Manual No. 411
61-00-11
Revision 5
December 2014

Propeller Owner's Manual
and Logbook

Constant Speed, Non-counterweighted
( )(A,B)1 Series "Bantam" Propellers
with Composite Blades

Hartzell Propeller Inc.
One Propeller Place
Piqua, OH 45356-2634 U.S.A.
Ph: 937-778-4200 (Hartzell Propeller Inc.)
Ph: 937-778-4379 (Product Support)
Product Support Fax: 937-778-4391

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As a fellow pilot, I urge you to read this Manual thoroughly. It contains a wealth of information about your new propeller.

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

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

Jim Brown
Chairman, Hartzell Propeller Inc.

WARNING

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

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

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

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

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

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

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

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

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REVISION 5 HIGHLIGHTS

- COVER
  - Revised to match this revision.
- REVISION HIGHLIGHTS
  - Revised to match this revision.
- LIST OF EFFECTIVE PAGES
  - Revised to match this revision.
- INSTALLATION AND REMOVAL
  - Updated the Torque Table, Table 3-1
  - Revised the section, "Painting of a Hartzell Propeller Inc. Composite Spinner Assembly"
  - Updated the Spinner Support Bracket/Bulkhead Mounting Hardware-Hub Mounted, Table 3-2
  - Added Figure 3-10.1, Spinner Mounting Ring Attachment to Hub and Bulkhead
  - Added instructions for attaching spinner mounting ring to bulkhead
  - Revised Table 3-3
  - Revised the name of Figure 3-12 and Figure 3-13
  - Added Figure 3-15, 105085 Spinner Assembly Installation
  - Added the 105085 spinner assembly and required installation and removal instructions
  - Revised the section, "Spinner Removal"

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REVISIONS 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	May/12	New Issue
Revision 1	Oct/12	Minor Revision
Revision 2	Feb/14	Major Revision
Revision 3	May/14	Minor Revision
Revision 4	Aug/14	Minor Revision
Revision 5	Dec/14	Minor Revision

RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By
Original	May/12	May/12	HPI
1	Oct/12	Oct/12	HPI
2	Feb/14	Feb/14	HPI
3	May/14	May/14	HPI
4	Aug/14	Aug/14	HPI
5	Dec/14	Dec/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. FAILURE TO COMPLY WITH INFORMATION CONTAINED IN A SERVICE DOCUMENT OR THE USE OF OBSOLETE INFORMATION MAY CREATE AN UNSAFE CONDITION THAT MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

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

Service Document Number	Incorporation Rev./Date

SERVICE DOCUMENTS LIST

Service Document Number	Incorporation Rev/Date

AIRWORTHINESS LIMITATIONS

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

FAA APPROVED

by: _____ date: MAR 0 7 2014

Manager, Chicago Aircraft Certification Office,
ACE-115C

Federal Aviation Administration

Rev. No.	Description of Revision
2	Added Airworthiness Limitations section to manual.

AIRWORTHINESS LIMITATIONS

1. Replacement Time (Life Limits)
   A. The FAA establishes specific life limits for certain component parts, as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.
   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 aircraft/engine/propeller combinations listed, and continues regardless of subsequent installations (which may or may not be life limited).
      (1) The propeller models affected by this manual currently do not have any life limited parts.

FAA APPROVED

by: _____ date: MAR 07 2014

Manager, Chicago Aircraft Certification Office,
ACE-115C

Federal Aviation Administration

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INTRODUCTION - CONTENTS

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1. Purpose

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

A. This manual has been reviewed and accepted by the FAA. Additionally, the Airworthiness Limitations Section of this manual has been approved by the FAA.

B. The purpose of this manual is to enable qualified personnel to install, operate, and maintain a Hartzell Propeller Inc. (2, 3, 5)(A,B)(1,2) aluminum hub propeller. Separate manuals are available concerning overhaul procedures and specifications for the propeller.

C. This manual includes several design types.

(1) Sample propeller and blade model designations within each design are 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 aircraft 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) All propeller models included in this manual use composite propeller blades.

2. Airworthiness Limitations

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

3. Airframe or Engine Modifications

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

   B. Engine modifications can also affect the propeller. The two primary categories of engine modifications are those that affect structure and those that affect power. An example of a structural engine modification is the alteration of the crankshaft or damper of a piston engine. Any change to the weight, stiffness, or tuning of rotating components could result in a potentially dangerous resonant condition that is not detectable by the pilot. Most common engine modifications affect the power during some phase of operation. Some increase the maximum power output, while others improve the power available during hot and high operation (flat rating) or at off-peak conditions. Examples of such engine modifications include, but are not limited to: the addition or alteration of a turbocharger or turbonormalizer, increased compression ratio, increased RPM, altered ignition timing, electronic ignition, full authority digital electronic controls (FADEC), or tuned induction or exhaust.

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

4. Restrictions and Placards
   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 aircraft model.
      (2) Review the propeller and aircraft type certificate data sheet (TCDS), Pilot Operating Handbook (POH), and any applicable Airworthiness Directives for specific information.
5. General
   A. Personnel Requirements
      (1) Compliance to the applicable regulatory requirements established by the Federal Aviation Administration (FAA) or foreign equivalent is mandatory for anyone performing or accepting responsibility for any inspection and/or repair and/or overhaul of any Hartzell Propeller Inc. product.
      (2) Personnel performing maintenance are expected to have sufficient training and certifications (when required by the applicable Aviation Authority) to accomplish the work required in a safe and airworthy manner.
   B. Maintenance Practices
      (1) The propeller and its components are highly vulnerable to damage when they are removed from the engine. Properly protect all components until they are reinstalled on the engine.
      (2) Never attempt to move the aircraft by pulling on the propeller.
      (3) Use only the approved consumables, e.g., solvents, lubricants, etc.
      (4) 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.

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

(5) Observe applicable torque values during maintenance.

(6) Approved paint must be applied to all composite blades. For information concerning the application of paint, refer to the Maintenance Practices chapter of this manual. Operation of blades without the specified finishes is not permitted.

(7) 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 airframe or engine manufacturer.

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

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

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

(9) As applicable, follow military standard NASM33540 for safety-wiring and cotter pinning general practices. Use 0.032 (0.81 mm) safety wire unless otherwise indicated.

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

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

(12) If the propeller is equipped with an ice protection system, applicable instructions and technical information 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 System 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

(13)Propeller ice protection system components installed on a Hartzell Propeller Inc. propeller are controlled by Hartzell Propeller Inc.

C. Continued Airworthiness

(1) Operators are urged to stay informed of Airworthiness information using Hartzell Propeller Inc. Propeller Service Bulletins and Service Letters that 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. 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 ICA for this product. Contact Hartzell Propeller Inc. 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.

6. Reference Publications

The following publications are referenced within this manual:

Hartzell Propeller Inc. Manual 401 (61-10-01) - ( )(A,B)1 Series Propeller Maintenance Manual

Hartzell Propeller Inc. Manual 130B (61-23-30) - Mechanically Actuated Governor Maintenance Manual

Hartzell Propeller Inc. Manual 137 (61-23-37) - Electrically Actuated Governor Overhaul Manual

Hartzell Propeller Inc. Manual 135F (61-13-35) - Composite Propeller Blade Maintenance Manual.

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

Hartzell Propeller Inc. Manual 165A (61-00-65) - Illustrated Tool and Equipment Manual

Hartzell Propeller Inc. Manual 170 (61-13-70) - Composite Propeller Blade Field Maintenance and Minor Repair - Also 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

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

7. Definitions

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

Term	Definition
Annealed	Softening of material due to overexposure to heat.
Aviation Certified	Intended for FAA or international equivalent type certificated aircraft applications. A TC and PC number must be stamped on the hub and blades.
Aviation Experimental	Intended for aircraft/propeller applications not certified by the FAA or international equivalent. Products marked with an "X" at or near the end of the model number, part number, or serial number are not certified by the FAA or international equivalent and are not intended to use on certificated aircraft.
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.
Composite Material	Kevlar® (yellow) or graphite (black) fibers bound together with or encapsulated within an epoxy resin.
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.
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface.
Debond	Separation of two materials that were originally bonded together in a separate operation.
Delamination	Internal separation of the layers of composite material.
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 rotated parallel to the relative wind, thus reducing aerodynamic drag.
Gouge	Surface area where material has been removed.
Hazardous Propeller Effect	The hazardous propeller effects are defined in Title 14 CFR section 35.15(g)(1).
Horizontal Balance	Balance between the blade tip and the center of the hub.
Impact Damage	Damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object while in flight or on the ground.

Term	Definition
Major Propeller Effect	The major propeller effects are defined in Title 14 CFR section 35.15(g)(2).
Nick	Removal of paint and possibly a small amount of material.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control lever and the actual engine (propeller) RPM are equal.
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly.
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.
Pitch	Same as "Blade Angle".
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear.
Porosity	An aggregation of microvoids. See "voids".
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15.

Term	Definition
Scratch	See "Nick".
Single Acting	Hydraulically actuated propeller which utilizes a single oil supply for pitch control.
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip.
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM.
Synchrophasing	A form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other.
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control lever.
Vertical Balance	Balance between the leading and trailing edges of a two-blade propeller with the blades positioned vertically.
Variable Force	A force which may be applied or removed during propeller operation.
Voids	Air or gas that has been trapped and cured into a laminate.
Windmilling	The rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power.

8. Abbreviations

Abbreviation	Term
AMM	Aircraft Maintenance Manual
AN.	Air Force-Navy (or Army-Navy)
AOG	Aircraft on Ground
FAA.	Federal Aviation Administration
Ft-Lb	Foot-Pound
ICA	Instructions for Continued Airworthiness
ID	Inside Diameter
In-Lb	Inch-Pound
IPS	Inches Per Second
kPa	Kilopascals
Lbs	Pounds
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection
MS	Military Standard
NAS	National Aerospace Standards
NASM	National Aerospace Standards, Military
N•m.	Newton-Meters
OD	Outside Diameter
POH	Pilot's Operating Handbook
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
STC	Supplemental Type Certificate
TBO	Time Between Overhaul
TC.	Type Certificate
TSN	Time Since New
TSO	Time Since Overhaul
UID	Unique Identification

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

9. Hartzell Propeller Inc. Product Support

   Hartzell Propeller Inc. is ready to assist you with questions concerning your propeller system. Hartzell Propeller Inc. product support may be reached during business hours (8:00 am through 5:00 pm, 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) 778-4215, 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 our website at www.hartzellprop.com.

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

10. Warranty Service

    If you believe you have a warranty claim, it is necessary to contact Hartzell Propeller Inc.'s Warranty Administrator. Hartzell Propeller Inc.'s 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 778-4379, 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) 778-4215, or by e-mail at warranty@hartzellprop.com.

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

11. 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

LIST OF ILLUSTRATIONS

LIST OF TABLES

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1. Description of Propeller and Systems

   A. System Overview

      The propellers covered in this manual are constant speed, single-acting, hydraulically actuated propellers. These propellers are designed for use with reciprocating engines.

      A constant speed propeller system is controlled by an engine/propeller speed sensing device (governor) to maintain a constant engine/propeller RPM by changing blade angle.

      The governor uses an internal pump that is driven by the engine. This pump increases engine oil pressure for supply to the propeller. Engine speed sensing hardware within the governor controls the supply of oil to the propeller, supplying or draining oil as appropriate to maintain constant engine speed.

      Propeller blade angle change is actuated by a hydraulic piston/cylinder combination mounted on the forward end of the propeller hub. The linear motion of the hydraulic piston is transmitted to each blade through a pitch change rod and a fork. A pitch change knob, located at the base of the blade, connects the blade to the fork. Each blade root is supported in the hub by a retention bearing. The retention bearing system holds the blade firmly in the hub, but also allows the blade angle to change.

      Propeller forces, consisting of: 1) mechanical spring action, 2) counterweight centrifugal twisting moment (if applicable), 3) centrifugal and aerodynamic twisting moment of the blades, and 4) an air charge on some propellers, in various combinations, are constantly present while the propeller is operating. The summation of these forces is opposed by a variable hydraulic force (oil pressure from the engine driven governor). Oil pressure is metered by the governor to oppose these constant forces and maintain a constant engine RPM.

Oil under pressure from the engine-driven governor is supplied to the hydraulic cylinder through the pitch change rod. Increasing or decreasing the oil volume within the hydraulic cylinder either increases blade angle to reduce engine RPM, or reduces blade angle to increase engine RPM. By changing the blade angle, the governor maintains constant engine RPM (within limits), independent of the throttle setting.

If oil pressure is lost at any time, the summation of propeller forces, which is in direct opposition to the lost variable hydraulic force, either increases or reduces blade angle, depending upon propeller model.

2. Functional Description of Constant Speed Propeller Types

A. ( )(A,B)1 Series Propellers with Composite Blades

These propeller model series are constant speed, non-counterweighted propellers. The propellers are capable of blade angles between a low positive pitch (low pitch) and high positive pitch (high pitch).

Centrifugal twisting moment acting on the blades moves the blades to a low blade angle (low pitch) to increase RPM. Since the centrifugal twisting moment is only present when the propeller is rotating, a mechanical spring is installed within the propeller to assist movement of the blades to a lower pitch position as RPM declines, and to reduce the propeller pitch to the low pitch stop when the propeller is static. With the blades at low pitch, the load on the starter when starting the engine is reduced significantly.

Oil pressure opposes the spring and centrifugal twisting moment to move the blades to a high blade angle (high pitch), reducing engine RPM.

If oil pressure is lost at any time, the propeller will move to low pitch. This occurs because the spring and blade centrifugal twisting moment are no longer opposed by hydraulic oil pressure. The propeller will then reduce blade pitch to the low pitch stop.

3. Model Designation

The following pages illustrate sample model designations for Hartzell Propeller Inc. propeller hubs and blades.

A. Refer to Table 2-1 for the propeller model designations for Hartzell Propeller Inc. (2,3,5)(A,B)(1,2)-( )( )( )( ) Series Bantam Propellers.

B. Refer to Table 2-2 for Composite Blade Model Identification

(1) Hartzell Propeller Inc. uses a model designation to identify specific propeller and blade assemblies. Example: (2,3,5)(A,B)(1,2)-( )( )( )/H79A06X( ).

(2) A slash mark separates the propeller and blade designations. The propeller model designation is impression stamped on the propeller hub. The blade designation is impression stamped on the blade butt end (internal) and may be on a label on the propeller cylinder (external).

4. Governors

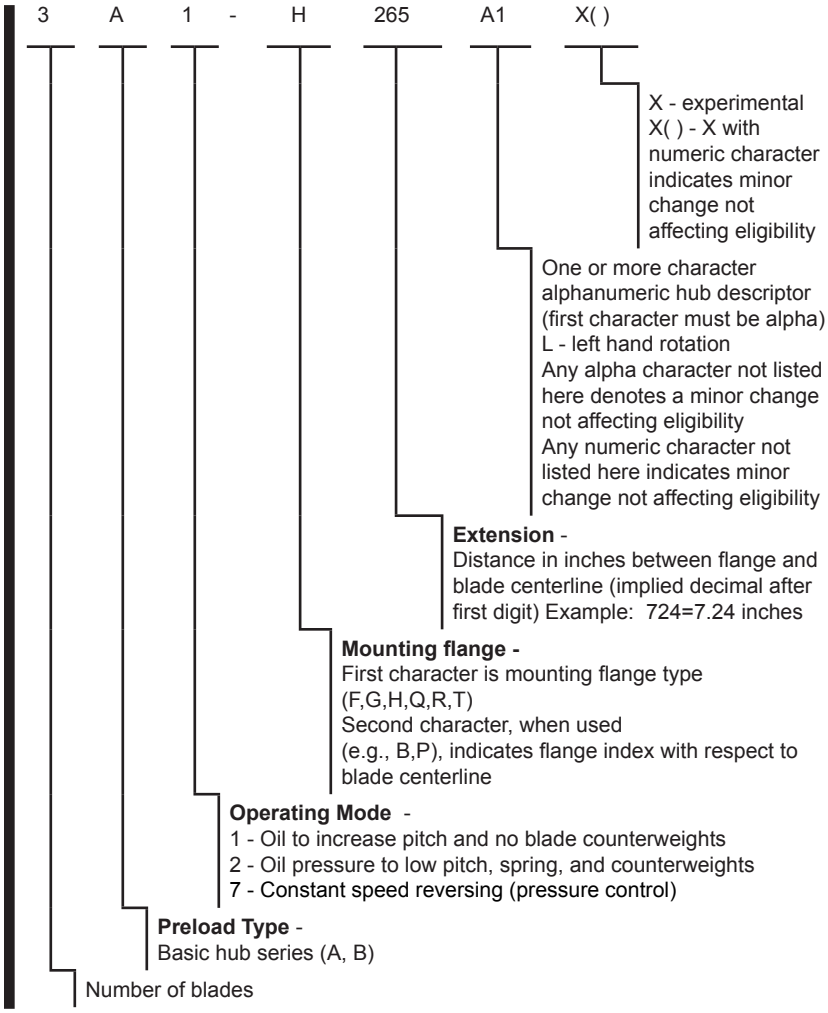
A. Theory of Operation

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. The governor is set for a specific RPM via the cockpit propeller control, which compresses or releases the governor speeder spring.

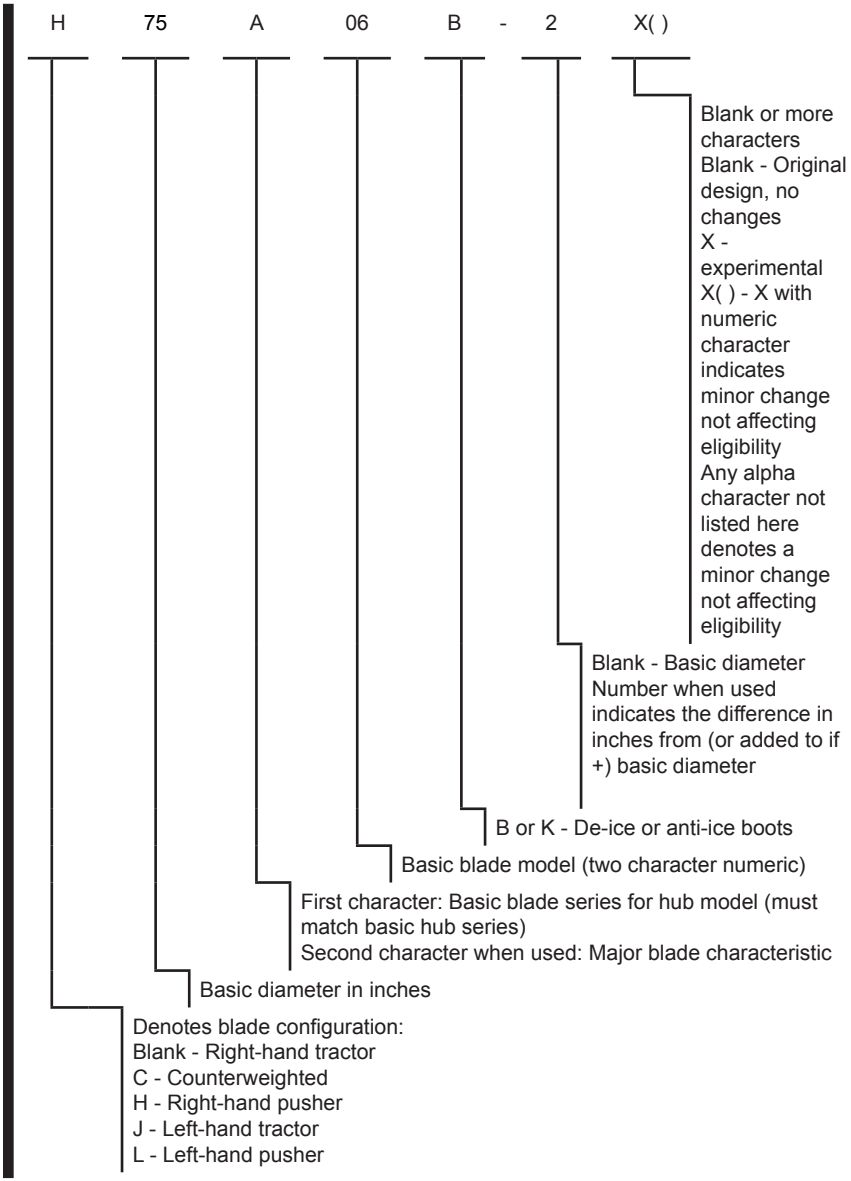
Refer to Figure 2-1. When the engine is operating at the RPM set by the pilot using the cockpit control, the governor is operating **onspeed**. In an onspeed condition, the centrifugal force acting on the flyweights is balanced by the speeder spring, and the pilot valve is neither directing oil to nor from the propeller hydraulic cylinder.

Refer to Figure 2-2. When the engine is operating below the RPM set by the pilot using the cockpit control, the governor is operating **underspeed**. 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.

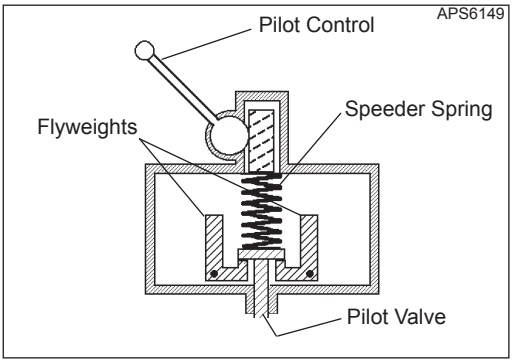
Refer to Figure 2-3. When the engine is operating above the RPM set by the pilot using the cockpit control, the governor is operating **overspeed**. In an overspeed condition, the centrifugal force acting on the flyweights is greater than the speeder spring force. The flyweights tilt outward, and raise the pilot valve. The pilot valve then meters oil flow to increase propeller pitch and lower engine RPM.



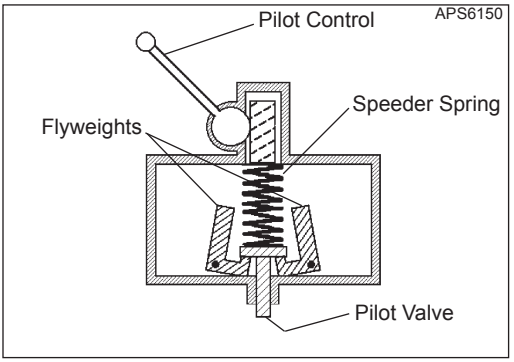
Propeller Model Designations
Table 2-1



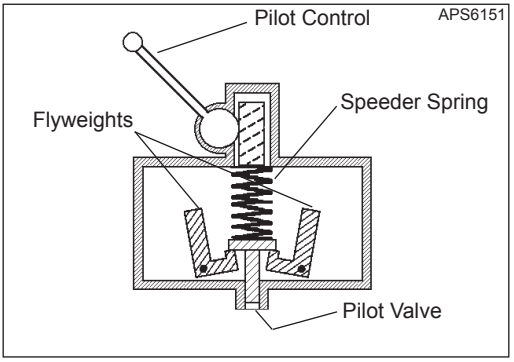
Blade Type and Blade Model Designations
Table 2-2



Governor in Onspeed Condition
Figure 2-1



Governor in Underspeed Condition
Figure 2-2



Governor in Overspeed Condition
Figure 2-3

B. Governor Types

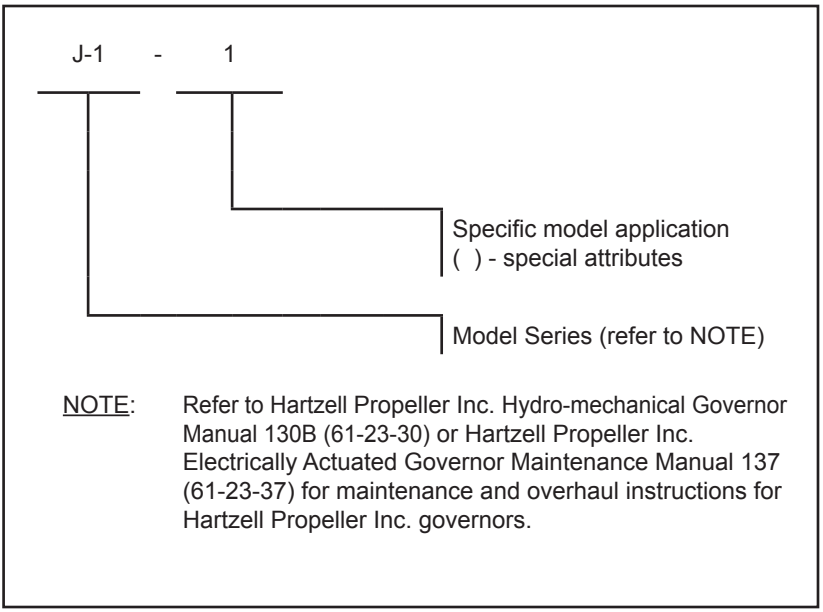
The governors commonly used in Hartzell Propeller Inc. Constant Speed propeller systems are supplied either by Hartzell Propeller Inc. or several other manufacturers. These governor types function in a similar manner.

