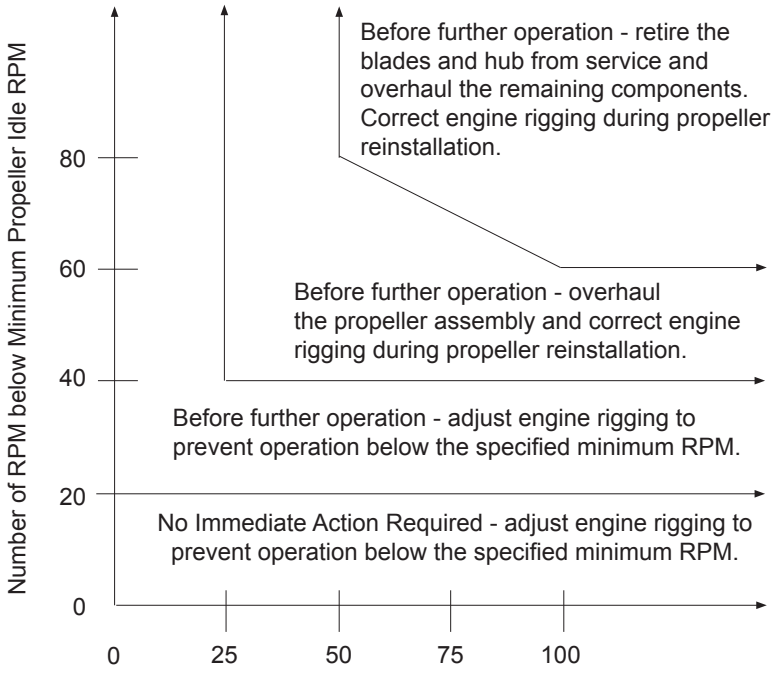
(1) General

(a) The information in this section is intended to emphasize the critical importance of correct propeller ground idle RPM on certain turboprop installations. It also defines the appropriate corrective action required when a propeller has been operated within this restricted RPM region.

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

(d) Four blade propellers operating on turbine engines can be sensitive to operation within restricted RPM ranges. These restricted ranges are usually in the lower RPM ranges, requiring that ground idle RPM be set above a critical minimum value.

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



To determine Corrective Action, refer to Figure 5-6.

Corrective Action Required
Figure 5-5

(2) Periodic Ground Idle RPM Check

(a) Perform the RPM check, especially following engine rigging/idle RPM adjustments.

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

(c) Check the accuracy of the tachometer. Refer to the Tachometer Inspection section in this chapter.

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

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

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

1 Refer to Figure 5-5 for corrective action. Refer to Figure 5-6 for help when using Figure 5-5.

Example:

Minimum propeller idle RPM listed in the AMM is	1180 RPM
Propeller idle is set at	1120 RPM
Propeller has operated with a RPM deviation of	**60 RPM**
Engine was rigged 2 months ago and has operated since it was rigged	**75 hours**

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

Example of an Evaluation of Ground Idle RPM Check
Figure 5-6

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

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

(3) Corrective Action

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

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

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

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

4 Refer to Figure 5-5 for the required corrective action.

5 Contact Hartzell Propeller Inc. if further clarification is required.

6 If a propeller restriction other than those described in Figure 5-5 has been violated, contact Hartzell Propeller Inc.

a The chart in Figure 5-5 applies only to operation below the minimum idle RPM.

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

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

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

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

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

11 Contact Hartzell Propeller Inc. Product Support Department to report the findings.

Hartzell Propeller Inc.
One Propeller Place
Piqua, Ohio 45356-2634 USA
Phone: 937.778.4379
Fax: 937.778.4391
techsupport@hartzellprop.com

C. Lightning Strike

CAUTION: CONSULT ENGINE AND CRAFT MANUFACTURER'S MANUALS. THERE MAY BE ADDITIONAL REQUIREMENTS SUCH AS DE-ICE SYSTEM CHECKS AND ENGINE SYSTEM CHECKS TO PERFORM AFTER A PROPELLER LIGHTNING STRIKE.

(1) General

(a) In the event of a propeller lightning strike, an inspection is required before further operation. It may be permitted to operate a propeller for an additional ten (10) hours of operation if the propeller is not severely damaged and meets the requirements in paragraph 6.C.(2).

(b) Regardless of the outcome of the initial inspection, the propeller must eventually be removed from the craft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating.