C. Identification of Hartzell Propeller Inc. Governors

Hartzell Propeller Inc. governor may be identified by model number. Refer to Figure 2-4.

Hartzell Propeller Inc. J and K series governors are electrically actuated governors.

All other series governors are hydro-mechanical governors.



Governor Model Designation
Figure 2-4

5. Propeller Ice Protection Systems

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

A. Propeller Anti-ice System

A propeller anti-ice system prevents ice from forming on propeller surfaces. The system dispenses a liquid (usually isopropyl alcohol) that mixes with moisture on the propeller blades, reducing the freezing point of the water. This water/alcohol mixture flows off the blades before ice forms. This system must be in use before ice forms. It is ineffective in removing ice that has already formed.

(1) System Overview

(a) A typical anti-ice system consists of a fluid tank, pump, and distribution tubing.

(b) The rate at which the anti-icing fluid is dispensed is controlled by a pump speed rheostat in the cockpit.

(c) The anti-icing fluid is dispensed through airframe mounted distribution tubing and into a rotating slinger ring mounted on the rear of the propeller hub. The anti-icing fluid is then directed through blade feed tubes from the slinger ring onto the blades via centrifugal force. The anti-icing fluid is directed onto anti-icing boots that are attached to the leading edge of the blade. These anti-icing boots evenly distribute and direct the fluid along the blade leading edge.

B. Propeller De-ice System

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

(1) System Overview

(a) A de-ice system consists of one or more on/off switches, a timer or cycling unit, a slip ring, brush blocks, and de-ice boots. The pilot controls the operation of the de-ice system by turning on one or more switches. All de-ice systems have a master switch, and may have another toggle switch for each propeller. Some systems also have a selector switch to adjust for light or heavy icing conditions.

(b) The timer or cycling unit determines the sequence of which blades (or portion thereof) are currently being de-iced, and for what length of time. The cycling unit applies power to each de-ice boot or boot segment in a sequential order.

(c) A brush block, which is normally mounted on the engine just behind the propeller, is used to transfer electricity to the slip ring. The slip ring rotates with the propeller, and provides a current path to the blade de-ice boots.

(d) De-ice boots contain internal heating elements. These boots are securely attached to the inboard leading edges of each blade with adhesive.

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INSTALLATION AND REMOVAL - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Tools, Consumables, and Expendables

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

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

NOTE: Hartzell Propeller Inc. propellers with composite blades are manufactured with basic hub mounting flange designs. The flange type used on a particular propeller installation is indicated in the propeller model number stamped on the hub. For example, 3A1-**T**P724A1 indicates an T flange. Refer to Table 2-1, Aluminum Hub Propeller Model Identification in the Description and Operation chapter of this manual for a description of each flange.

B. Tooling		Propeller Flange
(1)	Safety wire pliers	F, G, H, Q, and R
(2)	Torque wrench (1/2 inch drive)	F, G, H, Q, and R
(3)	Torque wrench adapter (Hartzell Propeller Inc. Part Number BST-2860)	F, G, H, Q, and R
(4)	3/4 inch open end wrench for installation	F, H, Q, and R
(5)	5/8 inch open end wrench for installation	T
(6)	1/2 inch open end wrench for installation	G
(7)	5/32 inch socket for oil level screw	

C. Consumables

Hartzell Part Number	Description
A-6741-41(-1)	Toluene
N/A	Stoddard Solvent
N/A	Methyl Propyl Ketone (MPK)
N/A	Contax HP, 9093
N/A	Denatured alcohol
N/A	Safety Wire 0.032 inch (0.81 mm)
N/A	Grease, Aeroshell No. 5, 70025

D. Expendables

0.032 Aircraft Safety Wire
O-ring (Refer to Table 3-3)

2. Pre-Installation

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Inspection of Shipping Package

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

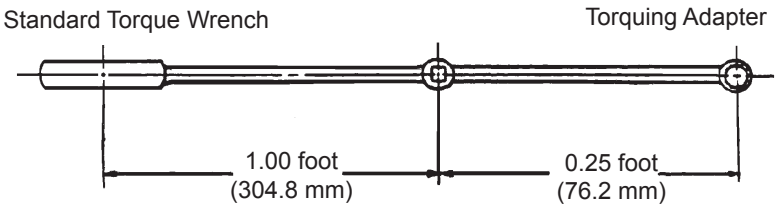
(a) If the propeller is damaged, contact the shipper or Hartzell Propeller Inc.

B. Uncrating

(1) Put the propeller on a firm support.

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

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



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

EXAMPLE:

$$\frac{\text{100 Ft-Lb (136 N•m) x 1.00 ft (304.8 mm)}}{\text{1.00 ft (304.8 mm) + 0.25 ft (76.2 mm)}} = \text{80 Ft-Lb (108 N•m)} <$$

reading on torque wrench with 3-inch (76.2 mm) adapter for actual torque of 100 Ft-Lb (136 N•m)

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

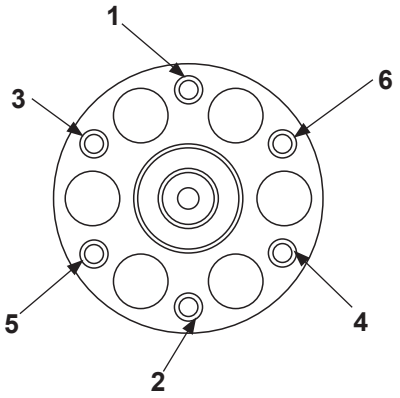
APS0212A

Determining Torque Value When Using Torquing Adapter
Figure 3-1

Installation Torques	
CAUTION 1:	MOUNTING HARDWARE MUST BE CLEAN AND DRY TO PREVENT EXCESSIVE PRELOAD OF THE MOUNTING FLANGE.
CAUTION 2:	ALL TORQUES LISTED ARE DRY TORQUE.
CAUTION 3:	REFER TO FIGURE 3-1 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.
3-blade hub clamping bolts ONLY	27-33 ft-lbs (37-44 N•m)
3-blade low pitch jam nut ONLY	13.5-16.5 ft-lbs (18.3-22.4 N•m)
5-blade low pitch jam nut (B-3839-16) ONLY	120 ft-lbs (163 N•m)*
Spinner bracket/bulkhead mounting bolts (hub clamping bolt installation only)	27-33 ft-lbs (37-44 N•m)
Spinner bracket/bulkhead/ring mounting bolt to rear of hub	96-120 in-lbs (10-13 N•m)
Spinner bulkhead to ring mounting screw	70-85 in-lbs (94- 115 N•m)
F flange propeller mounting nuts	Initial torque 30 ft-lbs (54 N•m) Final torque 70-80 ft-lbs (94-108 N•m)
G flange propeller mounting nuts	Initial torque 10 ft-lbs (13 N•m) Final torque 15-20 ft-lbs (21-27 N•m)
H flange propeller mounting nuts	Initial torque 30 ft-lbs (54 N•m) Final torque 60-65 ft-lbs (81-88 N•m)
Q flange propeller mounting nuts	Initial torque 30 ft-lbs (54 N•m) Final torque 60-65 ft-lbs (81-88 N•m)
R flange propeller mounting bolts	Initial torque 30 ft-lbs (54 N•m) Final torque 60-70 Ft-Lbs (82-94 N•m)
T flange propeller mounting bolts	Initial torque 30 ft-lbs (54 N•m) Final torque 50-55 ft-lbs (67-74 N•m)
* Torque tolerance is ± 10 percent unless otherwise noted.	

Torque Table
Table 3-1

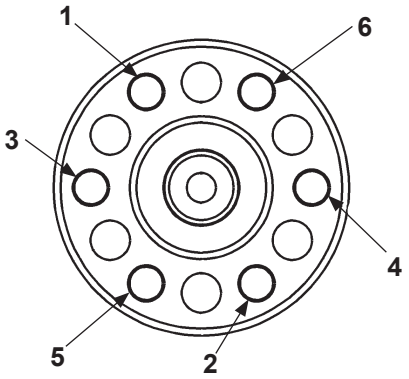
TI-411-003
TI-411-004
TI-411-008



G Flange

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

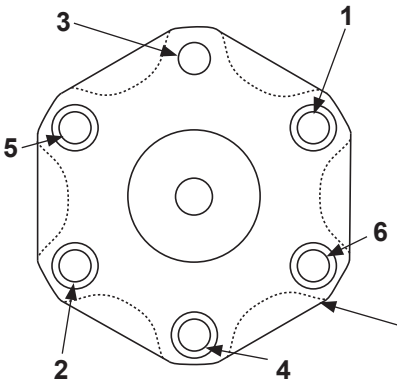
Step 2 - Torque all mounting nuts to the final torque value in accordance with Table 3-1 and Figure 3-1 in the sequence shown



F, H, Q and T Flange

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

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



R Flange

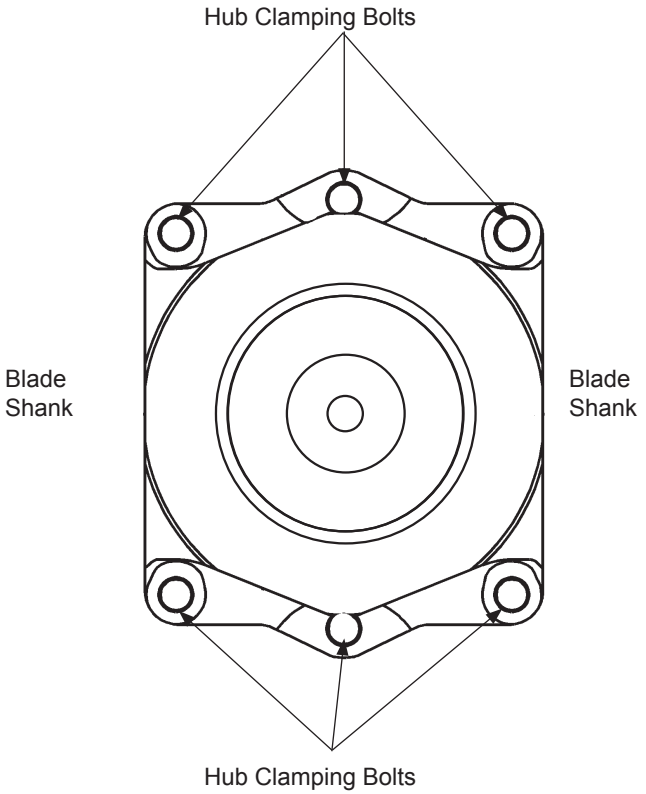
Step 1 - Torque all mounting nuts to the initial torque value in accordance with Table 3-1 and Figure 3-1 in the sequence shown

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

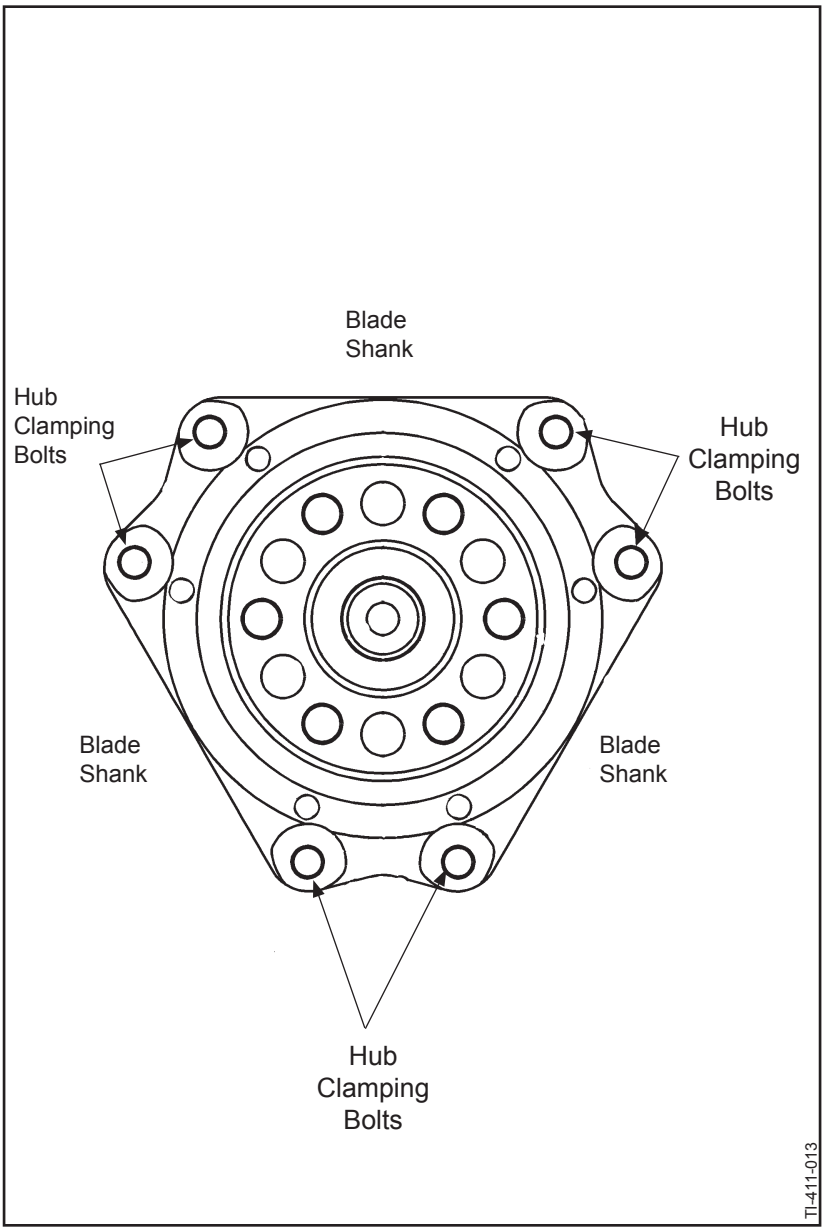
Dashed line shows flange for 3 blade

Solid line shows flange for 5 blade

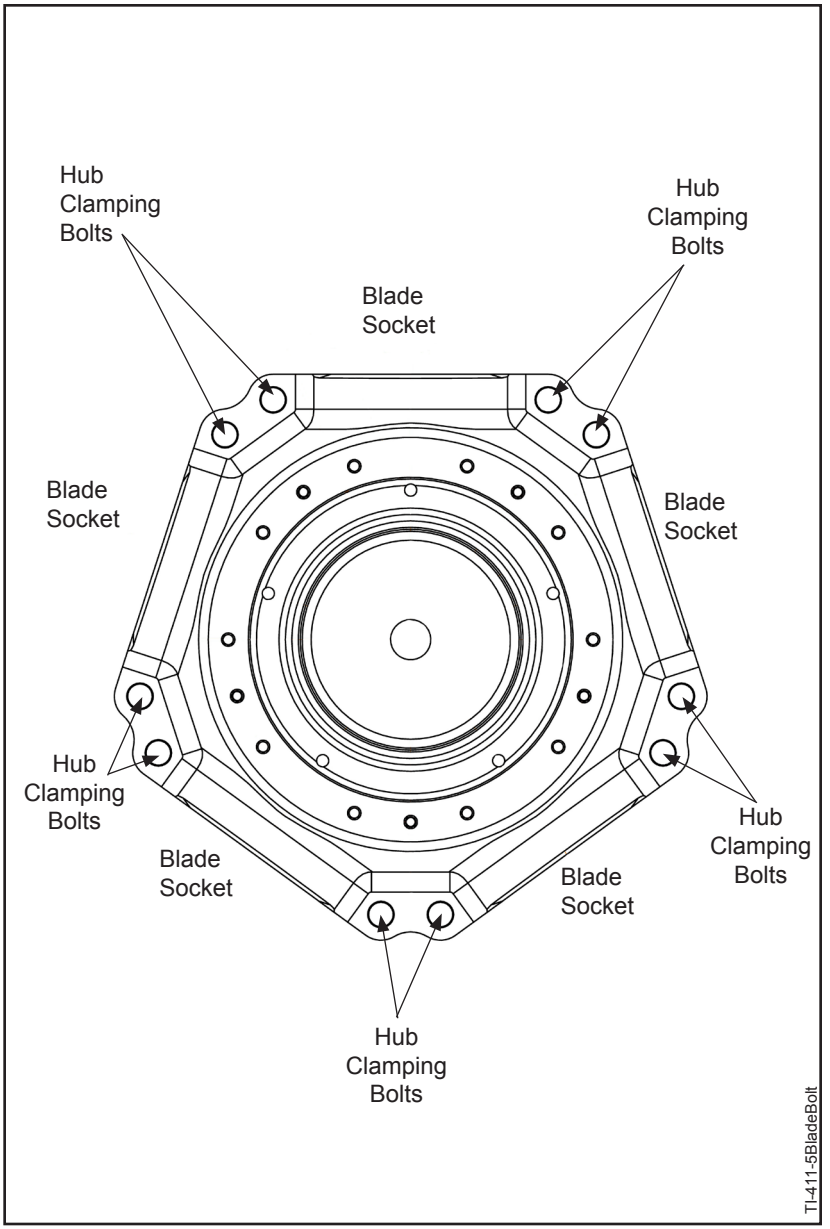
Diagram of Torquing Sequence for Propeller Mounting Hardware
Figure 3-2



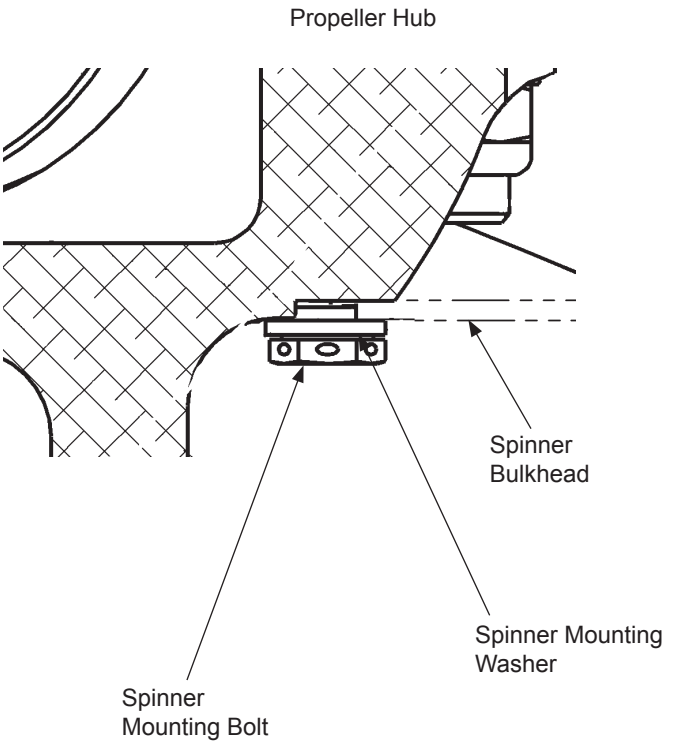
2 Blade Hub Clamping Bolt Location
Figure 3-3



3 Blade Hub Clamping Bolt Location
Figure 3-4



5 Blade Hub Clamping Bolt Location
Figure 3-5



Bulkhead and Spinner Mounting (Hub Mounting Spinner)
Figure 3-6

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

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

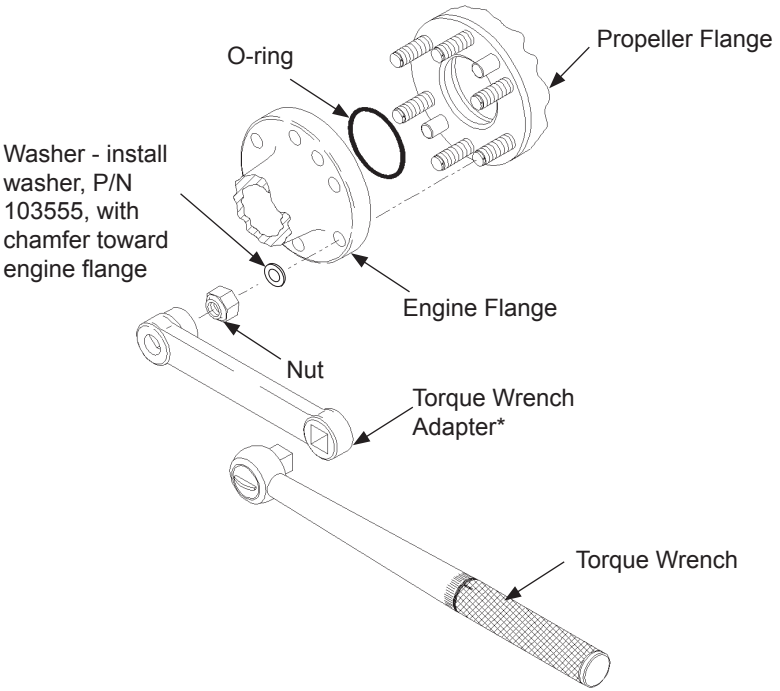
(5) Remove the plastic dust cover cup from the propeller mounting flange, if installed.

C. Inspection after Shipment

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

D. Reassembly of a Propeller Disassembled for Shipment

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



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

F, H, Q, and T Flange Propeller Mounting
Figure 3-7

3. Painting of a Hartzell Propeller Inc. Composite Spinner Assembly

A. General

(1) A Hartzell Propeller Inc. spinner assembly may consist of a combination of metal or composite components.

(2) Composite spinner components supplied primed for painting require a resistance check after painting. Refer to Figure 3-8, Figure 3-9, and Figure 3-10 for resistance check instructions.

(a) Composite spinner assemblies may be supplied primed for paint or may be painted at the time of manufacture.

(b) If the spinner assembly is primed for paint, the spinner dome must be painted before being installed.

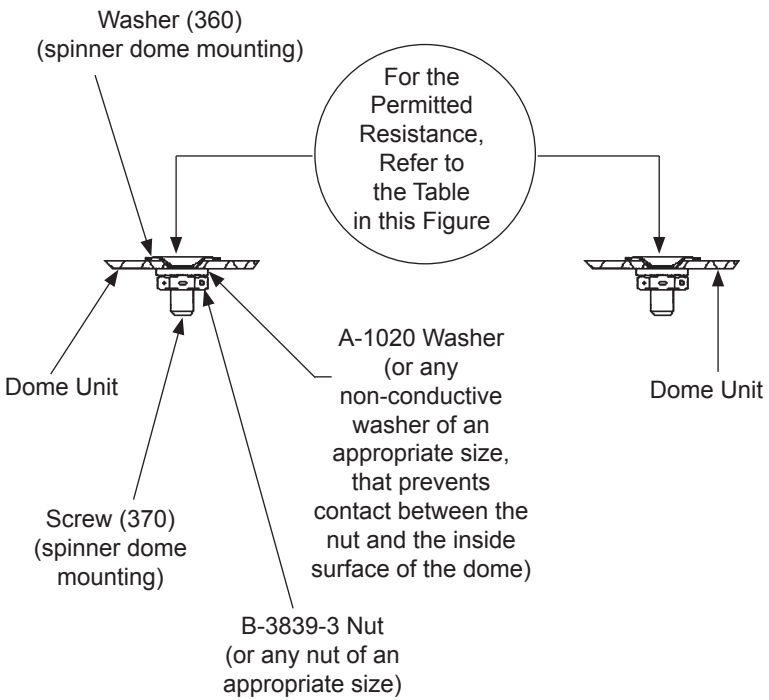
(3) Painting the Spinner Assembly Components.

CAUTION 1: CAUTION MUST BE TAKEN WHEN PAINTING A PRIMED COMPOSITE SPINNER COMPONENT IN ORDER TO MEET THE P-STATIC DISSIPATION REQUIREMENTS FOR THESE COMPONENTS. IMPROPER P-STATIC DISSIPATION COULD LEAD TO DISTORTION OR DAMAGE OF THE ELECTRONIC COMPONENTS IN THE AIRCRAFT, INCLUDING NAVIGATIONAL EQUIPMENT.

CAUTION 2: THE SCREW HOLES IN THE SPINNER DOME, SPINNER BULKHEAD, AND THE SPINNER FAIRING MUST BE MASKED TO MEET THE P-STATIC REQUIREMENTS.

CAUTION 3: THE MAXIMUM PERMITTED FILM THICKNESS OF PAINT IS 2 MILS WHEN DRY.

(a) The components must be finished to the aircraft manufacturer's specifications using an approved paint before flight.



Spinner Assembly Part Number	Dome Part Number	Maximum Permitted Resistance
104529	104573	0.1 megohm

TI-00114

Resistance Check of the Composite Spinner Dome
Figure 3-8

(b) Spinner dome, bulkhead, and fairing screw holes must be masked before painting.

(c) The maximum permitted thickness of paint is 2 mils dry.

B. Resistance Check of the Composite Spinner Dome After Painting

NOTE: The dome is not installed on the bulkhead.

(1) Install a screw with washers and a nut in each of two dome mounting holes with the maximum distance possible between them, in accordance with the information in Figure 3-8.

(2) Using an ohm meter capable of 20 Megohms, perform the following resistance checks:

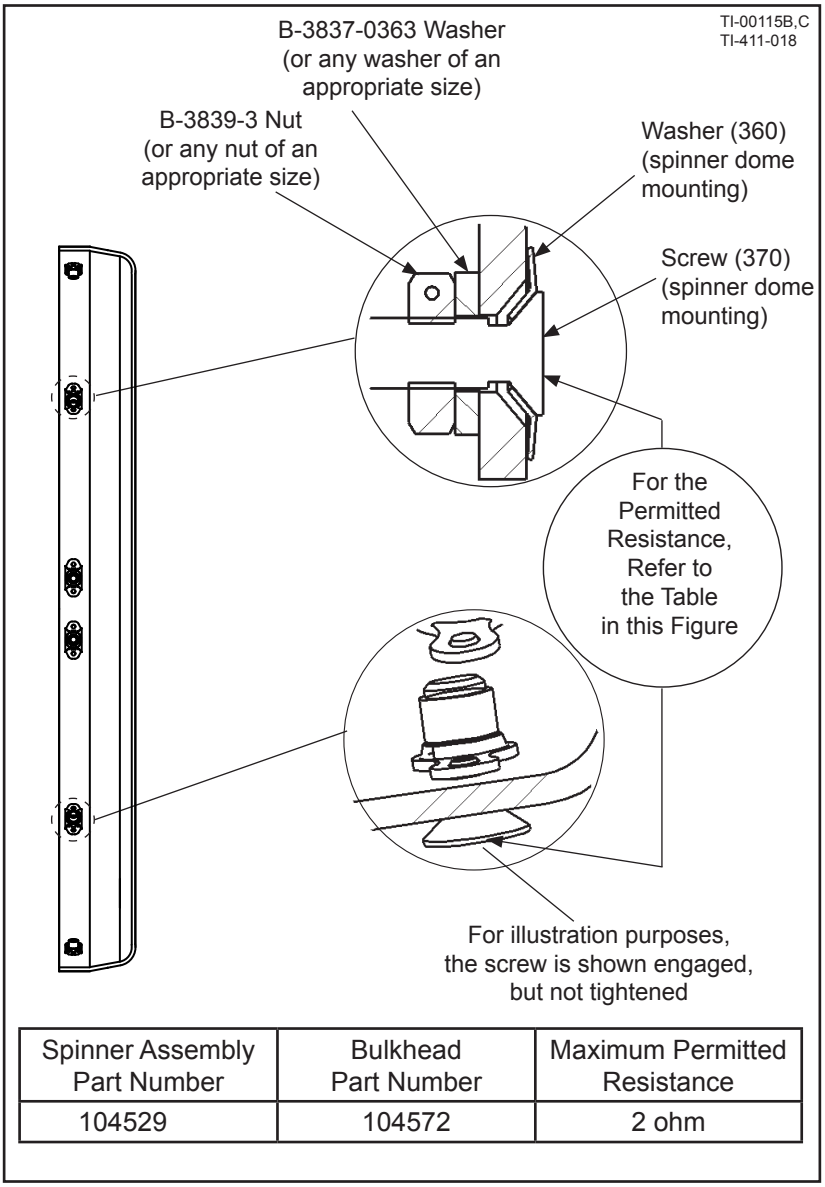
(a) Measure the resistance from the screw in one dome mounting hole to the screw in the other dome mounting hole. Refer to Figure 3-8.

(b) If the resistance measurement is not satisfactory, clean the contact points using a solvent such as CM23 or equivalent and repeat the resistance measurement.

(c) If the resistance measurement is not satisfactory after cleaning for the two holes, use two different holes with the maximum distance possible between them and repeat the measurement.

(d) Repeat the measurement using different holes with the maximum distance possible between them until the resistance measurement is satisfactory.

(3) Remove the hardware that was used for the resistance check of the dome from the dome mounting holes.



Spinner Assembly Part Number	Bulkhead Part Number	Maximum Permitted Resistance
104529	104572	2 ohm

Resistance Check of the Composite Spinner Bulkhead
Figure 3-9

C. Resistance Check of the Composite Spinner Bulkhead After Painting

NOTE: The dome or fairing are not installed on the bulkhead.

(1) In one bulkhead mounting hole, install a screw with washers and a nut in accordance with the information in Figure 3-9.

(2) Using an ohm meter capable of 20 Megohms, perform the following resistance checks.

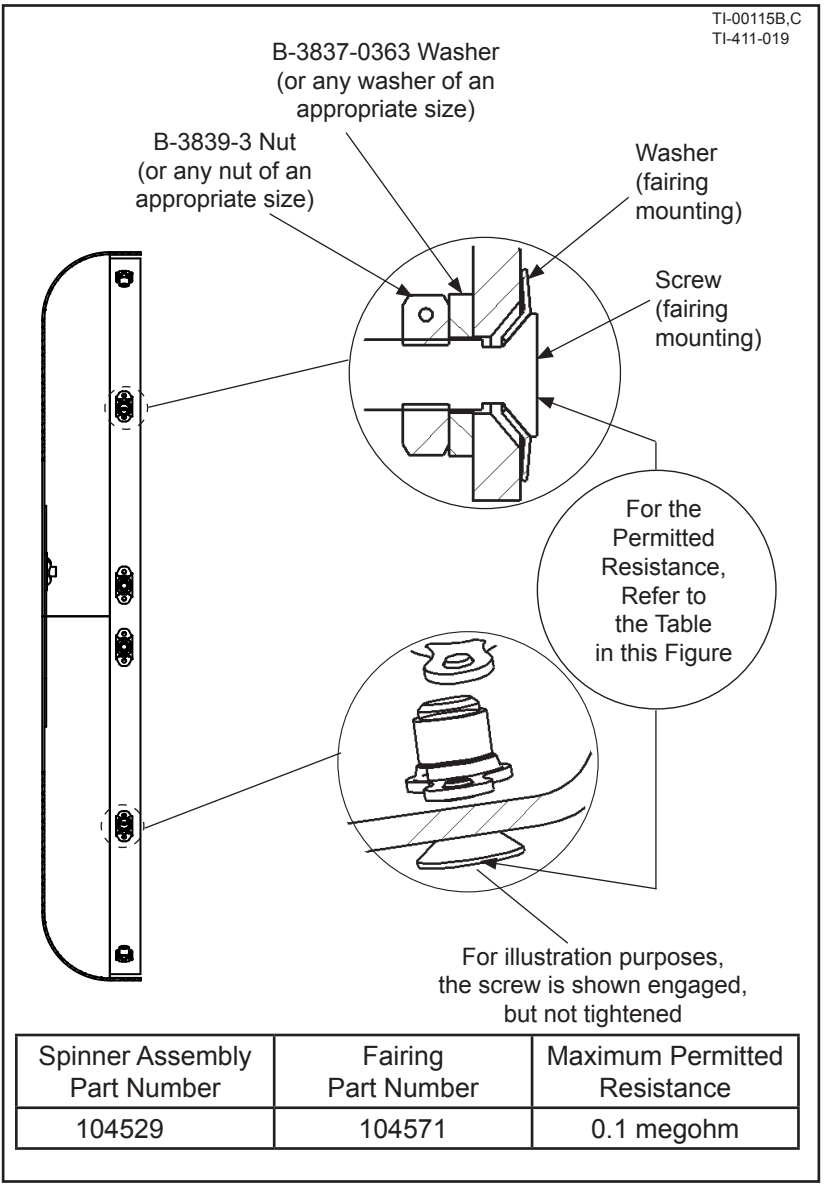
(a) Measure the resistance from the screw installed to a bulkhead screw that is the maximum distance possible away from the installed screw. Refer to Figure 3-9.

(b) If the resistance measurement is not satisfactory, clean the contact points using a solvent such as CM23 or equivalent and repeat the resistance measurement.

(c) If the resistance measurement is not satisfactory after cleaning for the two holes, use two different locations with the maximum distance possible between them and repeat the measurement.

(d) Repeat the measurement using different locations with the maximum distance possible between them until the resistance measurement is satisfactory.

(3) Remove the hardware that was used for the resistance check of the bulkhead from the bulkhead mounting holes.



Spinner Assembly Part Number	Fairing Part Number	Maximum Permitted Resistance
104529	104571	0.1 megohm

Resistance Check of the Composite Spinner Fairing
Figure 3-10

D. Resistance Check of the Composite Spinner Fairing

NOTE: The fairing is not installed on the bulkhead.

(1) In one fairing mounting hole, install a screw with washers and a nut in accordance with the information in Figure 3-10.

(2) Using an ohm meter capable of 20 Megohms, perform the following resistance checks.

(a) Measure the resistance from the screw installed to a fairing screw that is the maximum distance possible away from the installed screw. Refer to Figure 3-10.

(b) If the resistance measurement is not satisfactory, clean the contact points using a solvent such as CM23 or equivalent and repeat the resistance measurement.

(c) If the resistance measurement is not satisfactory after cleaning for the two (2) holes, use two (2) different locations with the maximum distance possible between them and repeat the measurement.

(d) Repeat the measurement using different locations with the maximum distance possible between them until the resistance measurement is satisfactory.

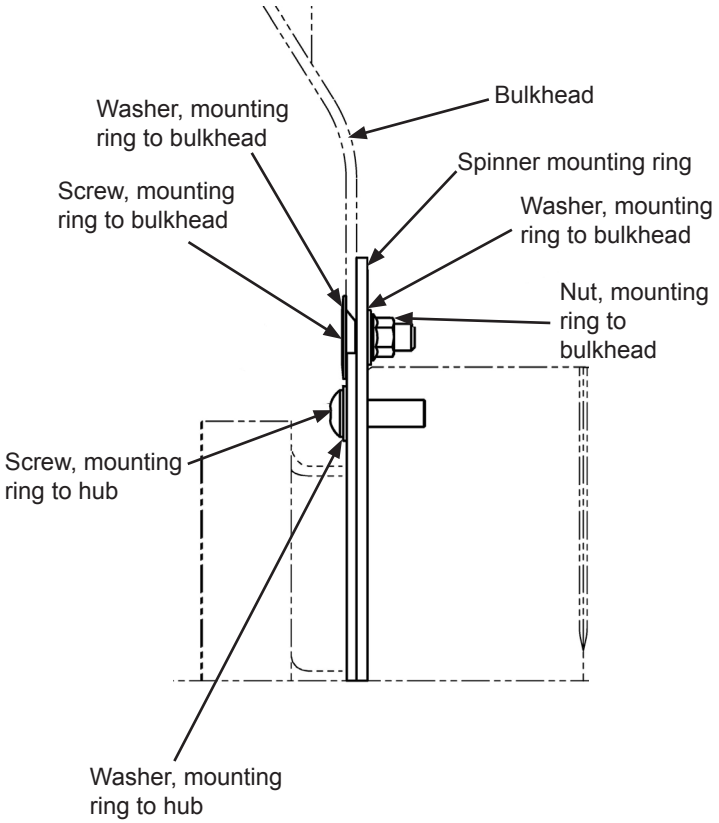
(3) Remove the hardware that was used for the resistance check of the fairing from the fairing mounting holes.

Spinner Support Bracket/Bulkhead Mounting Hardware Aluminum Spinner Assembly	
Description	**Hartzell Part Number**
Bolt, 1/4-28, hex head	B-3384-( )
Washer	B-3851-0463
104529 Spinner Dome and Fairing Attaching Hardware	
Screw, bulkhead to hub	B-3872-2
Washer, bulkhead to hub	B-3860-416
Screw, spinner dome and fairing attaching to spinner bulkhead	B-3867-272
Washer, spinner dome and fairing attaching to spinner bulkhead	A-1020
Screw, fairing tab holes	B-3845-8
Washer, fairing tab holes	A-1020
104888( ) Spinner Dome and Bulkhead Attaching Hardware	
Bolt, bulkhead to hub	B-3384-1H
Washer, bulkhead to hub	B-3837-0432
Screw, spinner dome attaching to spinner bulkhead	B-3867-272
Screw, spinner dome attaching to spinner bulkhead	B-3860-10L
Spacers	105542
O-ring, Cylinder to Bulkhead	C-3317-129

Spinner Support Bracket/Bulkhead Mounting Hardware - Hub Mounted
Table 3-2 (page 1 of 2)

105085( ) Spinner Dome and Bulkhead Attaching Hardware	
Spinner mounting ring	105124
Screw, mounting ring to hub	A-2070-6
Washer, mounting ring to hub	B-3837-0432
Screw, mounting ring to bulkhead	104789
Washer, mounting ring to bulkhead	B-3860-416
Nut, mounting ring to bulkhead	B-3814
Washer, mounting ring to bulkhead	B-3837-0432
Screw, spinner dome attaching to spinner bulkhead	102612-S50
Washer, spinner dome attaching to spinner bulkhead	B-3860-10L
Forward bulkhead mount	105330
O-ring, cylinder to bulkhead	C-3317-129

Spinner Support Bracket/Bulkhead Mounting Hardware
- Hub Mounted
Table 3-2 (page 2 of 2)



Spinner Mounting Ring Attachment to Hub and Bulkhead
Figure 3-10.1

4. Spinner Pre-Installation

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

CAUTION 2: CONTACT HARTZELL PROPELLER INC. PRODUCT SUPPORT BEFORE REMOVING A SPINNER BULKHEAD FROM A PROPELLER WITH THE SPINNER BULKHEAD ATTACHED USING THE HUB CLAMPING BOLTS. DO NOT REMOVE THE HUB CLAMPING BOLTS EXCEPT AS SPECIFIED IN THIS INSTRUCTION. REMOVAL OF THE INCORRECT BOLTS MAY BREAK THE SEAL AND PERMIT LEAKAGE OF THE OIL.

A. General

(1) The spinner support, bulkhead, or spinner mounting ring mount to the propeller hub. The spinner dome will mount to the bulkhead. Follow the applicable directions in this section.

(2) Early configurations may have had a spinner support bracket/bulkhead that attached to the hub using the hub clamping bolts. Contact Hartzell Propeller Inc. Product Support before removing this spinner support bracket/bulkhead.

B. Spinner Mounting Ring to Bulkhead Installation - Refer to Figure 3-10.1

(1) Align the holes in the spinner mounting ring to the holes in the bulkhead.

(2) Using the screws and washers specified in Table 3-2, attach the spinner mounting ring to the bulkhead.

(3) Torque the spinner mounting ring to bulkhead mounting screws (dry) in accordance with Table 3-1.

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Flange	O-ring	Stud/Bolt	Nut	Washer/Spacer	Spring Pin
F	C-3317-225-1	A-2429-( )	A-2044	A-1381	n/a
G	C-3317-225-1	104606	104339	B-3851-0563	B-3842-0500
H	C-3317-225-1	A-2429-3	A-2044	A-1381	n/a
Q	C-3317-225-1	A-2429-( )	A-2044	103555	n/a
R	C-3317-228	A-2067	A-2069	A-1381	B-3842-0750
T	C-3317-225-1	100041	A-1373	A-965	n/a

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

(4) Align the holes in the spinner mounting ring to the attaching holes in the hub.

(5) Using the screws and washers specified in Table 3-2, attach the spinner mounting ring to the hub.

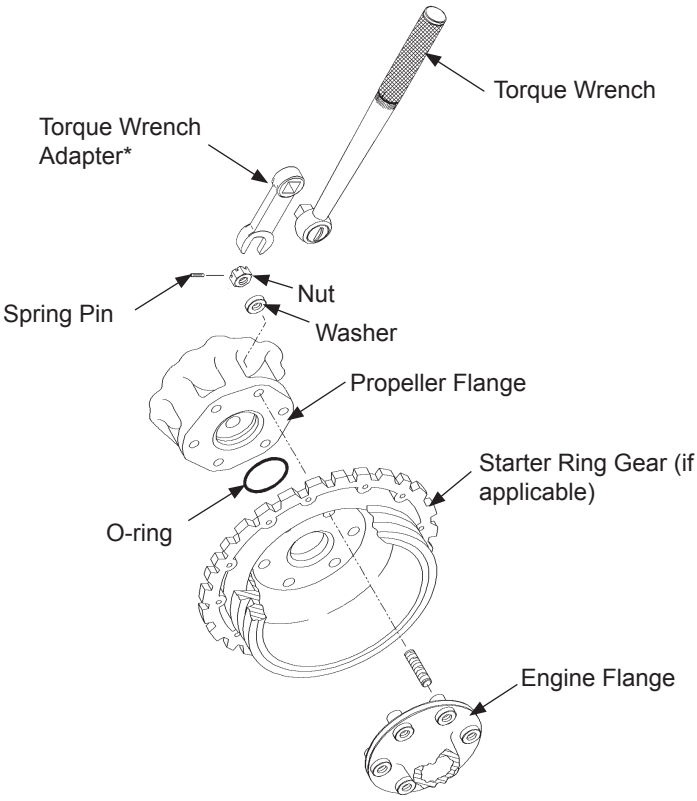
(6) Torque the spinner mounting screws (dry) in accordance with Table 3-1.

C. Spinner Bracket/Bulkhead Installation - Hub Mounted

(1) Align the holes in the spinner bracket/bulkhead to the attaching holes in the hub.

(2) Using the screws and washers specified in Table 3-2, attach the spinner support bracket/bulkhead to the hub.

(3) Torque the spinner support bracket/bulkhead mounting bolts (dry) in accordance with Table 3-1.



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

G and R Flange Propeller Mounting
Figure 3-11

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.

5. Propeller Installation

A. Flange Description

CAUTION: THE ALUMINUM HUB PROPELLER MOUNTING O-RING IS LOCATED ON THE INSIDE DIAMETER OF THE PROPELLER HUB. THERE SHOULD NOT BE AN O-RING ON THE ENGINE FLANGE WHEN INSTALLING AN ALUMINUM HUB PROPELLER.

(1) Hartzell Propeller Inc. ( )(A,B)(1,2) series propellers with composite blades are manufactured with several basic hub mounting flange designs. For example, 3A1-T( )( ) Series Propellers indicates an T flange.

(2) Refer to Propeller Model Designation in the Description and Operation chapter of this manual for description of each flange type. Sample flanges are also shown in Figure 3-7 and Figure 3-11.

B. Installation of F, H, Q, and T Flange Propellers

(1) Perform the applicable steps under Spinner Pre-Installation in this chapter.

WARNING: SOLVENTS 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.

(2) Clean the engine flange and propeller flange with solvent specified.

(3) Refer to Figure 3-7. Lubricate the mounting flange O-ring with engine oil. Install the O-ring in the O-ring groove in the hub bore. Refer to Table 3-3 for the applicable O-ring and mounting hardware.

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

(4) If applicable, install the washer, P/N 103555, with the chamfer side towards the engine flange.

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

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

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

(5) With a suitable support, such as a crane hoist or similar equipment, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.

(6) Install the propeller on the engine flange.

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

CAUTION 2: TIGHTEN NUTS EVENLY TO AVOID HUB DAMAGE.

(7) Install the propeller mounting nuts (dry) with spacers, if required. Refer to Table 3-3.

(8) Torque the propeller mounting nuts (dry) in accordance with Table 3-1, Figure 3-1, and Figure 3-2.

(9) 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 System 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

(10) Propeller ice protection system components installed on a propeller manufactured by Hartzell Propeller Inc. are controlled by the Hartzell Propeller Inc. Instructions for Continued Airworthiness (ICA).

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

C. Installation of G and R Flange Propellers

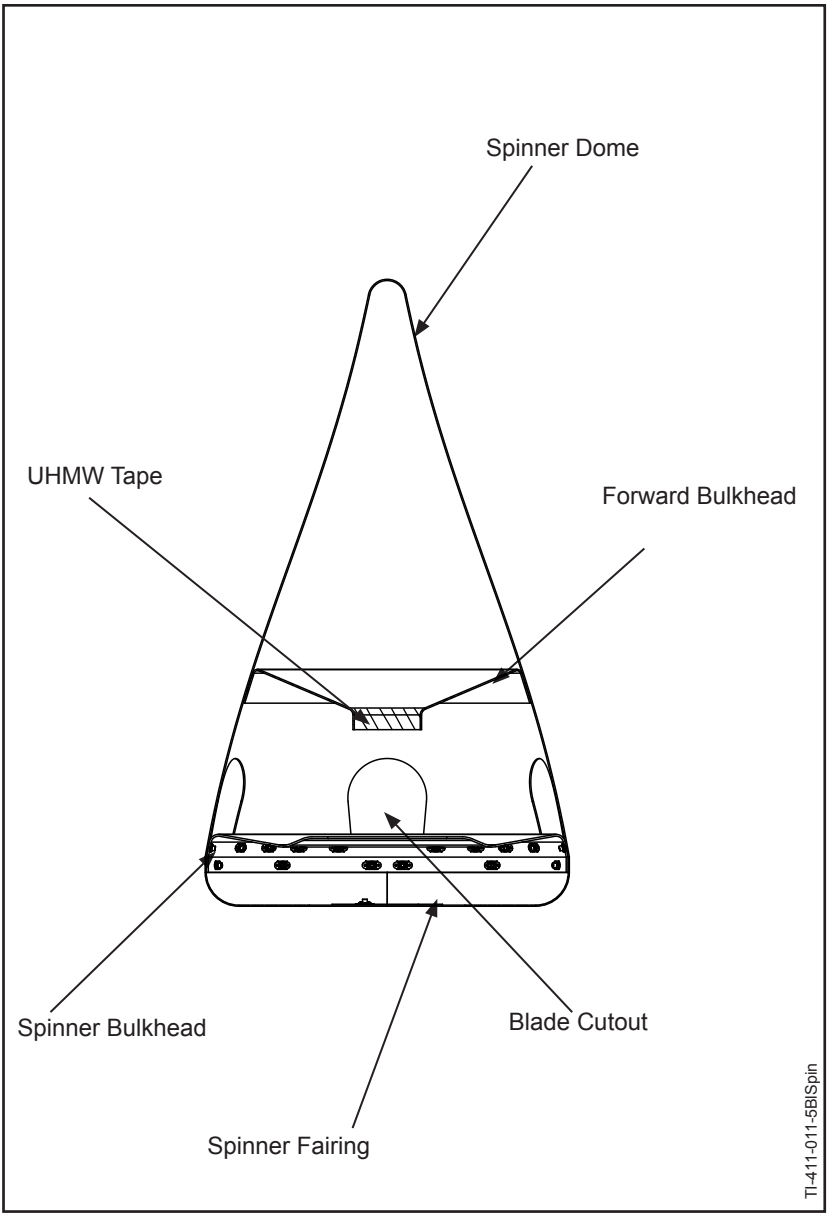
(1) Perform the applicable steps under Spinner Pre-Installation within this chapter.