(2) Procedure for Temporary Operation

If temporary additional operation is desired before propeller removal and disassembly:

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

(b) If the only evident damage is minor arcing burns to the blades, then operation for ten (10) hours is acceptable before disassembly and inspection.

(c) Perform a functional check of the propeller de-ice system (if installed) in accordance with craft maintenance manual procedures.

(d) Regardless of the degree of damage, make an entry in the propeller logbook about the lightning strike.

(e) The propeller must be removed from the craft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating for operation beyond the temporary operation limits granted above.

D. Foreign Object Strike/Ground Strike

(1) General

(a) A foreign object strike/ground strike can include a broad spectrum of damage, from a minor stone nick to severe ground/water impact damage. A conservative approach in evaluating the damage is required because there may be hidden damage that is not readily apparent during an on-wing, visual inspection.

(b) A foreign object strike is defined as:

1 Any incident, whether or not the engine is operating, that requires repair to the propeller other than minor dressing of the blades. Examples of foreign object strike include situations where a craft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade. These cases should be handled as foreign object strikes because of potentially severe side loading on the propeller hub, blades and retention bearings.

2 Any incident during engine operation in which the propeller impacts a solid object that causes a drop in revolutions per minute (RPM) and also requires structural repair of the propeller (incidents requiring only paint touch-up are not included). This is not restricted to propeller strikes against the ground.

3 A sudden RPM drop while impacting water, tall grass, or similar yielding medium, where propeller blade damage is not normally incurred.

(2) Procedure

(a) In the event of a foreign object strike, an inspection is required before further operation. If the inspection reveals one or more of the following indications, the propeller must be removed from the craft, disassembled, and overhauled in accordance with the applicable propeller and blade maintenance manuals.

1 A loose blade in the hub.

2 Any noticeable or **suspected** damage to the pitch change mechanism.

3 A bent blade (out of track or angle).

4 Any blade diameter reduction.

5 A bent, cracked, or failed engine shaft.

6 Vibration during operation that was not present before the event.

(b) Nicks, gouges, and scratches on blade surfaces or the leading and trailing edges must be removed before operation. Refer to the Blade Repairs section in the Maintenance Practices chapter of this manual.

(c) For engine mounted components (for example governors, pumps, and control units) manufactured by Hartzell Propeller Inc., if the foreign object strike resulted in a sudden stop of the engine, the unit must be disassembled and inspected in accordance with the applicable maintenance manual.

(d) Regardless of the degree of damage, make a log book entry to document the foreign object strike incident and any corrective action(s) taken.

E. Fire Damage or Heat Damage

WARNING: HUBS ARE MANUFACTURED FROM HEAT TREATED FORGINGS AND ARE SHOT PEENED. BLADES ARE MANUFACTURED FROM HEAT TREATED FORGINGS AND ARE COMPRESSIVELY ROLLED AND SOMETIMES SHOT PEENED. EXPOSURE TO HIGH TEMPERATURES CAN DESTROY THE FATIGUE RESISTANCE BENEFITS OBTAINED FROM THESE PROCESSES.

(1) On rare occasions propellers may be exposed to fire or heat damage, such as an engine or hangar fire. In the event of such an incident, an inspection by a certified propeller repair station with the appropriate rating is required before further operation.

7. Long Term Storage

A. Parts shipped from the Hartzell Propeller Inc. factory are not shipped or packaged in a container which is designed for long term storage.

B. Long term storage procedures may be obtained by contacting a Hartzell Propeller Inc. distributor, or the Hartzell Propeller Inc. factory via the Product Support number listed in the Introduction chapter of this manual. Storage information is also detailed in Hartzell Propeller Inc. Manual 202A (61-01-02).

C. Information regarding the return of a propeller assembly to service after long term storage may be obtained by contacting a Hartzell Propeller Inc. distributor, or the Hartzell Propeller Inc. factory via the Product Support number listed in the Introduction chapter of this manual. This information is also detailed in Hartzell Propeller Inc. Manual 202A (61-01-02).

MAINTENANCE PRACTICES - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Cleaning

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.

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

CAUTION 2: WHEN CLEANING THE PROPELLER, DO NOT PERMIT SOAP OR SOLVENT SOLUTIONS TO RUN OR SPLASH INTO THE HUB AREA.

CAUTION 3: DO NOT USE ANY SOLVENT DURING CLEANING THAT COULD SOFTEN OR DESTROY THE BOND BETWEEN CHEMICALLY ATTACHED PARTS.

(1) Wash propeller with a noncorrosive soap solution.

(2) To remove grease or oil from propeller surfaces, apply Stoddard Solvent or equivalent to a clean cloth and wipe the part clean.

(3) Thoroughly rinse with water and permit to dry.

B. Spinner Cleaning and Polishing

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

(2) Polish the dome, if necessary, with an automotive-type aluminum polish.

2. Lubrication

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. Lubrication Intervals

(1) The propeller is to be lubricated at intervals not to exceed 100 hours or (12) calendar months, whichever occurs first.

(a) If annual operation is significantly less than 100 hours, calendar lubrication intervals should be reduced to six months.

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

(2) Owners of high use craft may wish to extend their lubrication intervals. Lubrication interval may be gradually extended after evaluation of previous propeller overhauls with regard to bearing wear and internal corrosion.

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

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

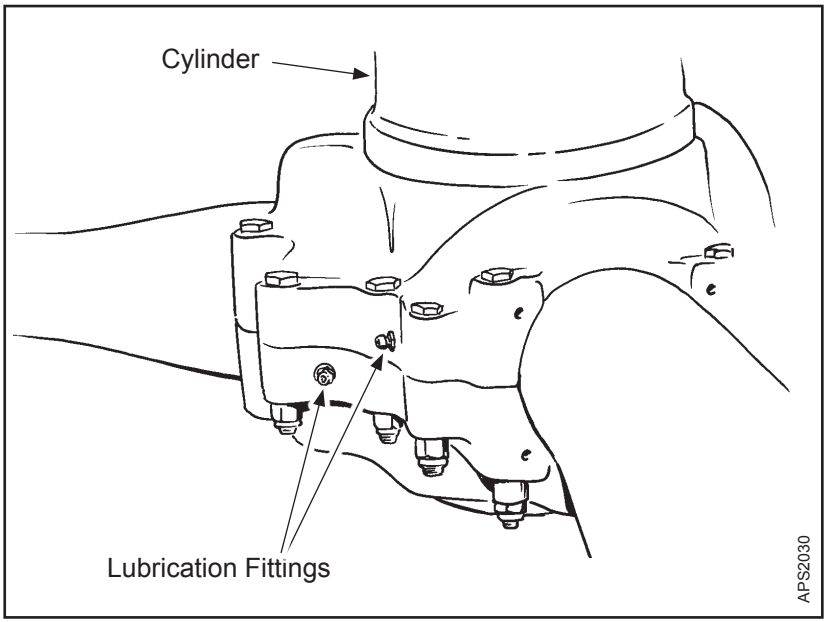
B. Lubrication Procedure

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

(1) Remove the propeller spinner.

(2) Refer to Figure 6-1. Each blade socket has two lubrication fittings. Remove the lubrication fitting caps from the lubrication fittings. Remove the lubrication fittings from either the cylinder side or the engine side of the hub assembly.

(a) It is preferable to apply grease to the fitting located nearest the leading edge of the blade on a tractor installation and nearest the trailing edge on a pusher installation. Lubricating at this location reduces the possibility of grease bypassing the bearing area and entering the hub cavity.



Lubrication Fittings
Figure 6-1

(b) A 45 degree lubrication fitting (Hartzell Propeller Inc P/N C-6349) may be installed on the engine-side or cylinder-side of the propeller in any location where a straight lubrication fitting (Hartzell Propeller Inc P/N A-279) was originally installed. The 45 degree lubrication fitting simplifies lubrication.

(c) The lubrication fittings installed on the engine-side or cylinder-side must be either all straight (Hartzell Propeller Inc P/N A-279) or all 45 degree (Hartzell Propeller Inc. P/N C-6349).

(3) Using a piece of safety wire, loosen any blockage or hardened grease at the threaded holes where the lubrication fitting was removed.

WARNING: WHEN MIXING AEROSHELL GREASES 5 AND 6, AEROSHELL GREASE 5 MUST BE INDICATED ON THE LABEL (HARTZELL P/N A-3594) AND THE CRAFT MUST BE PLACARDED TO INDICATE THAT OPERATION IS PROHIBITED IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN -40°F (-40°C).

CAUTION: USE HARTZELL PROPELLER INC. APPROVED GREASE ONLY. EXCEPT IN THE CASE OF AEROSHELL GREASES 5 AND 6, DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE.

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

(5) A label (Hartzell Propeller Inc. P/N A-3494) is normally applied to the propeller to indicate the type of grease previously used. Refer to Figure 6-2.