WARNING: SOLVENTS 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.

(2) Clean the engine flange and propeller flange with solvent.

(3) Refer to Figure 3-11. Install the O-ring in the O-ring groove in the rear of the hub. Refer to Table 3-3 for the applicable O-ring and mounting hardware.

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



104529 Single Piece Spinner Assembly
Figure 3-12

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

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

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

(4) Install the propeller mounting bolts (dry). Refer to Table 3-3.

(5) With a suitable support, such as a crane hoist or similar equipment, carefully move the propeller assembly to the aircraft engine mounting flange in preparation for installation.

(6) Install the propeller on the engine flange.

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

CAUTION 2: TIGHTEN NUTS EVENLY TO AVOID HUB DAMAGE

(7) Torque the propeller mounting bolts (dry) and spacers/washers, if required, in accordance with Table 3-1, Figure 3-1, and Figure 3-2.

(8) Safety wire the bolts in pairs (if required by the aircraft maintenance manual) at the rear of the propeller mounting flange.

(9) 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 System 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

(10) Propeller ice protection system components installed on a propeller manufactured by Hartzell Propeller Inc. are controlled by the Hartzell Propeller Inc. Instructions for Continued Airworthiness (ICA).

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

6. Spinner Dome Installation

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

CAUTION 2: TO PREVENT DAMAGE TO THE BLADE AND BLADE PAINT, WRAP THE BLADE SHANKS IN SEVERAL LAYERS OF MASKING OR DUCT TAPE BEFORE INSTALLING THE SPINNER DOME. REMOVE THE TAPE AFTER THE SPINNER IS INSTALLED.

A. General

(1) The following instructions relate to Hartzell Propeller Inc. spinner assemblies only. In some cases, the airframe manufacturer produced the spinner assembly. If so, refer to the airframe manufacturer's manual for spinner assembly installation instructions.

(2) Composite spinner assemblies P/N 104529 and with part serial numbers listed in Table 3-4 must be indexed when installed.

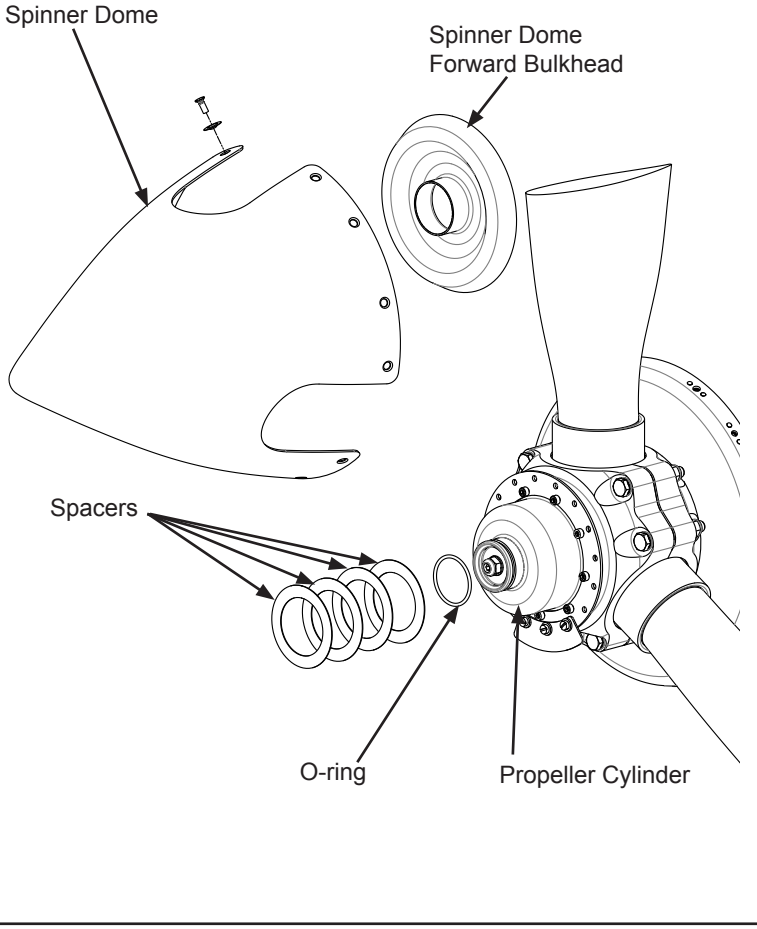
(a) The parts listed in Table 3-4 were manufactured using a process that matched the spinner dome, spinner bulkhead, and spinner fairing.

(b) The parts are identified with a number and the index mark.

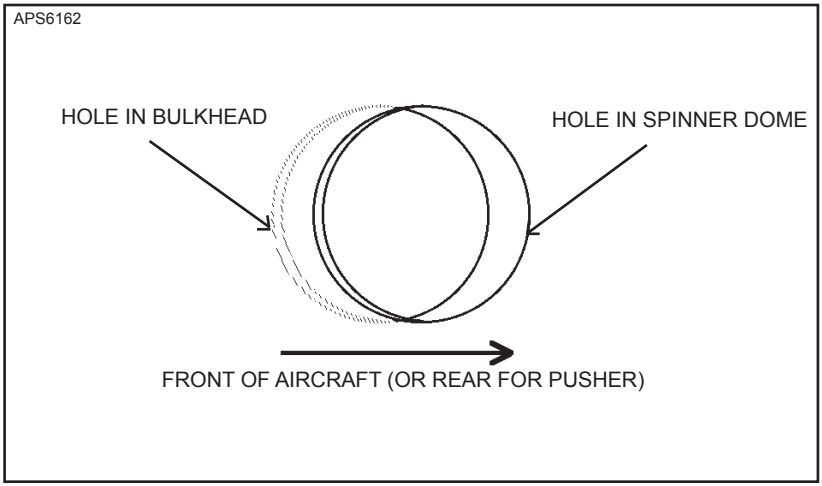
1 The spinner dome, spinner bulkhead, and spinner fairing being installed must have the same number.

2 The parts will be identified with a number 1, 3, or 4.

NOTE: For spinner assembly 104888( ) the forward bulkhead is bonded inside the spinner dome. For spinner assembly 105539( ) the forward bulkhead is not bonded to inside the spinner dome. The forward bulkhead is shown separately for illustration purpose only.



Installation of 104888( ) and 105539 Spinner Assemblies
Figure 3-13



Spinner Dome to Bulkhead Mounting Hole Alignment
Figure 3-14

DESCRIPTION	P/N	S/N
Spinner dome	104573	1203753
Spinner Dome	104573	1203754
Spinner Dome	104573	1203755
Spinner Bulkhead	104572	1203758
Spinner Bulkhead	104572	1203759
Spinner Bulkhead	104572	1203760
Spinner Fairing	104571	1203799
Spinner Fairing	104571	1203800
Spinner Fairing	104571	1203801

Serial Numbers Affected by Indexing Requirement
Table 3-4

(c) The spinner bulkhead has an index mark showing an arrow with two arrowheads and a number.

1 One side of the arrow is the index mark for the spinner dome and one side of the arrow is the index mark for the fairing.

B. Aluminum Single Piece Spinner Dome except 105539( )

(1) Examine the interior of the spinner dome. If the spinner dome has an internal support that encircles the propeller cylinder, the cylinder may need to be wrapped with one or more layers of UHMW tape (Hartzell Propeller Inc. P/N B-6654-100).

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

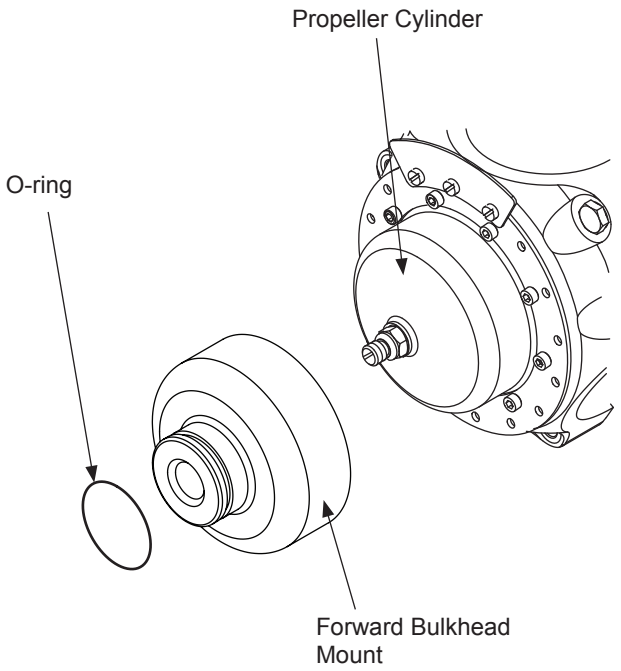
(2) Install the spinner dome and check for a snug fit where the internal support contacts the cylinder. If the support does not fit snugly on the cylinder, apply a layer of tape and recheck. Repeat until the spinner support fits snugly on the cylinder.

CAUTION: TO AVOID DAMAGING THE AIRCRAFT COWLING, THE SCREWS MUST NOT EXTEND MORE THAN THREE THREADS PAST THE BULKHEAD NUT PLATES.

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

(a) When the spinner dome has been removed to facilitate maintenance, check the spinner dome internal support to cylinder fit.

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



105085 Spinner Assembly Installation
Figure 3-15

C. Composite spinner assembly P/N 105539( )

(1) Using grease, Aeroshell 5 or Aeroshell 6, thoroughly lubricate the O-ring. Refer to Table 3-2.

(2) Put the O-ring in the groove on the cylinder. Refer to Figure 3-13.

(3) Put four spacers on the cylinder. Refer to Table 3-2.

NOTE: The spacers are used to adjust the spinner dome preload.

(4) Gently push the spinner dome as far aft as it will go onto the bulkhead unit.

(5) Visually examine the spinner fit.

(a) The spinner is correctly spaced when the holes in the spinner dome are misaligned 1/4 -1/3 of their diameter toward the front of the aircraft, or rear in a pusher installation. Refer to Figure 3-14.

(b) Remove the spinner dome and add or remove spacers to achieve this alignment.

(6) Install and push the spinner dome aft to align the spinner mounting holes with those of the bulkhead or adapter ring.

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

(7) Using screws and washers, attach the spinner to the bulkhead or adapter ring. Refer to Table 3-5.

D. Composite Single Piece Spinner Dome

(1) If a P/N 104529 spinner assembly is being installed:

(a) Align the index mark on the inside of the spinner dome with the index mark on the spinner bulkhead.

(b) Installation of the spinner dome. Refer to Figure 3-12. The forward bulkhead is bonded to the spinner dome. This spinner assembly incorporates a fairing attached to the engine side of the spinner bulkhead.

(2) If a P/N 105085 spinner assembly is being installed:

(a) Install the forward bulkhead mount on the cylinder.

1 The forward bulkhead mount should fit snugly on the cylinder.

2 If the forward bulkhead mount is loose on the cylinder, cut the B-6654-100-1 UHMW tape into strips approximately 2.0 inches (50.8 mm) long, as needed.

a Install strips of the B-6654-100-1 UHMW tape from front to back and spaced evenly around the inner diameter of the forward bulkhead mount.

b If needed, install multiple layers of the B-6654-100-1 UHMW tape until the forward bulkhead mount fits snugly on the cylinder.

(b) Using grease, Aeroshell 5 or Aeroshell 6, thoroughly lubricate the O-ring. Refer to Table 3-2.

(c) Put the O-ring in the groove on the forward bulkhead mount. Refer to Figure 3-15.

(d) Install the spinner dome over the forward bulkhead mount and onto the bulkhead. The O-ring on the forward bulkhead mount will cause resistance when the spinner dome is installed.

(e) The spinner dome must fit snugly on the forward bulkhead mount.

NOTE: This spinner dome installation is not preloaded.

(3) For all composite spinner domes, except 104888( ):

(a) Cut the B-6654-100-1 UHMW tape into strips approximately 2.0 inches (50.8 mm) long as needed.

(b) Install strips of the B-6654-100-1 UHMW tape from front to back and spaced evenly around the inner diameter of the forward bulkhead.

1 If needed, install multiple layers of the B-6654-100-1 UHMW tape until the spinner dome fits snugly on the cylinder.

(c) Install the spinner dome over the cylinder and onto the bulkhead. If the spinner dome slips easily over the cylinder, remove the spinner dome and install an additional layer of UHMW tape.

(d) The spinner dome must be a snug fit on the cylinder of the propeller.

NOTE: This spinner dome installation is not preloaded.

CAUTION: TO AVOID DAMAGING THE AIRCRAFT COWLING, THE SCREWS MUST NOT EXTEND MORE THAN THREE THREADS PAST THE SPINNER BULKHEAD NUT PLATES.

(e) Using the supplied screws and washers, attach the spinner dome to the spinner bulkhead. Refer to Table 3-2.

1 Install two screws in the two holes centered between two blade cutouts.

2 Tighten the two screws until snug.

3 Install two screws in the two holes centered between two blade cutouts on the opposite side of the spinner dome.

4 Tighten the two screws until snug.

5 Repeat installation of two screws in the holes centered between two blade cutouts for the remaining areas.

6 Tighten two screws until snug.

7 Install the remaining screws in the remaining holes.

8 Tighten until snug.

(4) Installation of the fairing, if applicable:

(a) Align the attaching holes of the fairing to the holes in the spinner bulkhead.

(b) Using the supplied screws and washers, attach the fairing to the spinner bulkhead. Refer to Table 3-2.

1 Install two screws in the center two holes used to attach the fairing to the bulkhead.

2 Tighten the two screws until snug.

3 Install each remaining screw and tighten until snug.

(c) Each fairing, has a tab. Using the supplied screws and washers, attach the tab to the opposite fairing. Tighten until snug. Refer to Table 3-2.

(5) Composite spinner assembly P/N 104888( )

(a) Using grease, Aeroshell 5 or Aeroshell 6, thoroughly lubricate the O-ring. Refer to Table 3-2.

(b) Put the O-ring in the groove on the cylinder. Refer to Figure 3-13.

(c) Put four spacers on the cylinder. Refer to Table 3-2.

NOTE: The spacers are used to adjust the spinner dome preload.

(d) Gently push the spinner dome as far aft as it will go onto the bulkhead unit.

(e) Visually examine the spinner fit.

1 The spinner is correctly spaced when the holes in the spinner dome are misaligned 1/4 -1/3 of their diameter toward the front of the aircraft, or rear in a pusher installation. Refer to Figure 3-14.

2 Remove the spinner dome and add or remove spacers to achieve this alignment.

(f) Install and push the spinner dome aft to align the spinner mounting holes with those of the bulkhead or adapter ring.

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

(g) Using screws and washers, attach the spinner to the bulkhead or adapter ring. Refer to Table 3-5.

7. Post-Installation Checks

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

8. Spinner Removal

   CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

   CAUTION 2: WRAP THE BLADE SHANKS IN SEVERAL LAYERS OF MASKING OR DUCT TAPE BEFORE REMOVING THE SPINNER DOME, TO PREVENT DAMAGING THE BLADE AND BLADE SURFACE.

   A. If the spinner assembly is supplied by a source other than Hartzell Propeller Inc., refer to the airframe manufacturer's manual for spinner installation instructions.

   B. Removal of Hartzell Propeller Inc. Single Piece Spinner

      (1) If applicable, remove the screws and washers that attach the tabs on the fairing to the opposite fairing.

      (2) If applicable, remove the screws and washers that attach the spinner fairing to the spinner bulkhead.

      (3) Remove the screws and washers that attach the spinner dome to the spinner bulkhead or adapter ring.

      (4) Remove the spinner dome.

      (5) If applicable, remove the forward bulkhead mount and O-ring from the cylinder.

9. Propeller Removal

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Removal of F, H, Q, and T Flange Propellers

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

(2) If the propeller is equipped with an ice protection system applicable instructions and technical information for the components 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 System 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 installed on a propeller manufactured by Hartzell Propeller Inc. are controlled by the Hartzell Propeller Inc. Instructions for Continued Airworthiness (ICA).

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

(4) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting nuts and spacers have been removed.

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

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

(6) Remove the six mounting nuts.

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

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

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

(8) Put the propeller on a cart for transport.

B. Removal of G and R Flange Propellers

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

(2) If the propeller is equipped with an ice protection system applicable instructions and technical information for the components 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 System 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 installed on a propeller manufactured by Hartzell Propeller Inc. are controlled by the Hartzell Propeller Inc. Instructions for Continued Airworthiness (ICA).

(4) Cut and remove the safety wire (if installed) on the propeller mounting bolt.

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

(5) Support the propeller assembly with a sling.

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

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

(7) Unscrew the mounting bolts from the engine bushings.

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

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

(8) Using the support sling, remove the propeller from the mounting flange.

(9) Put the propeller on a cart for transport.

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TESTING AND TROUBLESHOOTING - CONTENTS

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1. Operational Tests
   A. General
      (1) The propeller may be installed on an application that uses an electrically actuated governor or a hydro-mechanical governor. The test procedures are applicable based on the type of governor.
      (2) Perform the appropriate test following propeller installation and before every flight. The propeller system must be purged of air and proper operation verified.
   B. Initial Run-Up
      (1) Perform engine start and warm-up in accordance with the Pilot's Operating Handbook (POH).

      CAUTION: AIR TRAPPED IN THE PROPELLER HYDRAULIC SYSTEM WILL CAUSE THE PITCH CONTROL TO BE IMPRECISE AND MAY RESULT IN PROPELLER SURGING.

      (2) Cycle the propeller control throughout its operating range from low to high (or as directed by the POH).
      (3) Repeat this procedure at least three times to purge air from the propeller hydraulic system and to introduce warmed oil to the cylinder.

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

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

C. Static RPM Check - Hydro-mechanical Governor Only

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

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

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

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

(3) Start the engine.

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

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

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

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

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

(7) Stop the engine.

(8) Return the governor maximum RPM stop to the original position. Test fly the aircraft to confirm maximum rated RPM is achieved in accordance with the aircraft TC or STC. Adjust the governor high RPM screw as necessary.

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

D. Static RPM Check - Electrically Actuated Governor Only

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

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

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

(2) Install a blanker plate in place of the governor.

(3) Start the engine.

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

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

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

(5) Stop the engine.

(6) Install the governor

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

E. Post-Run Check

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

2. Propeller Ice Protection Systems
   A. Electric De-ice System
      (1) Consult the Pilot Operating Handbook (including all supplements) regarding flight into conditions of known icing. The aircraft may not be certificated for flight in known icing conditions, even though propeller de-ice equipment is installed.
      (2) Refer to the Anti-ice and De-ice Systems Chapter of this manual for functional tests of the de-ice system.
   B. Anti-ice System
      (1) Consult the Pilot Operating Handbook (including all supplements) regarding flight into conditions of known icing. The aircraft may not be certificated for flight in known icing conditions, even though propeller anti-ice equipment is installed.
      (2) Refer to the Anti-ice and De-ice Systems Chapter of this manual for functional tests of the anti-ice system.
3. Troubleshooting
   A. 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 the propeller is hunting, a repair station should check:
         (a) Governor
         (b) Fuel control
      (2) If the propeller is surging:

         Perform Steps 1.A. (1) through 1.A.(5) under "Operational Tests," in this chapter. If surging recurs, it is most likely due to a faulty governor. Have the governor tested at a certified propeller repair station with the appropriate rating.

(3) 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. The propeller must be tested at a certified propeller repair station with the appropriate rating to isolate these faults.

B. Engine Speed Varies with Flight Attitude (or Airspeed)

(1) Small variances in engine speed are normal and are no cause for concern.

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

(a) Non-feathering ( )(A,B)1 series propeller:

1 Governor is not increasing oil volume in the propeller.

2 Engine transfer bearing leaking excessively

3 Excessive friction in the blade bearings or pitch changing mechanism

(3) Decrease in engine speed while increasing airspeed:

(a) Non-feathering ( )(A,B)1 series propeller:

1 Governor pilot valve is stuck and is excessively increasing oil volume.

(4) Increase in engine speed while decreasing airspeed:

(a) Non-feathering ( )(A,B)1 series propeller:

1 Governor pilot valve is stuck and is excessively decreasing oil volume.

(5) Decrease in engine speed while decreasing airspeed:

(a) Non-feathering ( )(A,B)1 series propeller:

1 Governor is not reducing oil volume in propeller.

2 Excessive friction in blade bearings or pitch changing mechanism

C. Loss of Propeller Control - ( )(A,B)1 series propellers only:
   (1) Propeller goes to uncommanded low pitch (high RPM)
      (a) Loss of propeller oil pressure - Check:
         1 Governor pressure relief valve for proper operation
         2 Governor drive for damage
         3 Adequate engine oil supply
         4 Engine transfer bearing leaking excessively
      (b) Internal oil leakage to opposite side of piston and into hub
   (2) Propeller goes to uncommanded high pitch (low RPM)
      (a) Governor pilot valve sticking
   (3) RPM increases with power and airspeed, propeller RPM control has little or no effect
      (a) Excessive friction in the blade bearings or pitch changing mechanism
      (b) Internal oil leakage to opposite side of piston and into hub

D. Vibration

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

CAUTION 2: VIBRATION PROBLEMS BECAUSE OF PROPELLER SYSTEM IMBALANCE ARE NORMALLY FELT THROUGHOUT THE RPM RANGE, WITH THE INTENSITY OF VIBRATION INCREASING WITH RPM. VIBRATION PROBLEMS THAT OCCUR IN A NARROW RPM RANGE ARE A SYMPTOM OF RESONANCE, THAT IS POTENTIALLY HARMFUL TO THE PROPELLER. AVOID OPERATION UNTIL THE PROPELLER CAN BE CHECKED AT A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING.

(1) Check:

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

(b) Isolation of engine controls and lines

(c) Engine mount wear

(d) Uneven or over lubrication of propeller

(e) Proper engine/propeller flange mating

(f) Blade track: Refer to Blade Track in the Inspection and Check chapter of this manual.

(g) 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 blade angle check procedure.

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

(i) Static balance

(j) Propeller installation - remove and reinstall the propeller 180 degrees from the original installation position.

1 "R" flange propellers installed on an R engine flange cannot be reinstalled 180 degrees from original installation position.

(k) Hub damage or cracking

(l) Oil leakage

(m) Blade deformation

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

E. Propeller Overspeed

(1) Check:

(a) Tachometer error

(b) Low pitch stop adjustment

(c) Governor Maximum RPM set too high

(d) Loss of oil pressure (-1 propellers only)

1 Oil starvation

2 Governor failure

3 Accumulator air pressure low

(e) Oil leaking past piston causing the hydraulic lock of piston in the cylinder - ( )(A,B)1 propeller only

F. Overspeed Avoidance (Operational) - ( )(A,B)1 Series Propellers

(1) Hartzell Propeller Inc. ( )(A,B)1 series propellers are designed to reduce blade angle in the event of a loss of oil pressure. This reduction in blade angle allows all available engine power to be utilized in the event of an oil system failure. This reduction in blade angle also can allow the engine to overspeed, especially at higher airspeeds.

G. Propeller Underspeed

(1) Check:

(a) Tachometer error

(b) Excessive transfer bearing oil leakage

(c) Governor oil pressure low

(d) Governor oil passage clogged

H. Oil Leakage

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

(1) If there is a suspected or confirmed red dyed oil leak, perform the following:

(a) If not already removed, remove the spinner dome in accordance with the Propeller Installation and Removal Chapter of this manual.

(b) Visually inspect the propeller for the location of the red dyed oil leak.

(2) If the red dyed oil leak is determined to be from a source other than a blade O-ring, hub parting line, seeping under the cylinder flange, or seeping around the cylinder attaching screws:

(a) Remove the propeller before further flight.

(b) The propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating for the cause of the red dyed oil leak.

(3) If the red dyed oil leak is determined to be from the blade O-ring, hub parting line, seeping under the cylinder flange, or seeping around the cylinder attaching screws:

(a) Perform the "Oil Level Check Procedure - 3 Blade Only" or the "Oil Level Check Procedure - 5 Blade Only" in the Inspection and Check chapter of this manual.

INSPECTION AND CHECK - CONTENTS

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LIST OF FIGURES

1. Pre-Flight 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. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

Follow propeller preflight inspection procedures as specified in the Pilot Operating Handbook (POH). In addition, perform the following inspections:

A. Blades

(1) Visually inspect the entire blade for nicks, gouges, erosion, 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 the Lightning Strike Damage section in this chapter for a description of damage.

CAUTION 1: FAILURE TO INSTALL THE EROSION TAPE CM158 ON A NON-BOOTED BLADE THAT DOES NOT HAVE A DE-ICE BOOT INSTALLED WILL CAUSE THE INBOARD LEADING EDGE OF THE BLADE TO ERODE PREMATURELY.

CAUTION 2: DO NOT INSTALL EROSION TAPE CM158 ON A BLADE THAT USES AN ALCOHOL ANTI-ICE BOOT. INSTALLATION OF EROSION TAPE CM158 WILL PREVENT PROPER FUNCTION OF THE ANTI-ICE BOOT.

(3) A composite blade that does not have an anti-icing boot installed must have erosion tape CM158 installed on the leading edge. Refer to the Maintenance Practices chapter of this manual, for erosion tape installation instructions.

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

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

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

D. Using an appropriate light source, examine the propeller through the spinner blade cut-outs.

(1) Visually inspect for signs of leakage.

(2) Spinner removal is not required for this inspection.

E. Visually inspect the face and camber side of the blade for evidence of red dyed oil.

F. Wipe the blades with a clean white cloth. Red dyed oil leakage will appear on the cloth as a red stain.

G. If oil leakage is found, proceed to the Troubleshooting section of this manual.

H. Contact Hartzell Propeller Inc. Product Support if sudden or significant oil leakage is found.

I. Contact Hartzell Propeller Inc. Product Support if sudden or significant propeller imbalance is noticed. Inspect for oil leakage and determine its source.

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

K. Inspect the the 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.

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

2. Operational Checks

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

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

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

(1) Perform all ground functional, feathering, and cycling checks with the minimum propeller RPM drop required to demonstrate function.

(2) A typical RPM drop is 300-500 RPM for feathering propellers and 100 to 300 RPM for non-feathering propellers.

WARNING: ABNORMAL VIBRATION CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. AN INFLIGHT BLADE SEPARATION MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

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

D. Refer to Periodic Inspections in this chapter for additional inspection information and possible corrections to any discrepancies discovered as a result of Pre-Flight Checks.

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

3. Required Periodic Inspections and Maintenance

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

A. Periodic Inspections

Perform the following inspection procedures at intervals between 80 to 120 hours, not to exceed twelve (12) calendar months. Procedures involved in these inspections are detailed below.

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

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

(3) Remove the spinner dome.

CAUTION: DO NOT ATTEMPT TO REPAIR A CRACKED BLADE.

(4) Visually inspect the blades for nicks, gouges, and cracks. Refer to the Maintenance Practices chapter of this manual for procedure. If any damage is discovered, refer to the Blade Repairs section in the Maintenance Practices chapter of this manual for additional information. A cracked blade must be referred to a certified propeller repair station with the appropriate rating.

CAUTION: DO NOT ATTEMPT TO REPAIR A CRACKED HUB.

(5) Visually inspect the hub parts for cracks or wear. Refer to Oil Leaks in the Inspection Procedures section of this chapter for procedure. A cracked hub must be referred to a certified propeller repair station with the appropriate rating.

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

(7) Check for oil leaks. Refer to Oil Leaks in the Inspection Procedures section of this chapter for procedure.

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

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

(10) If an anti-ice system is installed, clean or replace the anti-ice system filter.

(11) Make an entry in the propeller logbook about completion of these inspections.

B. Oil Level Check

(1) Perform a visual inspection of the oil level in the hub, at 600 hour intervals not exceed twelve (12) calendar months. Refer to the Oil Level Check Procedure in the Inspections Procedures section of this chapter.

C. Airworthiness Limitations

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

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

(3) Operators are urged to keep informed of airworthiness information via Hartzell Propeller 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

In flight, the propeller is constantly subjected to vibration from the engine and the airstream, as well as high centrifugal forces. The propeller is also subject to corrosion, wear, and general deterioration due to aging. Under these conditions, metal fatigue or mechanical failures can occur. To protect your safety, your investment, and to maximize the safe operating lifetime of your propeller, it is essential that a propeller be properly maintained and overhauled according to the recommended service procedures.

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

CAUTION 2: CHECK THE LATEST REVISION OF HARTZELL PROPELLER INC. SERVICE LETTER HC-SL-61-61Y FOR THE MOST CURRENT INFORMATION. THE SERVICE LETTER IS AVAILABLE ON THE HARTZELL PROPELLER INC. WEBSITE AT WWW.HARTZELLPROP.COM.

(1) Propellers must be overhauled at 2400 hours or 72 months, whichever occurs first.

4. Inspection Procedures

The following inspections must be made on a regular basis, either before flight, during required periodic inspection as described in this chapter, or if a problem is found. Possible corrections to problems discovered during inspections, additional inspections, and limits are detailed in the following inspection procedures.

A. Blade Damage

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

B. Oil Leakage

WARNING 1: UNUSUAL OR ABNORMAL RED DYED OIL LEAKAGE, WHEN THE CONDITION INITIATED SUDDENLY, CAN BE AN INDICATION OF A FAILING PROPELLER HUB. A FAILED PROPELLER HUB MAY LEAD TO AN INFLIGHT BLADE SEPARATION WHICH COULD RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. UNUSUAL OR ABNORMAL RED DYED OIL LEAKAGE DEMANDS IMMEDIATE INSPECTION FOR A POSSIBLE CRACKED HUB.

WARNING 2: A RED DYED OIL LEAK MAY INDICATE A HUB FRACTURE CONDITION THAT MAY LEAD TO BLADE SEPARATION. IF A LEAK BECOMES EVIDENT WHILE ON THE GROUND, THE SOURCE OF THE LEAK MUST BE DETERMINED BEFORE FURTHER FLIGHT. IF A LEAK BECOMES EVIDENT WHILE IN FLIGHT AND ESPECIALLY IF IT IS ACCOMPANIED BY INCREASED VIBRATION, THE PILOT SHOULD PROCEED TO AN EARLY LANDING AND DETERMINE THE SOURCE OF THE LEAK BEFORE FURTHER FLIGHT.

WARNING 3: ONE SOURCE OF RED DYED OIL LEAKAGE MAY BE AT THE HUB AND BLADE PARTING LINE. AN OIL LEAK AT THIS LOCATION MAY INDICATE EITHER AN O-RING FAILURE OR A HUB FRACTURE. CAREFUL INSPECTION MUST BE PERFORMED TO PROPERLY DETERMINE THE SOURCE OF THE LEAK BEFORE FURTHER FLIGHT.

(1) Remove the spinner dome.

CAUTION: PERFORM A VISUAL INSPECTION WITHOUT CLEANING THE PARTS. A TIGHT CRACK IS OFTEN EVIDENT DUE TO TRACES OF RED DYED OIL EMANATING FROM THE CRACK OR A RED STAIN ON THE HUB SURFACE. CLEANING CAN REMOVE SUCH EVIDENCE AND MAKE A CRACK VIRTUALLY IMPOSSIBLE TO SEE.

(2) Perform a visual inspection for cracks in the hub. A crack may be readily visible, or may be indicated by red dyed oil leaking from a seemingly solid surface, or a red stain on the hub surface.

(a) If red dyed oil leakage is found, proceed to the Testing and Troubleshooting chapter of this manual.

(3) Perform a visual inspection for red dyed oil seeping around the cylinder flange where it attachs to the hub or the cylinder attaching screws.

(a) If red dyed oil leakage is found, proceed to the Testing and Troubleshooting chapter of this manual.

(4) Visually inspect the hub parting line for red dyed oil seeping or a red stain to the sealant between the hub halves.

(a) If red dyed oil leakage is found, proceed to the Testing and Troubleshooting chapter of this manual.

(5) Visually inspect the blade retention areas of the hub for red dyed oil seeping past the blade O-ring.

(a) If red dyed oil leakage is found, proceed to the Testing and Troubleshooting chapter of this manual.

(6) Visually inspect the face and camber side of the blade for evidence of red dyed oil.

(a) If red dyed oil leakage is found, proceed to the Testing and Troubleshooting chapter of this manual.

(7) Wipe the blades with a clean white cloth. Red dyed oil leakage will appear on the cloth as a red stain.

(a) If red dyed oil leakage is found, proceed to the Testing and Troubleshooting chapter of this manual.

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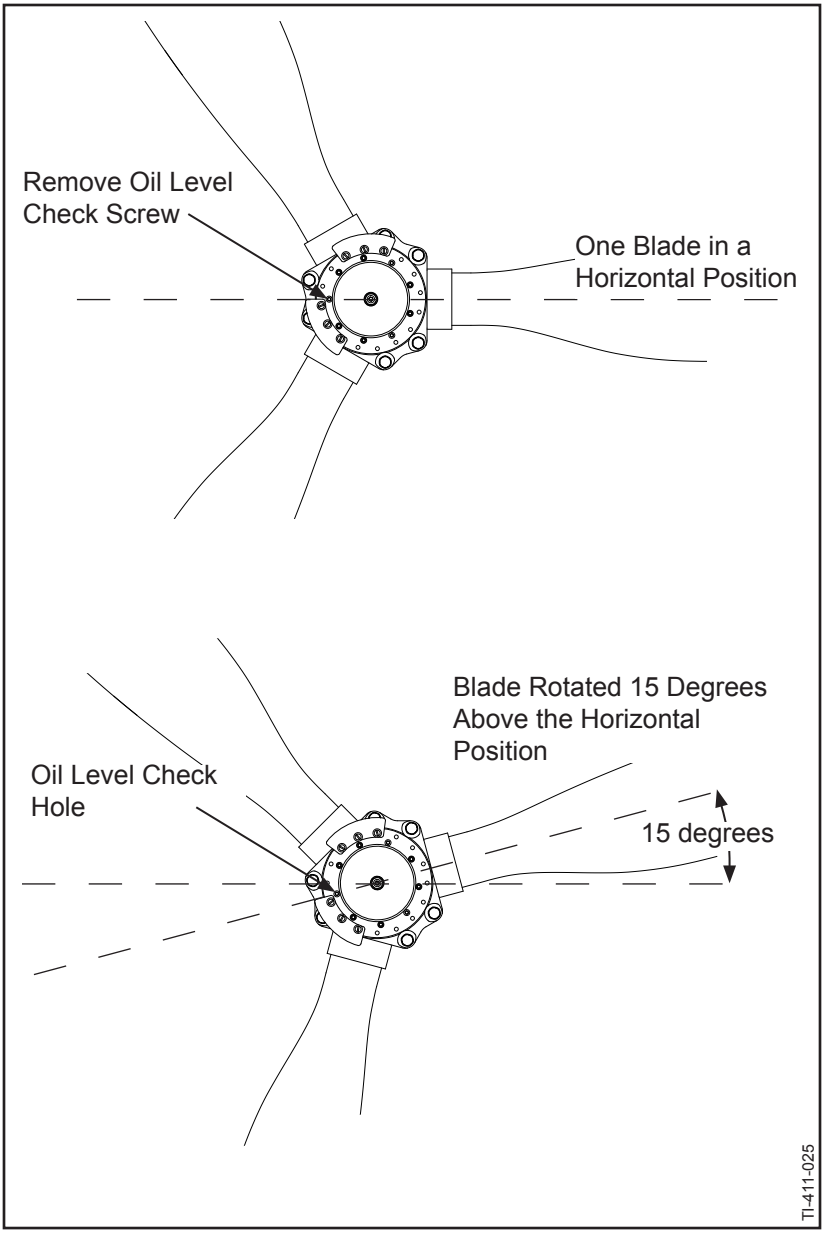


Oil Level Check - 3 Blade Propeller
Figure 5-1

(8) Contact Hartzell Propeller Inc. Product Support if sudden or significant red dyed oil leakage is found.

(9) Contact Hartzell Propeller Inc. Product Support if sudden or significant propeller imbalance is noticed. Inspect for red dyed oil leakage and determine its source.

(10) If cracks are suspected, additional inspections must be performed before further flight. 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 the parts, using non-destructive methods in accordance with published procedures.

(11) If cracks or failing components are found, parts must be replaced before further flight. Report such incidents to airworthiness authorities and Hartzell Propeller Inc. Product Support.

C. Oil Level Check Procedure - 3 Blade Only

(1) Three of the cylinder attaching holes are through drilled to permit inspection of the oil level in the hub.

(2) Rotate the propeller so one blade is in a horizontal position.

(3) Remove the screw and O-ring from the through drilled hole opposite the blade that is in the horizontal position. Refer to Figure 5-1.

(4) When the screw is removed, red dyed oil should leak from the hole.

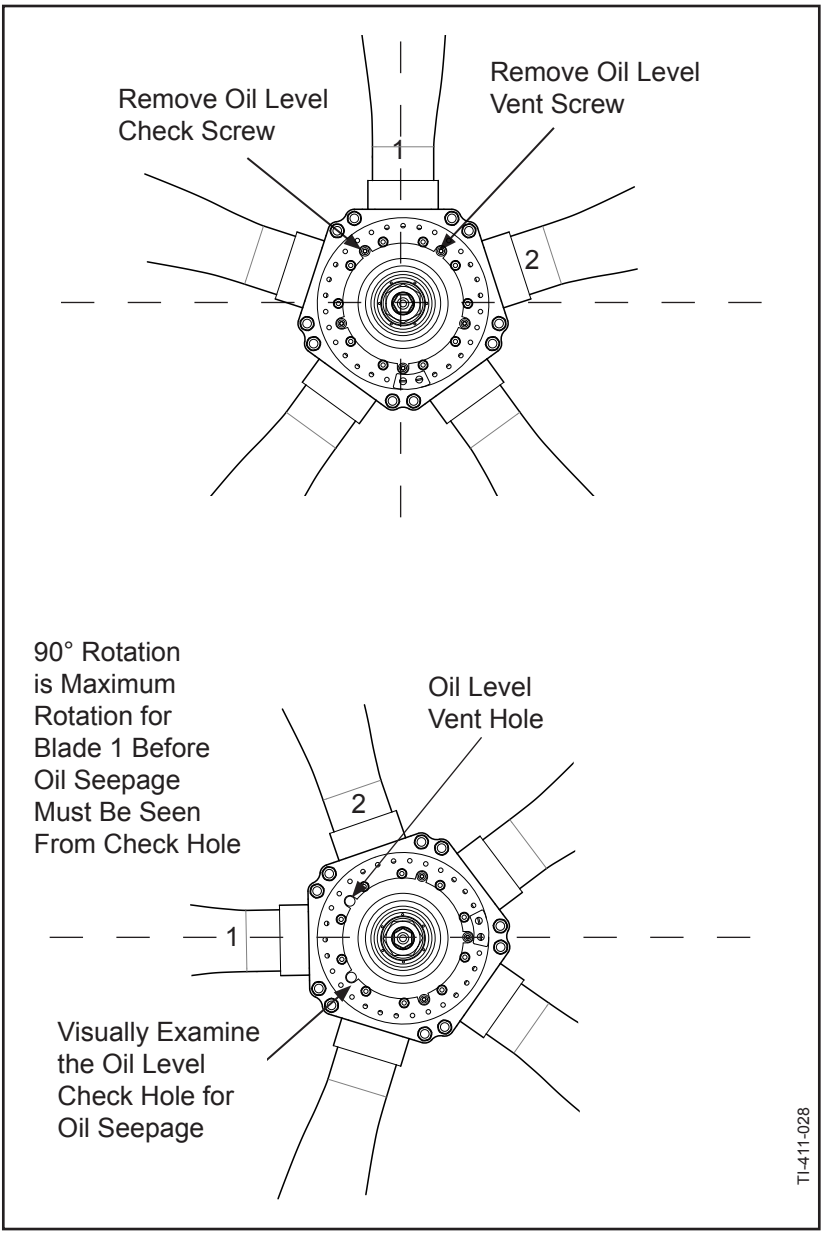
(a) If red dyed oil leaks from the hole:

1 Remove sealant from threads of screw.

2 Using approved solvent, clean the threads of the screw and the threads of the hole.

3 Using threadlocker CM116, apply a layer to the threads of the previously removed screw.

4 Put the screw in the hole and torque the screw 60 in lbs. (6.7 N•m).



Oil Level Check - 5 Blade Propeller
Figure 5-1A

5 If the red dyed oil leak continues for more than 10 hours after the oil level check, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating for the cause of the red dyed oil leak.

6 If the red dyed oil leak has stopped, no further action is required.

(b) If red dyed oil does not leak from hole:

1 Rotate the blade 15 degrees in a upward direction.

2 If red dyed oil, leaks from the hole, perform steps 4.C.(4)(a)1 through 4.C.(4)(a)4.

3 If red dyed oil does not leak from the hole, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating for the cause of the red dyed oil leak.

C1. Oil Level Check Procedure - 5 Blade Only - Refer to Figure 5-1A.

WARNING: A RED DYED OIL LEAK MAY INDICATE A HUB FRACTURE CONDITION THAT MAY LEAD TO BLADE SEPARATION. IF A LEAK BECOMES EVIDENT WHILE ON THE GROUND, THE SOURCE OF THE LEAK MUST BE DETERMINED BEFORE FURTHER FLIGHT. IF A LEAK BECOMES EVIDENT WHILE IN FLIGHT AND ESPECIALLY IF IT IS ACCOMPANIED BY INCREASED VIBRATION, THE PILOT SHOULD PROCEED TO AN EARLY LANDING AND DETERMINE THE SOURCE OF THE LEAK BEFORE FURTHER FLIGHT.

(1) Five of the cylinder attaching holes are through drilled to permit inspection of the oil level in the hub.

(2) Put the propeller so that one blade is in a vertical position.

(3) Identify this as blade 1.

(4) Identify the first blade clockwise from blade 1 as blade 2.

(5) Remove each cap head screw with O-ring from the two through drilled holes on the opposite sides of blade 1.

(6) The oil level check hole is the hole counterclockwise of blade 1.

(7) The oil level vent hole is the hole clockwise of blade 1.

(8) Slowly rotate blade 1 in a counterclockwise direction.

(9) Using a light source, visually examine the oil level check hole for oil seepage.

NOTE: The oil in the hub is very thick and will be visible in the oil level check hole before it seeps out.

(a) If oil is visible in the oil level check hole before blade 1 is in a horizontal position:

1 Rotate blade 1 back to the vertical position.

2 Remove sealant from the threads of the screw.

3 Using approved solvent, clean the threads of the screw and the threads of the hole.

4 Using threadlocker CM116, apply a layer to the threads of the previously removed screw.

5 Put the screw in the hole and torque the screw to 60 In-Lbs. (6.7 N•m).

6 Repeat for each screw.

(b) If blade 1 is in a horizontal position and oil is not visible in the oil level check hole, contact Hartzell Propeller Inc. Product Support department.

D. Vibration

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

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

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

(2) Refer to the Vibration section in the Testing and Troubleshooting chapter of this manual. Perform the checks to determine possible cause of the vibration. If no cause is found, then consider that the origin of the problem could be the propeller and proceed with steps 4.D.(3) through 4.D.(8) in this chapter.

(3) Remove the spinner dome.

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

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

(b) A crack may be readily visible, or may be indicated by oil leaking from a seemingly solid surface or a red stain on the hub surface.

(5) If cracks are suspected, additional inspections must be performed before further flight. 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 the Loose Blade section of this chapter.

(b) Check blade track. Refer to the Blade Track section of this chapter.

CAUTION: DO NOT USE BLADE PADDLES TO TURN THE BLADES.

(c) Manually (by hand) attempt to turn the blades (change pitch).

(d) Visually check for damaged blades (delaminations, debonds, cracks, etc.).

(7) If abnormal blade conditions or damage are found, additional inspections must be performed by a certified propeller repair station with the appropriate rating to evaluate the condition. Refer to the Composite Blade section in the Maintentance Practices chapter of this manual.

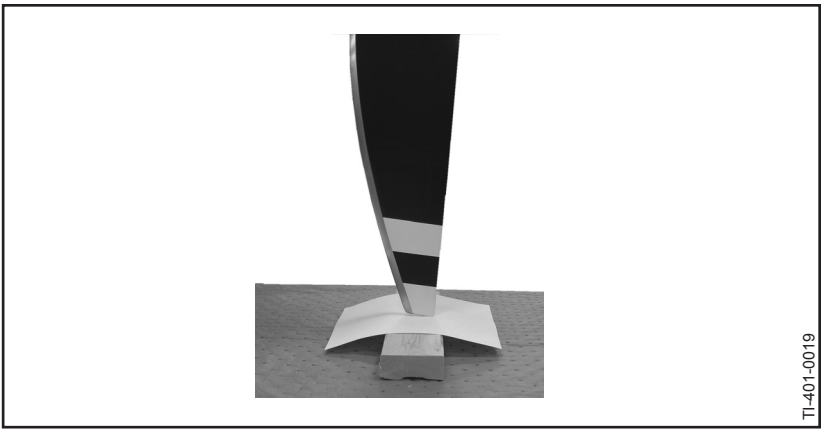
(8) If cracks or failing components are found, parts must be replaced before further flight. Report such incidents to airworthiness authorities and Hartzell Propeller Inc. Product Support.

E. Tachometer Inspection

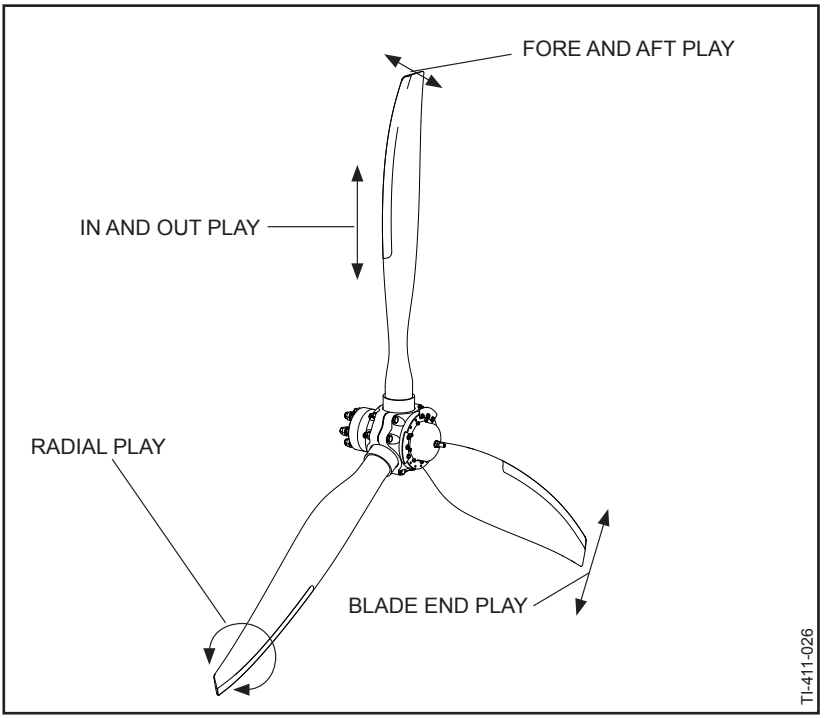
WARNING: OPERATION WITH AN INACCURATE TACHOMETER MAY RESULT IN RESTRICTED RPM OPERATION AND DAMAGING HIGH STRESSES. BLADE LIFE WILL BE SHORTENED AND COULD RESULT IN CATASTROPHIC FAILURE.

(1) Accuracy of the engine tachometer should be verified at 100 hour intervals or at annual inspection, whichever occurs first.

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



Checking Blade Track
Figure 5-2



Blade Play
Figure 5-3

F. Blade Track

(1) Check blade track as follows:

(a) Chock the aircraft wheels securely.

(b) Refer to Figure 5-2. Place a fixed reference point beneath the propeller, within 0.25 inch (6.00 mm) of the lowest point of the propeller arc.

NOTE: This reference point may be a flat board with a sheet of paper attached to it. The board may then be blocked up to within 0.25 inch (6.00 mm) of the propeller arc.