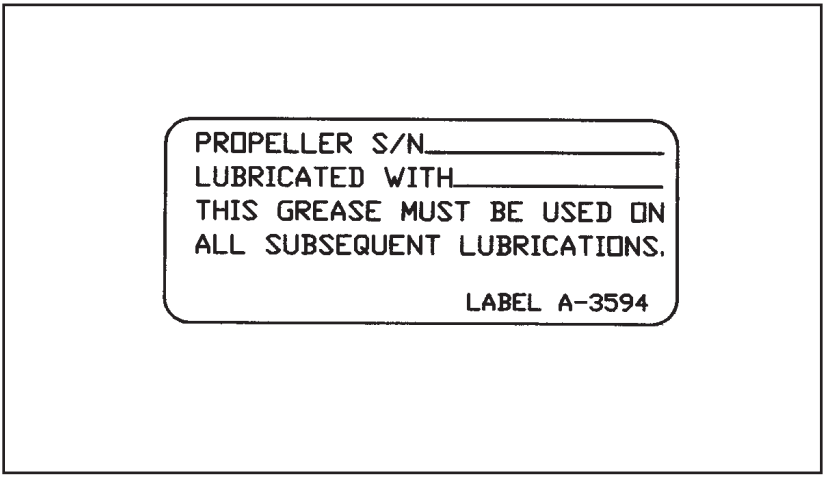
(a) This grease type should be used during re-lubrication unless the propeller has been disassembled and the old grease removed.

(b) Purging of old grease through lubrication fittings is only about 30 percent effective.

(c) To completely replace one grease with another, the propeller must be disassembled in accordance with the applicable overhaul manual.

CAUTION 1: OVER-LUBRICATING AN ALUMINUM HUB PROPELLER MAY CAUSE THE GREASE TO ENTER THE HUB CAVITY, LEADING TO EXCESSIVE VIBRATION AND/OR SLUGGISH OPERATION. THE PROPELLER MUST THEN BE DISASSEMBLED TO REMOVE THIS GREASE.

CAUTION 2: IF A PNEUMATIC GREASE GUN IS USED, EXTRA CARE MUST BE TAKEN TO AVOID EXCESSIVE PRESSURE BUILDUP.



Lubrication Label
Figure 6-2

CAUTION 3: GREASE MUST BE APPLIED TO ALL BLADES OF A PROPELLER ASSEMBLY AT THE TIME OF LUBRICATION.

(6) Pump 1 fl. oz. (30 ml) grease into each engine-side lubrication fitting, or until grease emerges from the hole where the lubrication fitting was removed - whichever occurs first.

NOTE: 1 fl. oz. (30 ml) is approximately 6 pumps with a hand-operated grease gun.

(7) Reinstall the removed lubrication fittings. Tighten until snug.

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

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

C. Approved Lubricants

The following lubricants are approved for use in Hartzell Propeller Inc. Aluminum hub propellers:

Aeroshell 6 - Recommended "all purpose" grease. Used in most new production propellers since 1989. Higher leakage/oil separation than Aeroshell 5 at higher temperatures.

Aeroshell 5 - Good high temperature qualities, very little oil separation or leakage. Cannot be used in temperatures colder than -40°F (-40°C). Craft serviced with this grease must be placarded to indicate that operation is prohibited if the outside air temperature is less than -40°F (-40°C).

Aeroshell 7 - Good low temperature grease, but high leakage/oil separation at higher temperatures. This grease has been associated with sporadic problems involving seal swelling.

Aeroshell 22 - Qualities similar to Aeroshell 7.

Royco 22CF - Not widely used. Qualities similar to Aeroshell 22.

3. Beta Feedback Block Assemblies

A. Inspection

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

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

(1) 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 per the craft manufacturer's instructions.

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

(1) Replace an A-3026 carbon block unit if the side clearance between the beta ring and carbon block exceeds 0.010 inch (0.25 mm).

(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. Replace the yoke if necessary.

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

(e) Secure the clevis pin with a T-head cotter pin. Refer to Figure 3-7.

(f) Refit the carbon block. Refer to Figure 3-6.

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.