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

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

(d) Repeat this procedure with the remaining blades.

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

(f) Possible Correction

1 Remove foreign matter from the propeller mounting flange.

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

G. Loose Blades

(1) Refer to Figure 5-3. Limits for blade looseness are as follows:

In And Out Play	None permitted
Radial Play	± 0.5 degree 1 degree total - measured at reference station
Blade End Play	± 0.09 inch (2.28 mm) 0.19 inch (4.82 mm) total
Fore And Aft Play	± 0.19 inch (4.82 mm) 0.38 inch (9.65 mm) total

NOTE: Blades are intended to be tight in the propeller, however slight movement is acceptable. Blades with excessive movement should be referred to a certified propeller repair station with the appropriate rating.

(2) Procedure for blade fore and aft play inspection.

(a) Measure or find a location on the blade approximately 12 inches inboard of the blade tip.

(b) Using fingers and light pressure 12 inches inboard of the blade tip, push the blade aft until movement stops.

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

(d) Using fingers and light pressure 12 inches inboard of the blade tip, push the blade forward until movement stops.

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

(f) Measure the amount of movement between the two locations.

(g) If the amount of movement is greater than the limits specified in Figure 5-3, the propeller should be referred to a certified propeller repair station with the appropriate rating.

H. Corrosion

WARNING: REPAIR THAT INVOLVES COLD WORKING THE METAL, RESULTING IN CONCEALMENT OF A DAMAGED AREA, IS NOT PERMITTED.

Light corrosion on the counterweights may be removed by qualified personnel in accordance with the Blade Repairs section in the Maintenance Practices chapter of this manual.

Heavy corrosion that results in severe pitting must be referred to a certified propeller repair station with the appropriate rating.

I. Spinner Damage

Inspect the spinner for cracks, missing hardware, or other damage. Refer to Hartzell Propeller Inc. Metal Spinner Assembly Maintenance Manual 127 (61-16-27), Hartzell Propeller Inc. Composite Spinner Maintenance Manual 148 (61-16-48), or a certified propeller repair station with the appropriate rating for spinner damage acceptance and repair information. Contact the local airworthiness authority for repair approval.

J. Electric De-ice System

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

K. Anti-ice System

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

L. UID Plate Inspection

(1) Specific installations require selected aircraft components to have a unique identification that is compatible with Military Standard MIL-STD-130M.

(2) The UID plate incorporates a laser etched scan code to identify the manufacturer's cage code, propeller IDS/item number, and propeller serial number.

(3) The cage code, propeller IDS/item number, and serial number are also laser etched on the UID plate.

(4) On a propeller, the UID plate is located on the balance ring attached to the cylinder on the propeller.

(5) On a governor, the UID identification is laser etched on the governor head cap.

(6) If the UID plate is found at any time to be damaged, the scan code is visibly damaged, or the scan code is not scannable, remove the UID plate from service.

(a) Mark the location of the UID plate on the balance ring.

(b) Remove and discard the safety wire.

(c) Remove the screws, washers, and nut.

(d) Contact Hartzell Propeller Inc. Product Support for replacement UID plate.

(e) The UID plate is also used as a static balance weight. Do not remove the UID plate until a replacement plate is received.

(d) Using the screws, washers, and nuts install the new UID plate in the same location on the balance ring.

(e) Tighten the nut until snug.

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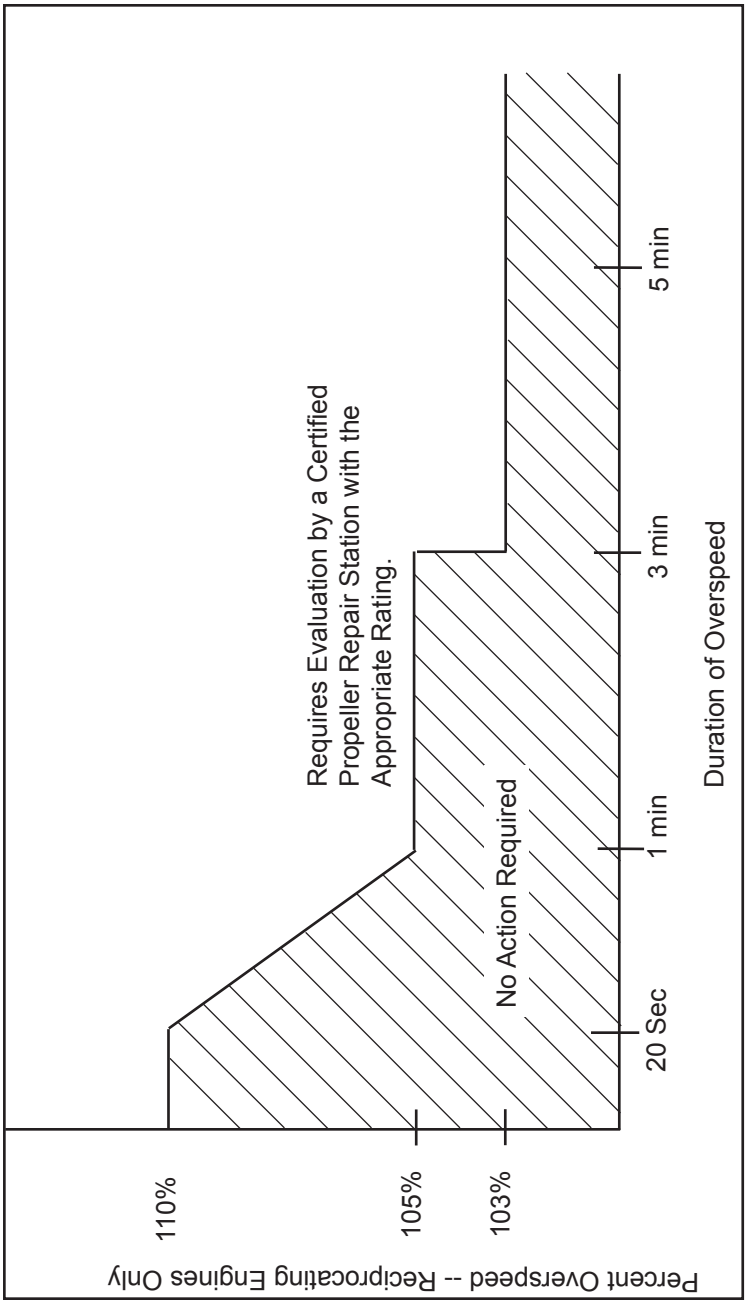

Reciprocating Engine Overspeed Limits
Figure 5-4

5. Special Inspections

A. Overspeed/Overtorque

An overspeed occurs when the propeller RPM exceeds the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. An overtorque condition occurs when the engine load exceeds the limits established by the engine, propeller, or airframe 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 airframe/engine/propeller combination.

(1) When a propeller installed on a reciprocating engine has an overspeed event, refer to the Reciprocating Engine Overspeed Limits (Figure 5-4) to determine the appropriate corrective action.

(2) Make an entry in the propeller logbook about the overspeed event.

B. Lightning Strike - Propeller

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

(1) General

(a) In the event of a propeller lightning strike, an inspection is required before further flight. It may be permissible for a propeller to be operated for an additional ten (10) hours if the propeller is not severely damaged and meets the requirements in paragraph 5.B.(2).

(b) Regardless of the outcome of the initial inspection, the propeller must be removed from the aircraft, 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) Inspect the propeller in accordance with the Lightning Strike Damage criteria specified in the Maintenance Practices chapter.

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

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

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

C. Lightning Strike - Electrically Actuated Governor

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

(1) General

(a) In the event of a propeller or aircraft lightning strike, an inspection is required before further flight.

(2) Perform Initial Run-Up test as outlined in the Testing and Troubleshooting chapter in this manual.

(3) If the propeller fails to cycle throughout its operating range, replace the electrically actuated governor.

D. Foreign Object Strike/Ground Strike

(1) General

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

(b) A foreign object strike is defined as:

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

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

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

(2) Procedure

(a) In the event of a foreign object strike, an inspection is required before further flight. If the inspection reveals one or more of the following indications, the propeller must be removed from the aircraft, disassembled and repaired or 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 blade out of track or angle

4 Any diameter reduction

5 A bent, cracked, or failed engine shaft

6 Vibration during operation that was not present before the event

(b) Unairworthy damage on composite blade surfaces or the leading and trailing edges must be repaired before flight. Refer to the Composite Blades section in the Maintenance Procedures chapter of this manual.

(c) For engine mounted accessories - for example, governors, pumps, and propeller 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 an entry in the propeller logbook about the foreign object strike incident and any corrective action(s) taken.

E. Fire Damage or Heat Damage

WARNING: EXPOSING COMPOSITE BLADES AND ALUMINUM HUBS TO HIGH TEMPERATURES MAY LEAD TO FAILURE THAT CAN CAUSE PERSONAL INJURY AND DEATH. ALUMINUM HUBS ARE MANUFACTURED FROM HEAT TREATED FORGINGS THAT ARE NOT TO BE ANNEALED AND RE-HEAT TREATED. EXPOSURE TO HIGH TEMPERATURES CAN ALSO DESTROY THE FATIGUE LIFE BENEFITS OBTAINED FROM SHOT PEENING. COMPOSITE BLADES ARE SUBJECT TO DELAMINATIONS BECAUSE OF HIGH TEMPERATURES.

(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 an authorized propeller repair station is required before further flight.

6. Long Term Storage

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

B. Long term storage procedures may be obtained by contacting a Hartzell 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. Standard Practices Manual 202A (61-01-02).

C. In addition to the long term storage requirements specified in Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02), The maximum permitted storage temperature for Hartzell Propeller Inc. composite blades is 180F degrees (82 degrees Celsius).

D. 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. Standard Practices Manual 202A (61-01-02).

MAINTENANCE PRACTICES - CONTENTS

MAINTENANCE PRACTICES - CONTENTS, CONTINUED

LIST OF ILLUSTRATIONS

LIST OF TABLES

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1. Cleaning

CAUTION: DO NOT USE PRESSURE WASHING EQUIPMENT TO CLEAN THE PROPELLER OR CONTROL COMPONENTS. PRESSURE WASHING CAN FORCE WATER AND/OR CLEANING FLUIDS PAST SEALS AND LEAD TO INTERNAL CORROSION OF PROPELLER COMPONENTS.

A. General Cleaning

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

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

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

(1) Using a cleaner, specified in the installation and removal chapter of this manual, and a clean cloth, wipe the part clean to remove oil from propeller surfaces.

(2) Using a non-corrosive soap solution, wash the propeller.

(3) Thoroughly rinse with water.

(4) Permit to dry.

B. Spinner Cleaning and Polishing

(1) Clean the spinner using the General Cleaning procedures, above.

(2) If the dome is a Hartzell Propeller Inc. aluminum dome, polish the dome, if necessary, with an automotive-type aluminum polish.

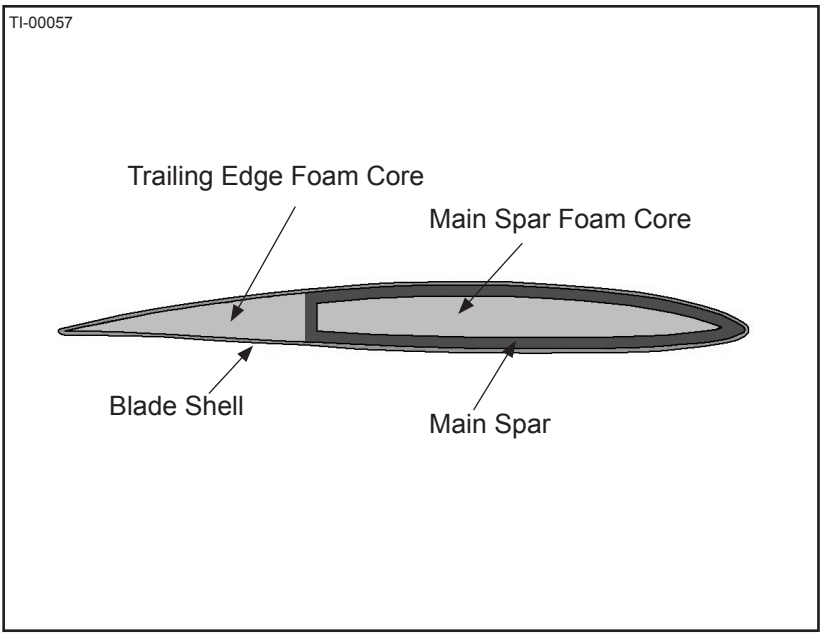
2. Composite Blades

A. General Description

(1) Composite Blades

(a) The Hartzell Propeller Inc. blade is a monocoque construction consisting of composite material over a foam core.

(b) The composite material is round at the inboard station sections, transitioning to an airfoil shape outboard on the blade. A typical airfoil section is shown in Figure 6-1 and Figure 6-2. The bulk of the composite material is truncated toward the trailing edge with foam material forming the remainder of the trailing edge. The entire structure is contained in a shell constructed of composite material.



Section of Typical Composite Blade
Figure 6-1

(c) An erosion shield of electroformed nickel is incorporated in the fabrication to protect the leading edge of the blade from impact and erosion damage.

(d) The composite blade is balanced in the horizontal plane during production by the addition of lead wool to a centrally located balance tube in the metal blade shank, which may protrude into the foam core of the blade.

(e) A finish covering of polyurethane paint protects the entire blade from erosion and ultraviolet damage.

(f) Aircraft that require ice protection use an external boot.

B. Component Life and Service

(1) Overhaul or Major Periodic Inspection (MPI)

(a) Overhaul or MPI, is the periodic disassembly, inspection, repair, refinish, and reassembly of the composite blade assembly.

NOTE: The term “overhaul” is used throughout the text of this manual.

(b) At specified periods, the propeller hub assembly and the blade assemblies are completely disassembled and inspected for cracks, wear, corrosion, and other unusual or abnormal conditions. As specified, some blades are refinished, and other blades are replaced.

(c) Overhaul procedures must be performed in accordance with the latest revision of Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35) and other applicable publications. Contact Hartzell Propeller Inc. for overhaul information.

(d) Overhaul and major repairs must be performed by an appropriately rated propeller repair station that is certified by the Federal Aviation Administration (FAA) or international equivalent.

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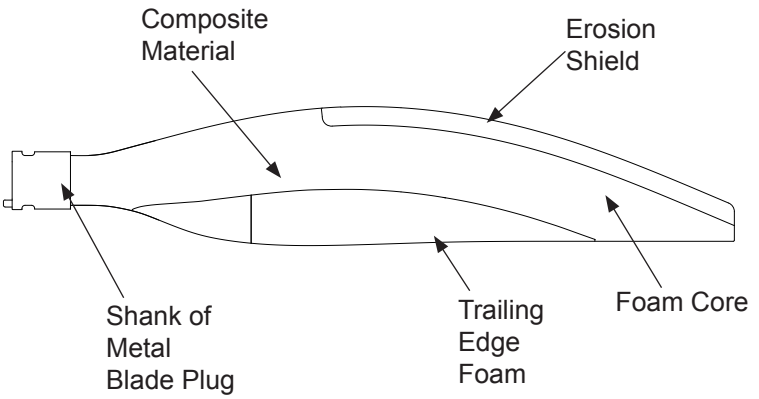


Basic Components of a Composite Blade
Figure 6-2

(2) Damage

(a) Airworthy Damage

CAUTION: DAMAGE THAT IS WITHIN THE AIRWORTHY LIMITS DOES NOT REQUIRE REPAIR BEFORE FURTHER FLIGHT, BUT SHOULD BE REPAIRED AS SOON AS PRACTICABLE TO PREVENT DEGRADATION OF THE DAMAGE.

1 Airworthy damage is a specific condition to a blade identified in Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70) that does not affect the safety or flight characteristics of the propeller blade and conforms to its type design by meeting the condition inspection criteria limitations found in this chapter.

(b) Unairworthy Damage

CAUTION: UNAIRWORTHY DAMAGE MUST BE REPAIRED BEFORE THE NEXT FLIGHT.

1 Unairworthy damage is damage that exceeds the airworthy damage limits as specified in Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

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

b This condition deems the blade unairworthy, requiring appropriate corrective action to repair or remove it from service, as applicable.

(3) Blade Life

Blade life is expressed in terms of total hours of service (TT, or Total Time), time between overhauls (TBO) and in terms of service since overhaul (TSO, or Time Since Overhaul). All references are necessary in defining the life of the propeller.

C. Personnel Requirements

(1) Refer to Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70) for personnel requirement for inspections and/or repairs to Hartzell Propeller Inc. composite parts.

D. Blade Inspection Requirements

CAUTION: MAINTAINING A GOOD LOGBOOK RECORD IS PARTICULARLY IMPORTANT FOR COMPOSITE PROPELLER BLADES. DAMAGE AND/OR REPAIRS MAY SUFFER FURTHER DEGRADATION AFTER CONTINUED USE. SUCH DEGRADATION MAY BE EASILY OVERLOOKED. IT IS IMPORTANT FOR INSPECTORS TO HAVE ACCESS TO ACCURATE HISTORICAL DATA WHEN PERFORMING SUBSEQUENT INSPECTIONS.

(1) Required Record-Keeping

(a) Composite blade damage and a description of any repair must be recorded in the composite blade logbook.

(2) Preflight Inspection

(a) Follow propeller preflight inspection procedures as specified in the aircraft maintenance manual, or an air carrier's operational specifications, or this manual. In addition, perform the following inspections:

1 Visually inspect each entire blade for nicks, gouges, loose material, erosion, cracks and debonds.

2 Visually inspect blades for lightning strike. Refer to "Lightning Strike Damage" in this chapter for a description of damage.

(b) Defects or damage discovered during preflight inspection must be evaluated in accordance with Hartzell Propeller Inc. Field Maintenance and Minor Repair for Composite Blades Manual 170 (61-13-70). This manual is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

(3) Maintenance Inspections

(a) Inspection procedures must be performed in accordance with this manual.

1 Perform a thorough visual inspection.

2 Perform a coin-tap test to the exposed section of the blade not to exceed 1200 hours and the erosion shield surface not to exceed 600 hours. Coin-tapping (described in this chapter) will indicate a delamination or debond by an apparent audible change.

3 Review Blade Damage Repair Sheets in the Records chapter of this manual and carefully inspect areas of airworthy damage and previously repaired areas for growth. If the damaged area has increased, estimate whether the flawed area is larger than the permitted airworthy damage limits. If this is the case, make arrangements to repair at the earliest practical time to prevent further damage to the blade.

4 Defects or damage discovered during scheduled inspections must be evaluated in accordance with allowables outlined later in this chapter to determine if repairs are required before further flight. Although repair of “airworthy damage” is not essential before further flight, such damage should always be repaired as soon as possible, to avoid further degradation. Unairworthy damage must be repaired before further flight.

5 Make a record of the details of all damage and/or repairs on the Blade Damage Repair Sheets in the Records chapter of this manual.

E. Airworthy Damage

(1) Refer to the airworthy damage limits specified in Hartzell Propeller Inc. Field Maintenance and Minor Repair for Composite Blades Manual 170 (61-13-70) are considered unairworthy. This manual is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

F. Unairworthy Damage

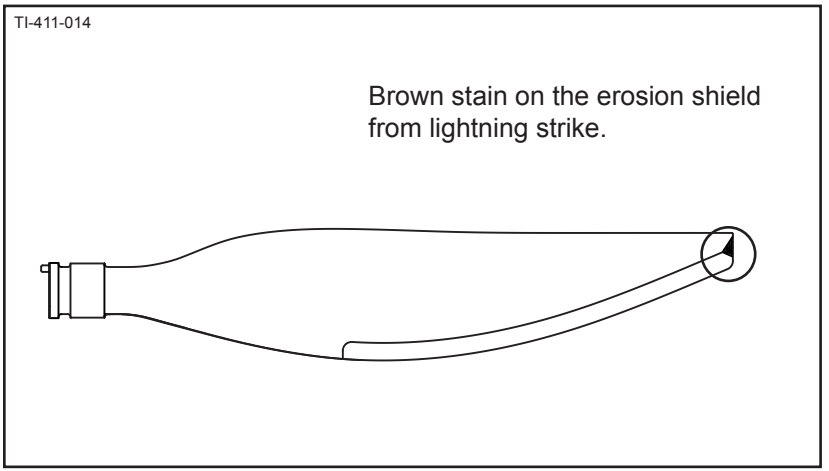
CAUTION: UNAIRWORTHY DAMAGE TO A HARTZELL PROPELLER INC. COMPOSITE BLADE MUST BE REPAIRED BEFORE THE NEXT FLIGHT.

(1) Definition

Any damage that exceeds airworthy damage limits specified in Hartzell Propeller Inc. Field Maintenance and Minor Repair for Composite Blades Manual 170 (61-13-70) are considered unairworthy. This manual is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

(2) Repair

(a) Areas of unairworthy damage must be repaired before further flight.



Evidence of Lightning Strike Damage to Composite Blade
Figure 6-3

G. Lightning Strike Damage - Refer to Figure 6-3.

CAUTION 1: ANY COMPOSITE BLADE SUSPECTED OF LIGHTNING STRIKE MUST BE INSPECTED AND MAY REQUIRE OVERHAUL.

CAUTION 2: CONSULT AIRFRAME MANUFACTURER'S MANUALS. THERE MAY BE ADDITIONAL REQUIREMENTS SUCH AS ICE PROTECTION SYSTEM CHECKS TO PERFORM IN THE EVENT OF PROPELLER LIGHTNING STRIKE.

NOTE: Lightning usually enters the propeller through the metal erosion shield of a blade. The charge typically enters at the tip of the blade and travels through the erosion shield toward the hub. The charge exits the erosion shield at the inboard end and enters the next conductive element in the path.

(1) Visual Inspection

(a) If a lightning strike is suspected, perform a thorough visual inspection, looking for the indications of a lightning strike.

(b) If a lightning strike is present, a darkened area and possible pitting, usually in proximity of the tip and at the most inboard end of the metal erosion shield, will be noticeable. Refer to Figure 6-3.

(c) If the blade has a anti-icing or de-ice boot installed, it may be debonded from the erosion shield due to the strike. In any case, the propeller ice protection system may be damaged.

(d) Lightning strikes may also cause one or all of the following: debonding, lifting, and buckling of the metal erosion shield and delamination and splitting of the laminate.

(e) If no evidence of a lightning strike exists, then further maintenance action is not required.

(2) Additional Inspection

CAUTION: IF EVIDENCE OF A LIGHTNING STRIKE IS DISCOVERED, FURTHER INSPECTION IS REQUIRED BEFORE FURTHER FLIGHT.

(a) A propeller may be permitted to be operated for an additional ten (10) hours before disassembly and inspection in accordance with the applicable overhaul manual. The additional ten (10) hours are permitted if the propeller and blades are not severely damaged, and if the blades meet airworthiness criteria discussed earlier in this section.

CAUTION: CONSULT AIRFRAME MANUFACTURER'S MANUALS. THERE MAY BE ADDITIONAL REQUIREMENTS, SUCH AS PROPELLER ICE PROTECTION SYSTEM CHECKS, TO PERFORM IN THE EVENT OF PROPELLER LIGHTNING STRIKE.

(b) Procedure for Temporary Operation

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

2 Perform visual and coin tap inspections of the composite blades that have indications of arcing. If the damage is minor and does not exceed airworthy damage limits specified earlier in this section, then operation for ten (10) hours is permitted before disassembly and inspection in accordance with the applicable overhaul manual.

(c) Required inspection in the event of a lightning strike.

1 Disassemble the propeller and inspect it in accordance with the applicable overhaul manual. This procedure must be performed by FAA approved personnel.

H. Minor Repair

(1) A complete description of minor repair techniques, tools, and materials is available in Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35) or Hartzell Propeller Inc. Composite Propeller Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

(2) Use only those repair techniques, tools and materials described in Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35). Substitution of materials described in Manual 135F is not permitted, i.e., the use of “Quick Setting” epoxies, unless described in Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35), is not permitted when performing blade repairs.

3. Painting of Composite Blades

A. General

(1) Propeller blades H79A06X( ) are finish coated with a paint that is restricted by U.S. law and is subject to ITAR controls. The export, transfer, and/or disclosure of ITAR information is restricted. Dissemination to non-U.S. persons, whether in the U.S. or abroad requires authorization from the U.S. Department of State.