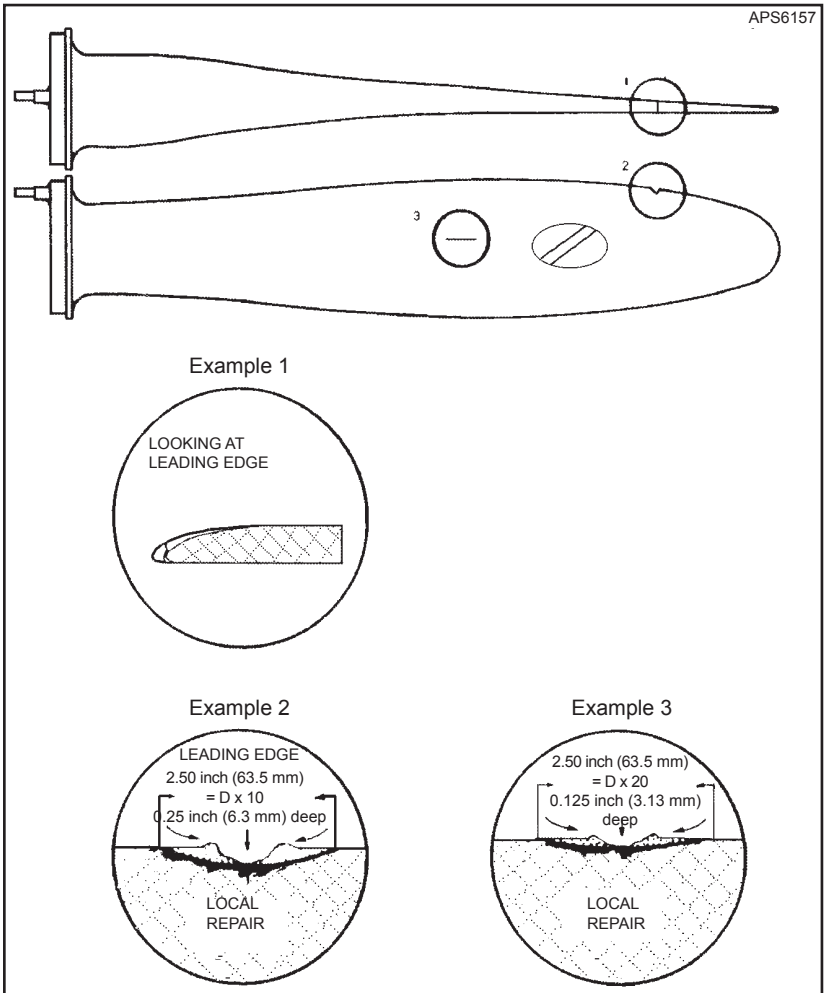
4. Aluminum Blade Repairs

WARNING: ALL NICKS, GOUGES, OR SCRATCHES OF ANY SIZE CAN CREATE A STRESS RISER THAT COULD POTENTIALLY LEAD TO BLADE CRACKING. ALL DAMAGE SHOULD BE VISUALLY EXAMINED CAREFULLY BEFORE OPERATION FOR THE PRESENCE OF CRACKS OR OTHER ABNORMALITIES.

CAUTION 1: BLADES THAT HAVE BEEN PREVIOUSLY REPAIRED OR OVERHAULED MAY HAVE BEEN DIMENSIONALLY REDUCED. BEFORE REPAIRING SIGNIFICANT DAMAGE OR MAKING REPAIRS ON BLADES THAT ARE APPROACHING SERVICEABLE LIMITS, CONTACT A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING OR THE HARTZELL PROPELLER INC. PRODUCT SUPPORT DEPARTMENT FOR BLADE DIMENSIONAL LIMITS.

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

Nicks, gouges, and scratches on blade surfaces or on the leading or trailing edges of the blade, greater than 1/32 inch wide or deep must be removed before operation. Field repair of small nicks and scratches may be performed by qualified personnel in accordance with FAA Advisory Circular 43.13-1B, as well as the procedures specified below. Normal blade lead edge erosion (sand-blasted appearance) is acceptable, and does not require removal before further operation.



To determine amount of rework needed, use the following formula:

On the leading and trailing edge of the blade, measure the depth of the damage, and multiply this number x 10 (see Example 2, above). Rework the area surrounding the damage 10 times the depth of the damage.

On the face and camber of the blade, measure the depth of the damage, and multiply this number x 20 (see Example 3, above). Rework the area surrounding the damage 20 times the depth of the damage.

Repair Limitations
Figure 6-3

A. Repair of Nicks and Gouges

Local repairs may be made using files, electrical or air powered equipment. Emery cloth, scotch brite, and crocus cloth are to be used for final finishing. Refer to Figure 6-3.

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

CAUTION 2: SHOT PEENED BLADES ARE IDENTIFIED WITH AN "S" FOLLOWING THE BLADE MODEL NUMBER, AS DESCRIBED IN THE DESCRIPTION AND OPERATION CHAPTER OF THIS MANUAL. BLADES THAT HAVE DAMAGE IN THE SHOT PEENED AREAS IN EXCESS OF 0.015 INCH (0.38 mm) DEEP ON THE FACE OR CAMBER OR 0.250 INCH (6.35 mm) ON THE LEADING OR TRAILING EDGES MUST BE REMOVED FROM SERVICE, AND THE REWORKED AREA SHOT PEENED BEFORE FURTHER OPERATION. SHOT PEENING OF AN ALUMINUM BLADE MUST BE ACCOMPLISHED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING IN ACCORDANCE WITH HARTZELL PROPELLER INC. ALUMINUM BLADE MANUAL 133C (61-13-33).

(1) Repairs to the leading or trailing edge are to be accomplished by removing material from the bottom of the damaged area. Remove material from this point out to both sides of the damage, providing a smooth, faired depression that maintains the general original airfoil shape.

(2) Repairs to the blade face or camber should be made in the same manner as above. Repairs that form a continuous line across the blade section (chordwise) are not permitted.

(3) The area of repair should be determined as follows: Leading and trailing edge damage: Depth of nick x 10. Face and camber: Depth of nick x 20. Refer to Figure 6-3.

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

(4) After filing or sanding of the damaged area, the area must then be polished, first with emery cloth or Scotch Brite Pad , and finally with crocus cloth to remove any traces of filing.

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

(a) Make sure that indications of the damage, file marks, or coarse surface finish do not remain.

(6) If inspections shows any remaining blade damage, repeat steps 4.A.(4) through 4.A.(5)(a) until no damage remains.

(a) Penetrant inspection is recommended in accordance with Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(7) Apply chemical conversion coating and approved paint to the repaired area before returning the blade to service. Refer to the section "Painting After Repair" in this chapter.

B. Repair of Bent Blades

CAUTION: DO NOT ATTEMPT TO "PRE-STRAIGHTEN" A BLADE BEFORE DELIVERY TO AN APPROPRIATELY LICENSED PROPELLER REPAIR FACILITY. THIS WILL CAUSE THE BLADE TO BE SCRAPPED BY THE REPAIR FACILITY.

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

5. Painting Aluminum Blades After Repair

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. General

(1) A propeller blade is painted with a durable specialized coating that is resistant to abrasion. If this coating becomes eroded, it is necessary to repaint the blades to provide proper corrosion and erosion protection. Painting must be performed at an appropriately licensed propeller repair facility in accordance with Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) It is permitted to perform a blade touch-up with aerosol paint in accordance with the procedures in Painting of Aluminum Blades in this chapter.

(3) Refer to Table 6-1 for paints approved for blade touch-up.

Vendor	Color	Vendor P/N	Hartzell Propeller Inc. P/N
Tempo	Epoxy Black	A-150	n/a
Tempo	Epoxy Gray	A-151	n/a
Tempo	Epoxy White (tip stripe)	A-152	n/a
Tempo	Epoxy Red (tip stripe)	A-153	n/a
Tempo	Epoxy Yellow (tip stripe)	A-154	n/a
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1
Sherwin-Williams	Gray	F75KXA10445-4311	A-6741-146-1
Sherwin-Williams	White (tip stripe)	F75KXW10309-4311	A-6741-147-1
Sherwin-Williams	Red (tip stripe)	F75KXR12320-4311	A-6741-149-1
Sherwin-Williams	Yellow (tip stripe)	F75KXY11841-4311	A-6741-150-1
Sherwin-Williams	Silver	F75KXS13564-4311	A-6741-190-1

Approved Touch-Up Paints
Table 6-1

(4) The paint manufacturers may be contacted by using the following information:

Tempo Products Co.
A plasti-kote Company
1000 Lake Road
Medina, OH 44256
Tel: 800.321.6300
Fax: 216.349.4241
Cage Code: 07708

Sherwin Williams Co.
2390 Arbor Boulevard
Dayton, Ohio
Tel: 937.298.8691
Fax: 937.298.3820
Cage Code: 0W199

B. Painting of Aluminum Blades

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

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

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

(2) Feather the existing coatings away from the eroded or repaired area with 120 to 180 grit sandpaper.

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

(3) Use acetone, #700 lacquer thinner, or MEK to wipe the surface of the blade. Permit the solvent to evaporate.