(a) Contact the airframe manufacturer about the painting instructions.

(2) All propeller blades are painted with a durable specialized coating that is resistant to abrasion. If this coating becomes eroded, it is necessary to repaint the blades to provide proper corrosion and erosion protection. Painting should be performed by an authorized propeller repair station in accordance with Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

Vendor	Color/Type	Vendor P/N	Hartzell P/N
Tempo	Epoxy Black	A-150	A-6741-145-2
Tempo	Epoxy Gray	A-151	A-6741-146-2
Tempo	Epoxy White (tip stripe)	A-152	A-6741-147-2
Tempo	Epoxy Red (tip stripe)	A-153	A-6741-149-2
Tempo	Epoxy Yellow (tip stripe)	A-154	A-6741-150-2
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1
Sherwin-Williams	Gray	F75KXA10445-4311	A-6741-146-1
Sherwin-Williams	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	Bright Red	1326305 or F63TXR16285-4311	A-6741-200-5
Sherwin-Williams	Bright Yellow	1326313 or F63TXY16286-4311	A-6741-201-5

Approved Touch-up Paints
Table 6-1

(3) It is permitted to perform a blade touch-up with aerosol paint in accordance with the procedures in section 3.B. Painting of Composite Blades in this chapter.

(4) Refer to Table 6-1 for paints that are approved for blade touch-up.

(5) The paint manufacturers may be contacted 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. Procedure

WARNING: CLEANING AGENTS (ACETONE, #700 LACQUER THINNER, AND MEK), ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION 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 a clean cloth moistened with acetone, #700 lacquer thinner, or MEK, wipe the surface of the blade to remove any contaminants. Permit the solvent to evaporate.

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

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

(3) Using lacquer thinner 700 or MEK, wipe the surface of the blade, and permit to evaporate.

(4) Apply masking material to the erosion shield, anti-icing or de-ice boot and tip stripes, as needed.

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

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

(5) Apply a sufficient amount of finish coating to achieve 2 to 4 mil 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.

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

(7) Apply sufficient tip stripe coating to achieve 2 to 4 mil thickness when dry.
   (a) Re-coat before 30 minutes, or after 48 hours. Remove the masking material immediately.
   (b) If the paint is permitted to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.

(8) Remove the masking material immediately from the anti-icing or de-ice boot and tip stripes, if required.

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

4. Painting of a Hartzell Propeller Inc. Composite Spinner Assembly

A. General

(1) The 104529 spinner assembly is supplied primed for paint.

CAUTION 1: CAUTION MUST BE TAKEN WHEN PAINTING A PRIMED COMPOSITE SPINNER COMPONENT IN ORDER TO MEET THE P-STATIC DISSIPATION REQUIREMENTS FOR THESE COMPONENTS. IMPROPER P-STATIC DISSIPATION COULD LEAD TO DISTORTION OR DAMAGE OF THE ELECTRONIC COMPONENTS IN THE AIRCRAFT, INCLUDING NAVIGATIONAL EQUIPMENT.

CAUTION 2: THE SCREW HOLES IN THE SPINNER DOME, SPINNER BULKHEAD, AND THE SPINNER FAIRING MUST BE MASKED TO MEET THE P-STATIC REQUIREMENTS.

CAUTION 3: THE MAXIMUM PERMITTED FILM THICKNESS OF PAINT IS IS 2 MILS WHEN DRY.

(2) The components must be finished to the aircraft manufacturer’s specifications using an approved paint before flight.

(3) Spinner dome, bulkhead, and fairing screw holes must be masked before painting.

(4) The maximum permitted thickness of paint is 2 mils dry.

B. Resistance check of the bulkhead

(1) Perform the resistance check of the spinner dome and the spinner bulkhead in accordance with the procedures specified in the Installation and Removal chapter of this manual.

5. Dynamic Balance

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. CONTACT HARTZELL PROPELLER INC. FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. Overview

CAUTION: IF REFLECTIVE TAPE IS USED FOR DYNAMIC BALANCING, REMOVE THE TAPE IMMEDIATELY AFTER BALANCING IS COMPLETED.

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

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

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

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

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

(4) For a Hartzell Propeller Inc. aluminum bulkhead, dynamic balance weights may be attached with nut plates or with through drilled holes.

(5) For a Hartzell Propeller Inc. composite bulkhead, dynamic balance weights may only be attached with through drilled holes.

(6) For a bulkhead supplied by another manufacturer, refer to the manufacturer's instructions for attachment of dynamic balance weights.

B. Inspection Procedures Before Dynamic 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 oil on the blades and inner surface of the spinner dome.

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

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

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

(2) If there is evidence of oil leakage, determine the location of the leak and correct.

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

(a) Bantam propeller static balance weights are installed on a balance ring attached to the cylinder of the propeller.

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

(4) Determine if the bulkhead is aluminum or composite.

(5) Determine if the bulkhead has been modified to permit attachment of dynamic balance weights.

C. Placement of Dynamic Balance Weights for Dynamic Balance

CAUTION: DO NOT INSTALL DYNAMIC BALANCE WEIGHTS ON THE BALANCE RING INSTALLED ON THE CYLINER ON THE FRONT OF THE PROPELLER HUB.

(1) Dynamic balance weights must be added to the spinner bulkhead.

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

(2) 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).

(a) 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) For an aluminum bulkhead:

(a) Install dynamic weights:

1 Use aircraft quality #10-32 screws or bolts when installed with nut plates.

2 Use AN-3( ) type screws or bolts and self-locking nuts when installed in through drilled holes.

(6) For a composite bulkhead,

(a) Install dynamic weights using aircraft quality AN-3( ) type screws or bolts and self-locking nuts in through drilled holes.

(b) A stainless or plated steel washer must be used on each side of the bulkhead under the screw and the nut.

(7) 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.

(a) It may be necessary to alter the number and/or location of static balance weights to achieve dynamic balance.

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

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

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

D. Modifying Spinner Bulkhead to Accommodate Dynamic Balance Weights

CAUTION 1: ALL HOLE AND DYNAMIC BALANCE WEIGHT LOCATIONS MUST TAKE INTO CONSIDERATION, AND MUST AVOID, ANY POSSIBILITY OF INTERFERING WITH THE ADJACENT AIRFRAME, PROPELLER ICE PROTECTION SYSTEM, AND ENGINE COMPONENTS.

CAUTION 2: DO NOT INSTALL DYNAMIC BALANCE WEIGHTS ON THE BALANCE RING INSTALLED ON THE CYLINER ON THE FRONT OF THE PROPELLER HUB.

(1) Dynamic balance weights must be placed in a radial location on aluminum or composite spinner bulkheads.

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

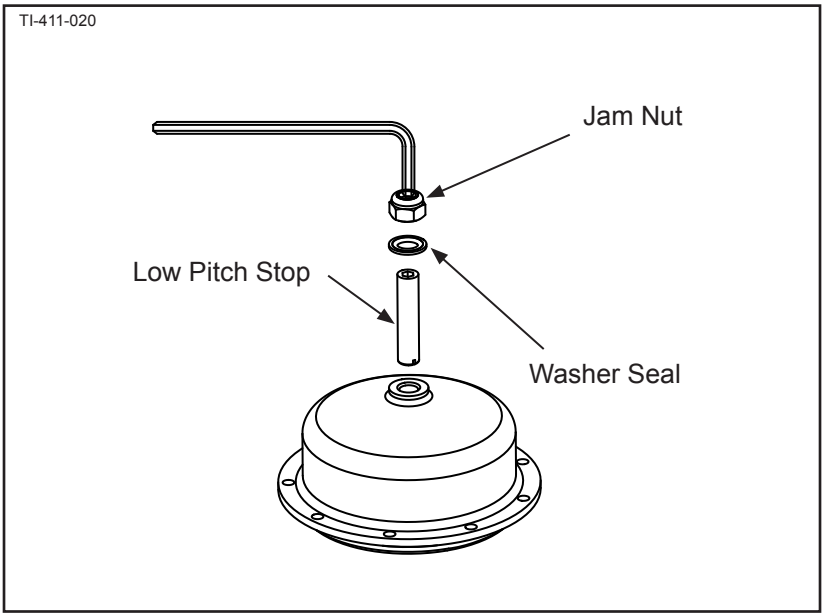
(3) Twelve equally spaced locations are recommended for weight attachment.

(4) Aluminum bulkhead only:

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

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

(6) Chadwick-Helmuth Manual AW-9611-2, “The Smooth Propeller”, specifies several generic bulkhead modification procedures. These are permitted if they comply with the conditions specified herein.



Low Pitch Stop Adjustment ( )(A,B)1 Series Three Blade Propellers
Figure 6-4

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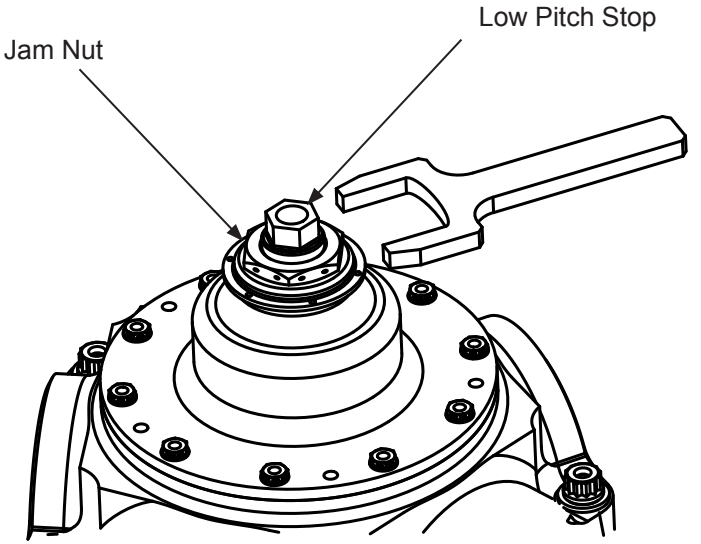

Low Pitch Stop Adjustment ( )(A,B)1 Series
Five Blade Propellers
Figure 6-5

6. Propeller Low Pitch Setting

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

WARNING 2: LOW PITCH BLADE ANGLE ADJUSTMENTS MUST BE MADE IN ACCORDANCE WITH THE APPLICABLE TYPE CERTIFICATE OR SUPPLEMENTAL TYPE CERTIFICATE HOLDER'S MAINTENANCE DATA.

A. Low Pitch Stop - All Propeller Models

(1) The propeller low pitch stop is set at the factory to the aircraft TC or STC Holder's requirements and should not require any additional adjustment. The TC or STC Holder provides the required low pitch stop blade angle and may also provide the acceptable RPM range for a maximum power static condition. Be aware that the aircraft TC or STC holder may specify the static RPM to be less than the RPM to which the engine is rated.

(2) An overspeed at the maximum power static condition may indicate that the propeller low-pitch blade angle is set too low and that the governor is improperly adjusted.

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

B. Max. RPM (Static) Low Pitch Stop Adjustment

WARNING: SIGNIFICANT ADJUSTMENT OF THE LOW PITCH STOP TO ACHIEVE THE SPECIFIED STATIC RPM MAY MASK AN ENGINE POWER PROBLEM.

Refer to the following applicable procedure for accomplishing an adjustment to the low pitch angle:

(1) Three Blade Non-Feathering ( )(A,B)1 Series Low Pitch Stop Adjustment

(a) Refer to Figure 6-4. Loosen the jam nut while holding the low pitch stop with an allen wrench to prevent the low pitch stop from turning as the jam nut is loosened. Turning the low pitch stop in will increase blade pitch to reduce RPM, and turning the low pitch stop out will lower blade pitch and increase RPM. The low pitch stop has 24 threads per inch.

1 Turning the stop 3/4 of a turn (0.030 inch [0.762 mm] of linear travel) will change the blade pitch by approximately one degree. One degree of blade pitch will change engine RPM by approximately 140-150 RPM.

2 Turning the low pitch stop screw one revolution equals 0.042 inch (1.06 mm) of linear travel, and results in approximately 1.4 degree blade angle change. This blade angle change results in an RPM increase/decrease of approximately 200 RPM.

WARNING: A MINIMUM OF FIVE THREADS IN THE CYLINDER MUST ENGAGE THE LOW PITCH STOP AFTER ADJUSTMENT IS COMPLETED.

(b) When the low pitch stop is adjusted, torque the low pitch stop jam nut in accordance with Torque Table 3-1.

(c) Repeat the Static RPM Check in the Testing and Troubleshooting chapter of this manual.

(2) Five Blade Non-Feathering ( )(A,B)1 Series Low Pitch Stop Adjustment

(a) Refer to Figure 6-5. Loosen the jam nut while holding the low pitch stop with an wrench to prevent the low pitch stop from turning as the jam nut is loosened. Turning the low pitch stop in will increase blade pitch to reduce RPM, and turning the low pitch stop out will lower blade pitch and increase RPM. The low pitch stop has 12 threads per inch.

1 Turning the stop 3/4 of a turn (0.062 inch [1.57 mm] of linear travel) will change the blade pitch by approximately two degrees. One degree of blade pitch will change engine RPM by approximately 140-150 RPM.

2 Turning the low pitch stop screw one revolution equals 0.083 inch (2.10 mm) of linear travel, and results in approximately 2.8 degree blade angle change. This blade angle change results in an RPM increase/decrease of approximately 400 RPM.

WARNING: A MINIMUM OF FIVE THREADS IN THE CYLINDER MUST ENGAGE THE LOW PITCH STOP AFTER ADJUSTMENT IS COMPLETED.

(b) When the low pitch stop is adjusted, torque the low pitch stop jam nut in accordance with Torque Table 3-1.

(c) Repeat the Static RPM Check in the Testing and Troubleshooting chapter of this manual.

7. Propeller High Pitch Settings

A. High Pitch (Min. RPM) Stop

(1) The high pitch stops are set at the factory per the aircraft manufacturer's recommendations. Adjustment of the high pitch stop requires partial disassembly of the propeller and can only be performed by a certified propeller repair station with the appropriate rating.

8. Propeller Ice Protection Systems

A. Electric De-ice System

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

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

B. Anti-ice System

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

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

Blade Model	Description	Tape Length (per Blade)
75A01-2( )	a blade that does not have a de-ice or anti-icing boot installed	14.851 inches (377.22 mm)
L76A01X( )	a blade that does not have a de-ice or anti-icing boot installed	15.6 inches (396.24 mm)
H79A06X( )	a blade that does not have a de-ice or anti-icing boot installed	14.875 inches (377.82 mm)

Erosion Tape
Table 6-2

CM Number	Hartzell Part Number	Description
CM158	A-6741-158, CM158	Erosion Tape
CM106	N/A	Methyl-Ethyl-Keytone (MEK)
CM219	N/A	Methyl Propyl Ketone (MPK)
CM173	N/A	Acetone
N/A	N/A	Cheesecloth, Grade 90 CM159, locally procured
N/A	N/A	Masking Tape, locally procured
N/A	N/A	3M Adhesive Promoter 86A,CM124, optional

Erosion Tape Installation Consumables
Table 6-3

Tooling
Ball Point Pen or Pencil, locally procured
Measuring Tape, locally procured
Rubber Roller TE330 or Silicon Roller TE331

Erosion Tape Installation Tooling
Table 6-4

9. Installation of Erosion Tape CM158

A. General

(1) This section provides the procedures for the installation of erosion tape CM158 on a blade that will not have an anti-icing or de-ice boot installed.

(a) For the installation of erosion tape CM158 on a blade that has a de-ice boot installed, refer to Hartzell Propeller Inc. Propeller Electrical De-ice Boot Removal and Installation Manual 182 (61-12-82).

(b) For the installation of erosion tape CM158 on a blade that has an anti-icing boot installed, refer to Hartzell Propeller Inc. Propeller Anti-icing Boot Removal and Installation Manual 183 (61-12-83).

(2) Application of erosion tape CM158 is required for the blade models listed in Table 6-2.

(3) Application of erosion tape CM158 is optional but highly recommended for all other models of composite blades.

(4) A minimum temperature of 60°F (10°C) is required for erosion tape CM158 application.

(5) Keep hands clean at all times.

(6) Paint must cure for a minimum of 8 hours before installing erosion tape CM158.

B. Materials Required

(1) Consumables

(a) For additional information about CM numbers or materials refer to the Consumable Materials chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) or contact the Hartzell Propeller Inc. Product Support Department.

(b) Refer to Table 6-2.

(2) Tools

(a) For additional information about TE numbers or materials in this manual refer to the Hartzell Propeller Inc. Illustrated Tool and Equipment Manual 165 (61-00-65) or contact the Hartzell Propeller Inc. Product Support Department.

(b) Refer to Table 6-4.

C. Installation Procedure

CAUTION: DO NOT INSTALL EROSION TAPE CM158 ON A BLADE THAT HAS PAINT THAT HAS CURED LESS THAN 8 HOURS.

(1) Preparation

(a) Cut the appropriate length of erosion tape CM158 in accordance with Table 6-2.

(b) Radius the corners of the erosion tape CM158 to 0.5 inch (13 mm) to remove any sharp corners.

(c) Using a pencil or a ball point pen, measure and make a mark on the nonadhesive side of the erosion tape CM158 to indicate the centerline of the erosion tape.

(d) Using a non-graphite pencil CM162 or equivalent, measure and make a mark on the blade 1.00 inch (25.4 mm) outboard of the metal blade shank near the leading edge.

1 This alignment mark on the blade will be used to align the inboard edge of the erosion tape at installation.

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

(e) Using a clean cloth dampened with solvent CM106 (MEK), CM219 (MPK), or CM41 (toluene) thoroughly clean the area of the blade where the erosion tape CM158 will be installed.

1 Using a clean, lint-free cloth, immediately wipe the area dry.

2 Permit the area to air dry.

3 Repeat the cleaning and drying of the area.

(2) Application of Optional Adhesive Promoter CM124

NOTE: Adhesive promoter CM124 will increase the adhesion between the erosion tape CM158 and the blade.

(a) Using masking tape or equivalent as masking material, apply the masking material to the perimeter of the area where the erosion tape CM158 will be installed.

(b) Apply a thin, uniform layer of adhesive promoter CM124 to the area of the blade where the erosion tape CM158 will be installed.

(c) Remove the masking material.

CAUTION: THE ADHESIVE PROMOTER CM124 WILL BEGIN TO LOSE ADHESION AFTER 60 MINUTES AT ROOM TEMPERATURE.

(d) Permit the adhesive promoter CM124 to dry at room temperature for a minimum of 15 minutes and a maximum of 60 minutes.

(3) Installation of the Erosion Tape CM158

(a) Peel the backing material from the erosion tape CM158.

(b) Holding the erosion tape CM158 with the adhesive side toward the blade, align the end of the erosion tape with the the alignment mark on the blade (outboard of the metal shank and near the leading edge), while aligning the centerline that was marked on the erosion tape with the leading edge of the blade.

(c) Press the erosion tape CM158 into position on the leading edge of the blade while maintaining light tension on the erosion tape to minimize air bubbles and keep the tape straight.

(d) Using a roller, such as TE330 or TE331, or fingers, press the erosion tape CM158 down onto the leading edge of the blade.

(e) Using a roller, such as TE330 or TE331, or fingers, work the erosion tape CM158 into position on one side of the blade.

1 Starting at the outboard end of the blade and working toward the shank, use a hard rubber or nylon roller, such as TE330 or TE331, or fingers to firmly seat the erosion tape CM158 to the blade.

2 Make sure that there are no wrinkles and that no air is trapped under the erosion tape CM158.

CAUTION: DO NOT DAMAGE THE BLADE WHEN REMOVING AIR BUBBLES.

3 Remove air bubbles under the erosion tape by carefully puncturing the erosion tape CM158 with a sharp pin and pressing out the trapped air.

(f) Repeat the procedure on the other side of the blade.

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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 anti-icing boot.

2. System Description

A. De-ice System

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

The de-ice system is controlled by the pilot via a cockpit control switch. This switch applies 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 allows the pilot to select two cycling speeds, for heavy or light icing conditions. Some systems on twin engine aircraft have a switch that provides a full de-ice mode, 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 meter may indicate total system load, or a separate meter may be supplied for each propeller.

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

A brush block 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

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

The anti-ice fluid is delivered through a filter, a check valve, and then through tubing to a slinger ring located at the rear of the spinner bulkhead. The anti-ice fluid is dispensed into the rotating slinger ring, 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 boot.

The blade anti-icing boot are ridged rubber sheets which are glued to the leading edge of the blades. The ridges in the anti-icing boot direct the fluid out onto the blades and allow for an even distribution of the anti-ice fluid across the blades.

3. De-ice System Functional Tests

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

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

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

4. Anti-ice System Functional Tests

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

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

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

5. De-ice and Anti-ice System Inspections

The inspections detailed below are made on a regular basis, either before flight, during the 100 hour inspection, or if a problem is found. 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

6. De-ice and Anti-ice 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

   Federal Aviation Regulations require that a record be kept of any repairs, adjustments, maintenance, or required inspections performed on a propeller or propeller system.

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

2. Record Keeping

   A. Information to be Recorded

      (1) Information which is required to be recorded is listed in Part 43 of the U.S. Federal Aviation Regulations.

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

         (a) Propeller position (on aircraft)

         (b) Propeller model

         (c) Propeller serial number

         (d) Blade design number

         (e) Blade serial numbers

         (f) Spinner assembly part number

         (g) Propeller pitch range

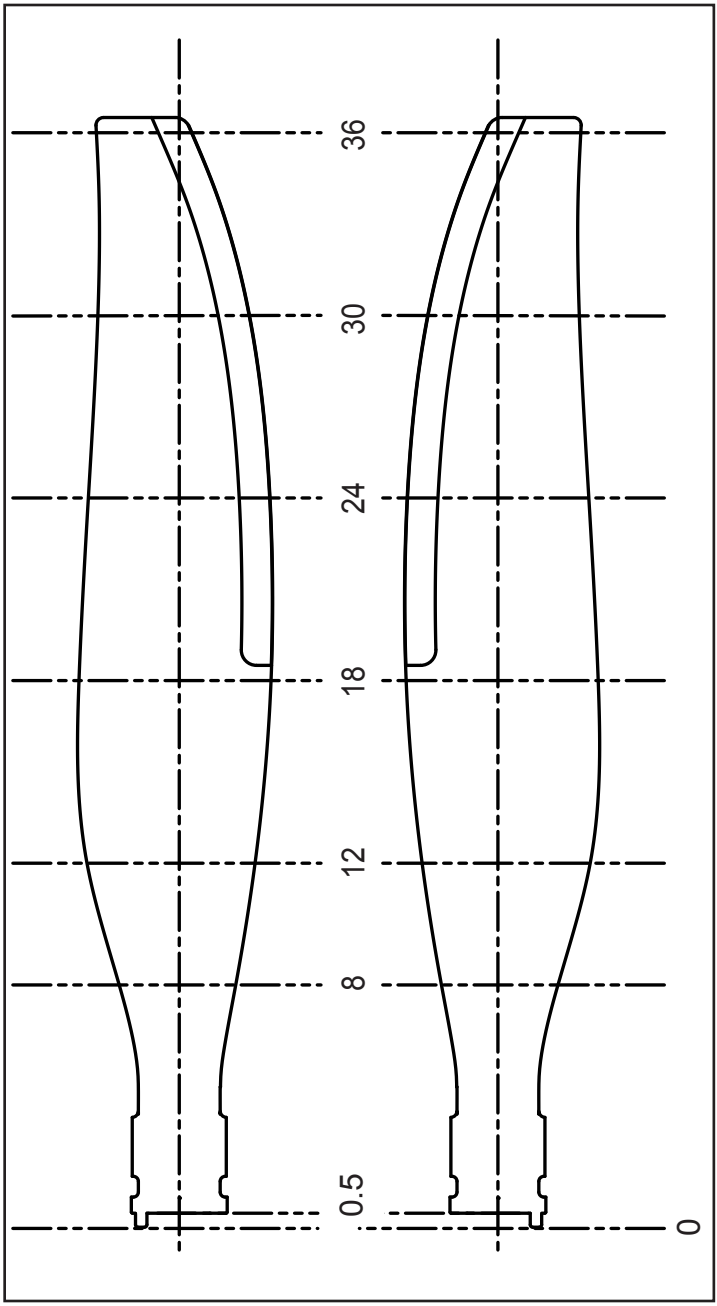
         (h) Aircraft information (aircraft type, model, serial number and registration number)

   B. Blade Damage Repair Sheets

      NOTE: The use of the Blade Damage Repair Sheets in this chapter is at the discretion of the user.