(4) Before refinishing the blades, apply a corrosion preventive coating to the bare aluminum surface.
   (a) Oakite 31, Chromicote L-25, or Alodine 1201 are approved chemical conversion coatings.
   (b) Apply these coatings in accordance with the directions provided by the product manufacturer.

(5) Apply masking material to the 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 IS REQUIRED. AVOID PROLONGED CONTACT. USE IN WELL VENTILATED AREA.

CAUTION: APPLY FINISH COATING ONLY TO THE DEGREE REQUIRED TO UNIFORMLY COVER THE REPAIR/EROSION. AVOID EXCESSIVE PAINT BUILD-UP ALONG THE TRAILING EDGE TO AVOID CHANGING BLADE PROFILE.

(6) 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 (4) hours it must be lightly sanded before another coat is applied.

(7) Remove the masking from the tip stripes and re-mask to permit tip stripe refinishing if required.

(8) 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 (4) hours it must be lightly sanded before another coat is applied.

(9) Immediately remove the masking material from the anti-icing or de-ice boot and tip stripes, if required.

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

6. Dynamic Balance

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

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS.

A. Overview

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

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

NOTE: If static balancing is not accomplished before dynamic balancing, the propeller may be so severely unbalanced that dynamic balance may not be achieved.

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

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

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

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

B. Inspection Procedures Before Balancing

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

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

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

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

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

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

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

C. Modifying Spinner Bulkhead to Accommodate Dynamic Balance Weights

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

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

(2) The radial location must be outboard of the de-ice slip ring or bulkhead doubler and inboard of the bend where the bulkhead creates the flange to attach the spinner dome.

(3) Twelve equally spaced locations for weight attachment are recommended.

(4) Install nut plates (10-32 thread) of the type used to attach the spinner dome. This will permit convenient balance weight attachment on the engine side of the bulkhead.

(5) Alternatively, drilling holes for use with the AN3-( ) type bolts with self-locking nuts is acceptable.

(6) Chadwick-Helmuth Manual AW-9511-2, "The Smooth Propeller", specifies several generic bulkhead rework procedures. These are acceptable providing they comply with the conditions specified herein.

D. Placement of Balance Weights for Dynamic Balance

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

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

(2) If the location of static balance weights has not been altered, subsequent removal of the dynamic balance weights will return the propeller to its original static balance condition.

(3) Use only stainless or plated steel washers as dynamic balance weights on the spinner bulkhead.

(4) Do not exceed a maximum weight per location of 0.9 oz. (25.5 g).

NOTE: This is approximately equal to six AN970 style washers (0.188 inch ID, 0.875 inch OD, 0.063 inch thickness) (4.78 mm ID, 22.23 mm OD, 1.60 mm thickness).

(5) Install weights using aircraft quality #10-32 or AN-3( ) type screws or bolts.

(6) Balance weight screws attached to the spinner bulkhead must protrude through the self-locking nuts or nut plates a minimum of one thread and a maximum of four threads.

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

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

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

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

7. Propeller Ice Protection Systems

A. Electric De-ice System

(1) Consult the Pilot Operating Handbook (including all supplements) regarding operation into conditions of known icing. The craft may not be certificated for operation in known icing conditions, even though propeller de-ice equipment is installed.

(2) Refer to the Anti-ice and De-ice Systems chapter of this manual for functional tests of the de-ice system.

B. Anti-ice System

(1) Consult the Pilot Operating Handbook (including all supplements) regarding operation into conditions of known icing. The craft may not be certificated for operation in known icing conditions, even though propeller anti-ice equipment is installed.

(2) Refer to the Anti-ice and De-ice Systems chapter of this manual for functional tests of the anti-ice system.

ANTI-ICE AND DE-ICE SYSTEMS - CONTENTS

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1. Introduction

   A. Propeller De-ice System

      (1) A propeller de-ice system is a system that removes ice after it forms on the propeller blades. A de-ice system uses electrical heating elements to melt the ice layer next to the blades, permitting the ice to be thrown from the blade by centrifugal force. Blades are alternately heated and permitted to cool as the current is applied and removed automatically by the de-ice system timer.

      (2) System components include a timer or cycling unit, electrical slip ring(s), brush block assembly, and blade mounted de-ice boots.

   B. Propeller Anti-ice System

      (1) A propeller anti-ice system is a system that prevents formation of ice on propeller surfaces. An anti-ice system dispenses a fluid that mixes with, and reduces the freezing point of, moisture on the propeller blades. The mixture may then flow off the blades before it forms ice.

      (2) System components include a fluid tank, pump, slinger ring, and blade mounted fluid anti-icing boots.

2. System Description

A. De-ice System

NOTE: Because of the many differences in various de-ice systems, the following description is general in nature. Consult the craft manufacturer's manual for a description of your specific de-ice system and controls.

The de-ice system is controlled by the pilot via a cockpit control switch. This switch applies electrical power to the de-ice system, which will operate as long as the switch is in the ON position. Depending upon the system, another set of cockpit controls may be available. One of these controls is a mode selector, which permits the pilot to select two cycling speeds, for heavy or light icing conditions. Some systems on twin engine craft have a switch which provides a full de-ice mode, which permits the pilot to de-ice both propellers simultaneously. This switch may only be used for short periods and is used when ice builds up on the propeller before the system is turned on.

An ammeter, which indicates current drawn by the system, is normally located near the de-ice system switches. This ammeter may indicate total system load, or a separate ammeter may be supplied for each propeller.

A timer, which is turned off and on by the cockpit control, is used to sequence the de-ice system. This timer turns the de-ice system on and off in proper sequence, controlling the heating interval to each propeller for even de-icing.

A brush block, which is mounted on the engine immediately behind the propeller, supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The slip ring is normally mounted on the spinner bulkhead.

When the pilot places the de-ice system cockpit control switch in the ON position, the system timer begins to operate. As the timer sequences, power is delivered to a power relay. The power relay delivers high current to the brush block and slip ring. Each propeller is de-iced in turn by the timer.

B. Anti-ice System

(1) The anti-ice system is controlled by the pilot via a cockpit mounted rheostat. This rheostat operates a pump that pumps anti-ice fluid from the tank at a controlled rate.

(2) The anti-ice fluid is delivered through a filter, a check valve, and then through tubing to a slinger ring located at the rear of the spinner bulkhead. The anti-ice fluid is dispensed into the rotating slinger ring, which holds the fluid in a curved channel by centrifugal force. The fluid then flows out of the slinger ring through feed tubes which are welded to the slinger ring, and then out onto the blade anti-icing boots.

(3) The blade anti-icing boots are ridged rubber sheets that are glued to the leading edge of the blades. The ridges in the anti-icing boots direct the fluid out onto the blades and permit for an even distribution of the anti-ice fluid across the blades.

3. Functional Tests

A. De-ice System

(1) Functional tests of the de-ice system should be performed in accordance with the following Hartzell Propeller Inc. Manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

B. Anti-ice System

(1) Operational Checks of the anti-ice system should be performed in accordance with the following Hartzell Propeller Inc. Manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

4. System Inspections

The inspections detailed below are made on a regular basis, either before operation, during the 100 hour inspection, or if a problem is noted. Possible corrections to problems discovered during inspections, additional inspections, and limits are detailed in the following Hartzell Propeller Inc. manuals.

A. De-ice System Inspections

(1) Perform inspections in accordance with the following Hartzell Propeller Inc. Manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

B. Anti-ice System Inspections

(1) Perform inspections in accordance with the following Hartzell Propeller Inc. Manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

5. System Troubleshooting

A. De-ice System Troubleshooting

(1) Perform troubleshooting in accordance with the following Hartzell Propeller Inc. manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual 182 (61-12-82) - Propeller Electrical De-ice Boot Removal and Installation Manual

B. Anti-ice System Troubleshooting

(1) Perform troubleshooting in accordance with the following Hartzell Propeller Inc. manuals, which are available on the Hartzell Propeller Inc. website at www.hartzellprop.com:

(a) Hartzell Propeller Inc. Manual 181 (30-60-81) - Propeller Ice Protection System Component Maintenance Manual

(b) Hartzell Propeller Inc. Manual 183 (61-12-83) - Propeller Anti-icing Boot Removal and Installation Manual

RECORDS - CONTENTS

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1. Introduction

   It is important to keep all records of any repairs, adjustments, maintenance, or required inspections performed on a propeller or propeller system.

   This chapter provides a method for maintaining these records. It also provides a location for recording information that can aid the service technician in maintaining the propeller system.

2. Record Keeping

   A. Information to be Recorded

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

         (a) Propeller position (on craft)
         (b) Propeller model
         (c) Propeller serial number
         (d) Blade design number
         (e) Blade serial numbers
         (f) Spinner assembly part number
         (g) Propeller pitch range
         (h) Craft information (craft type, model, serial number and registration number)

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