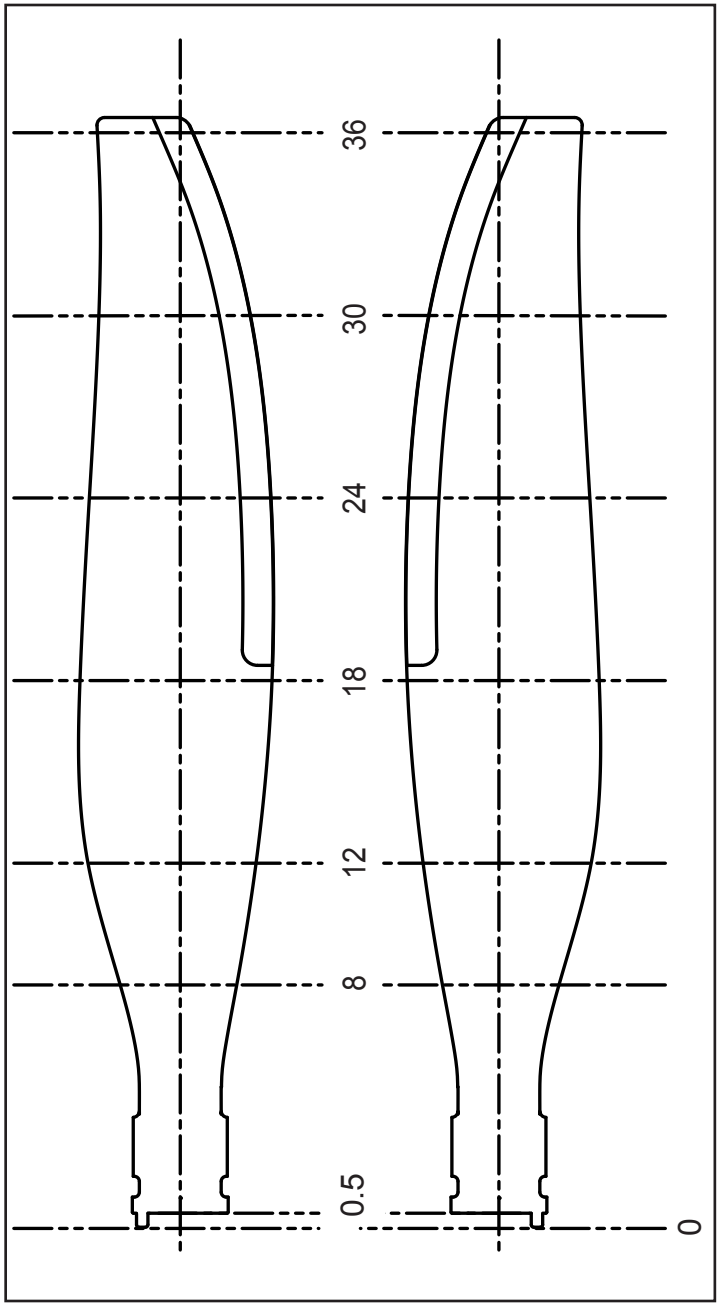
Record of 75A01-2( ) Composite Blade Damage Repair

Blade Serial No. _____



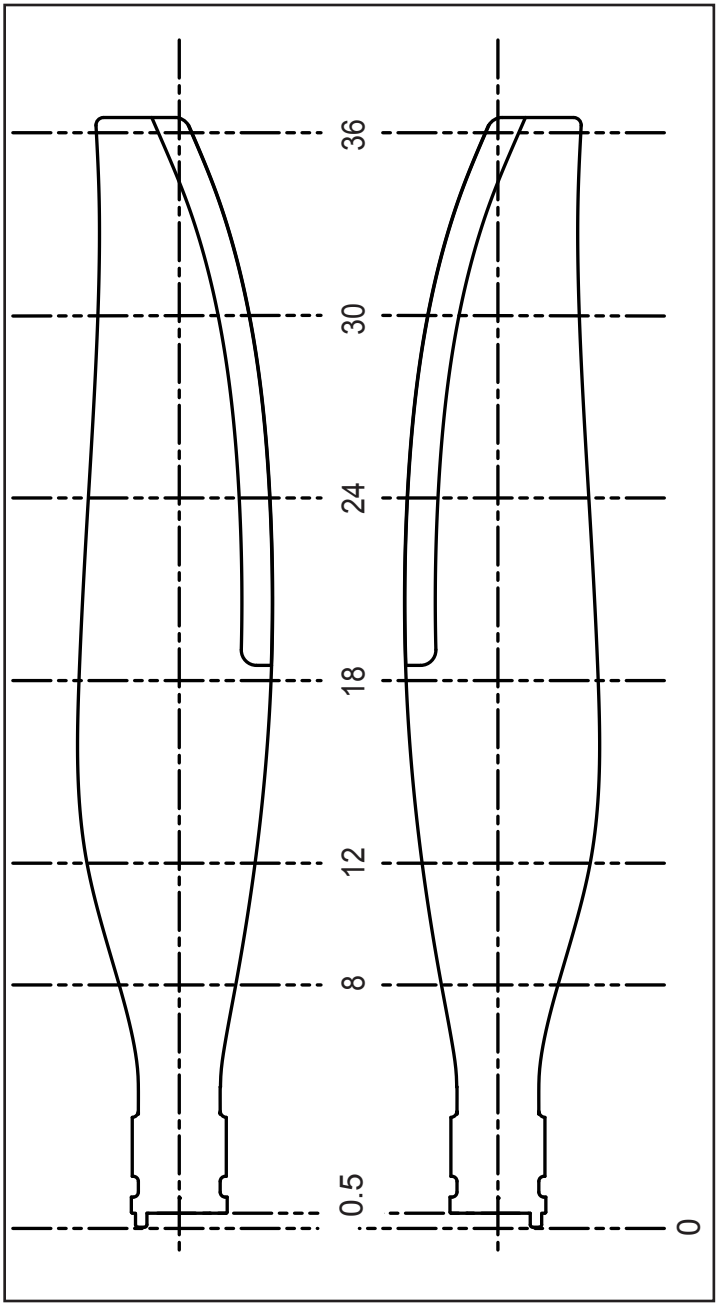
Record of 75A01-2( ) Composite Blade Damage Repair

Blade Serial No. _____



Record of 75A01-2( ) Composite Blade Damage Repair

Blade Serial No. _____



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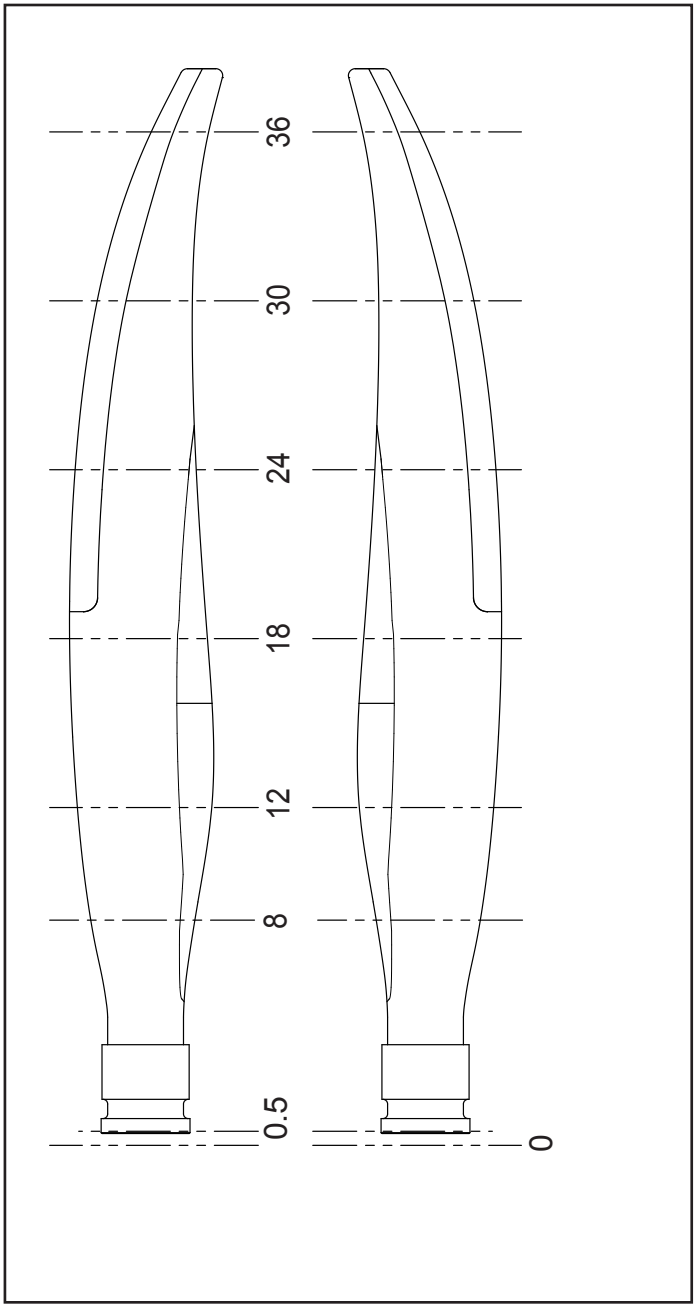
Record of L76A01X( ) Composite Blade Damage Repair

Blade Serial No. _____



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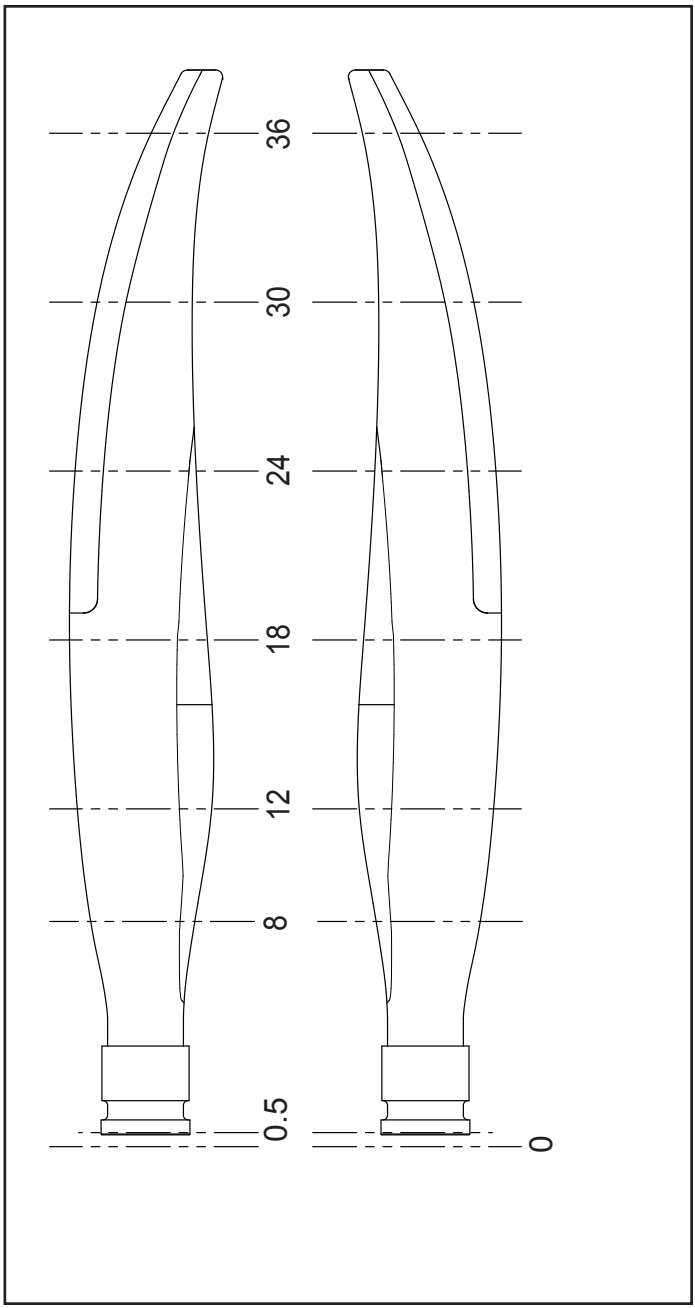

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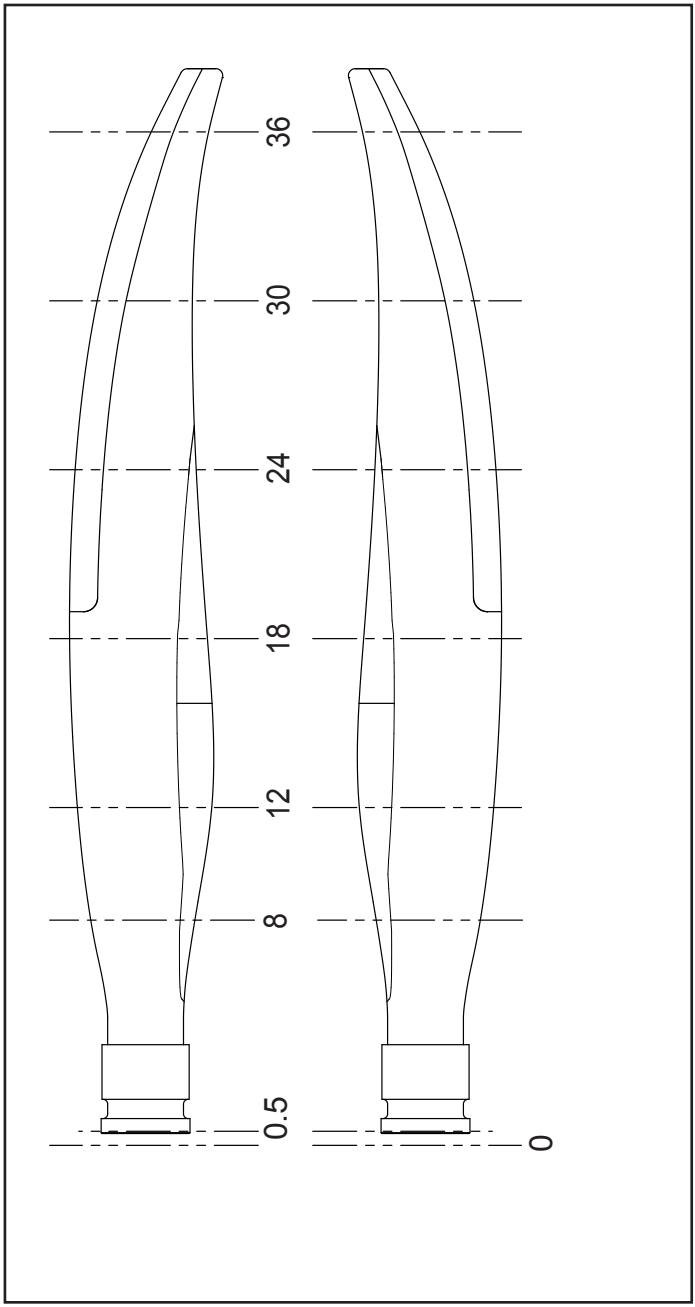

Record of L76A01X( ) Composite Blade Damage Repair

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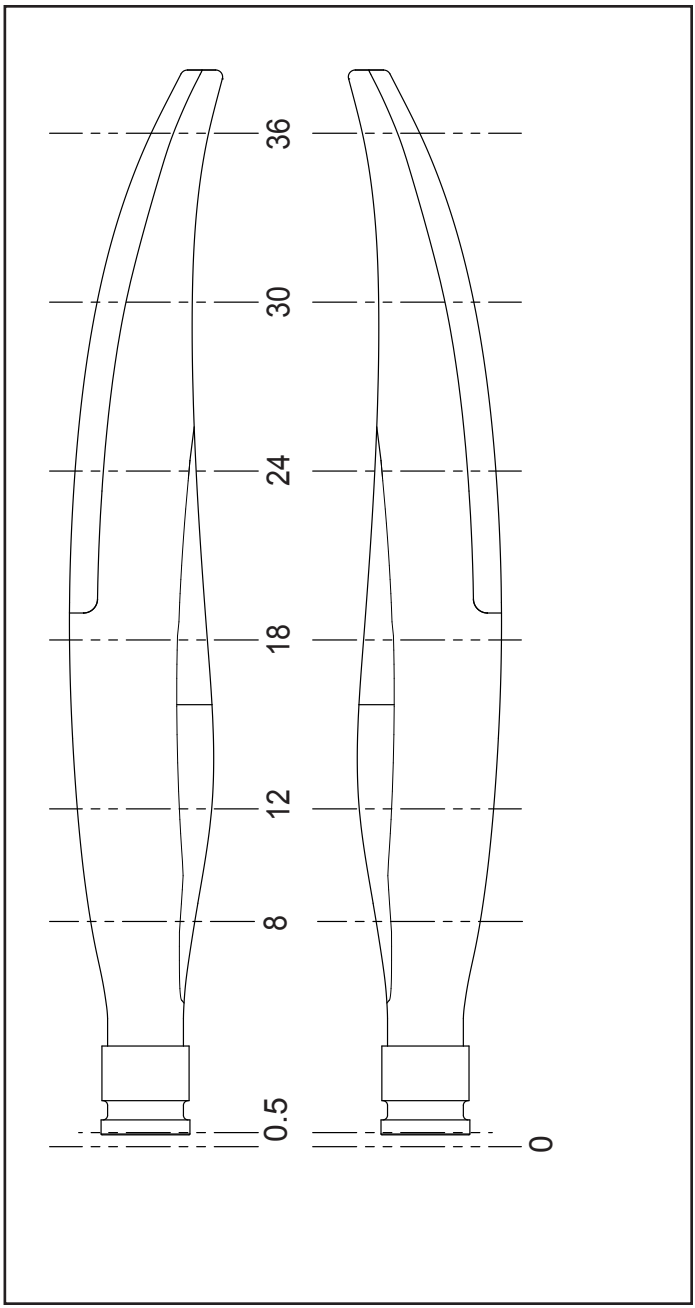

Record of L76A01X( ) Composite Blade Damage Repair

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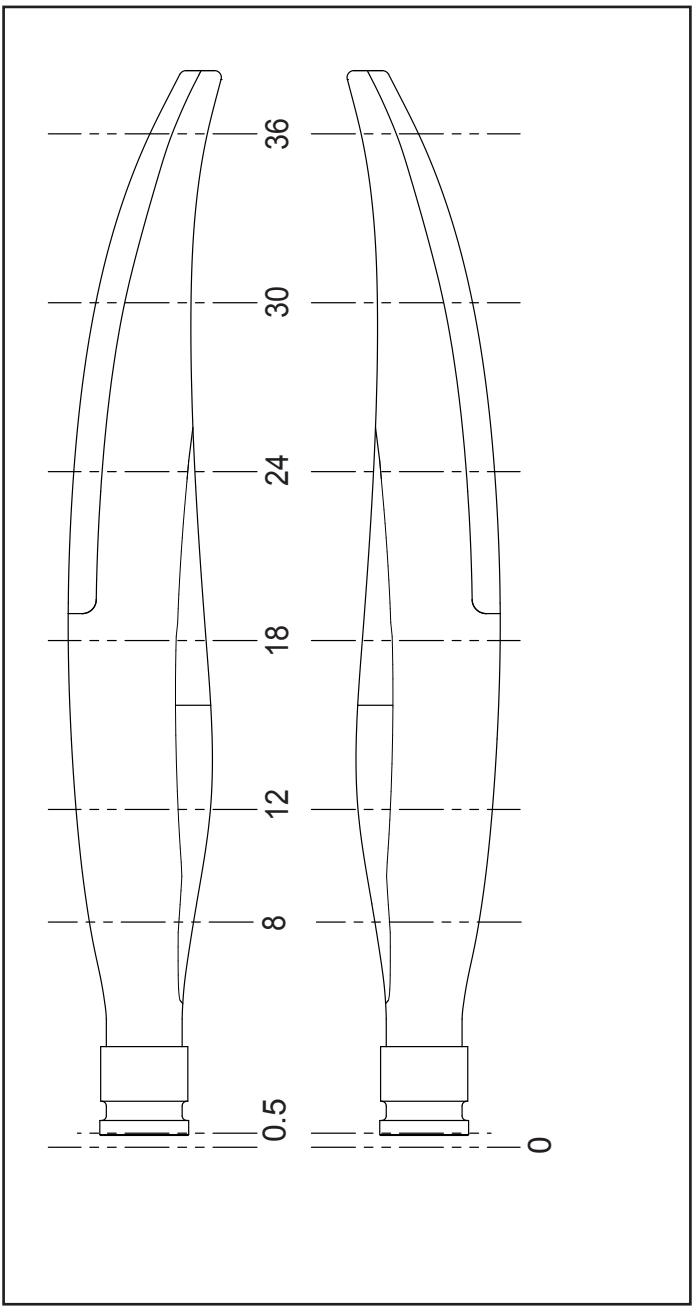

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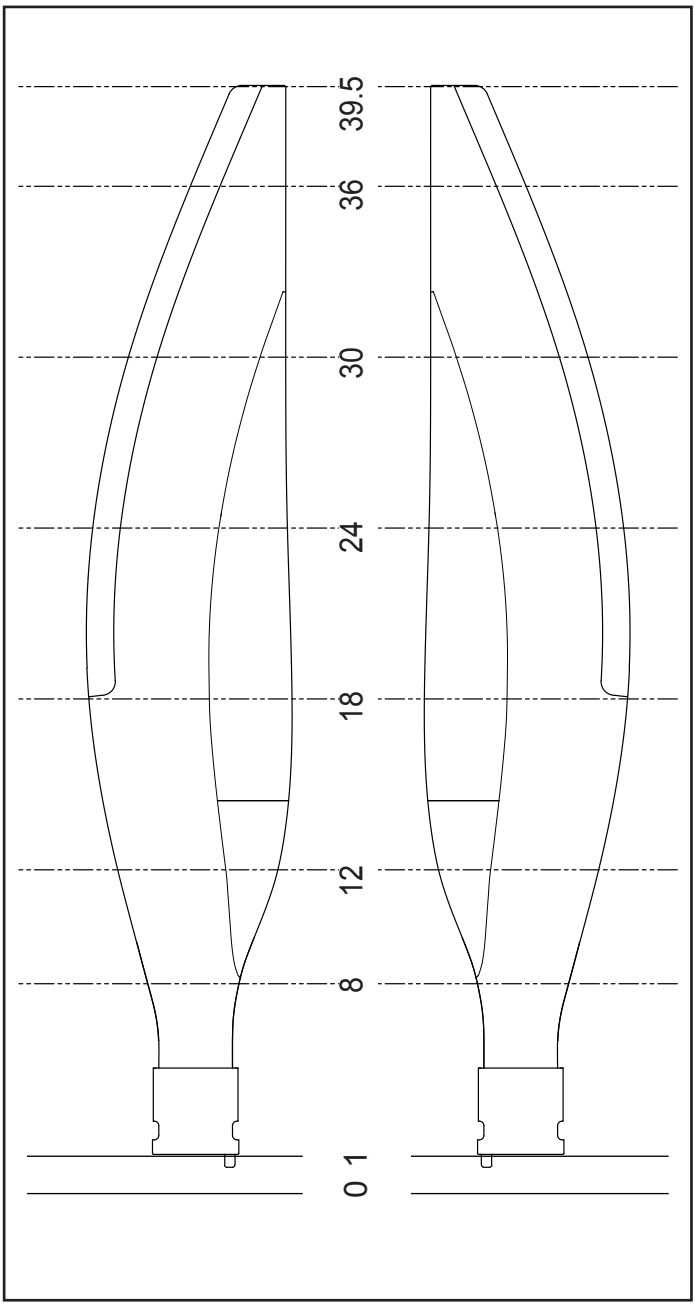

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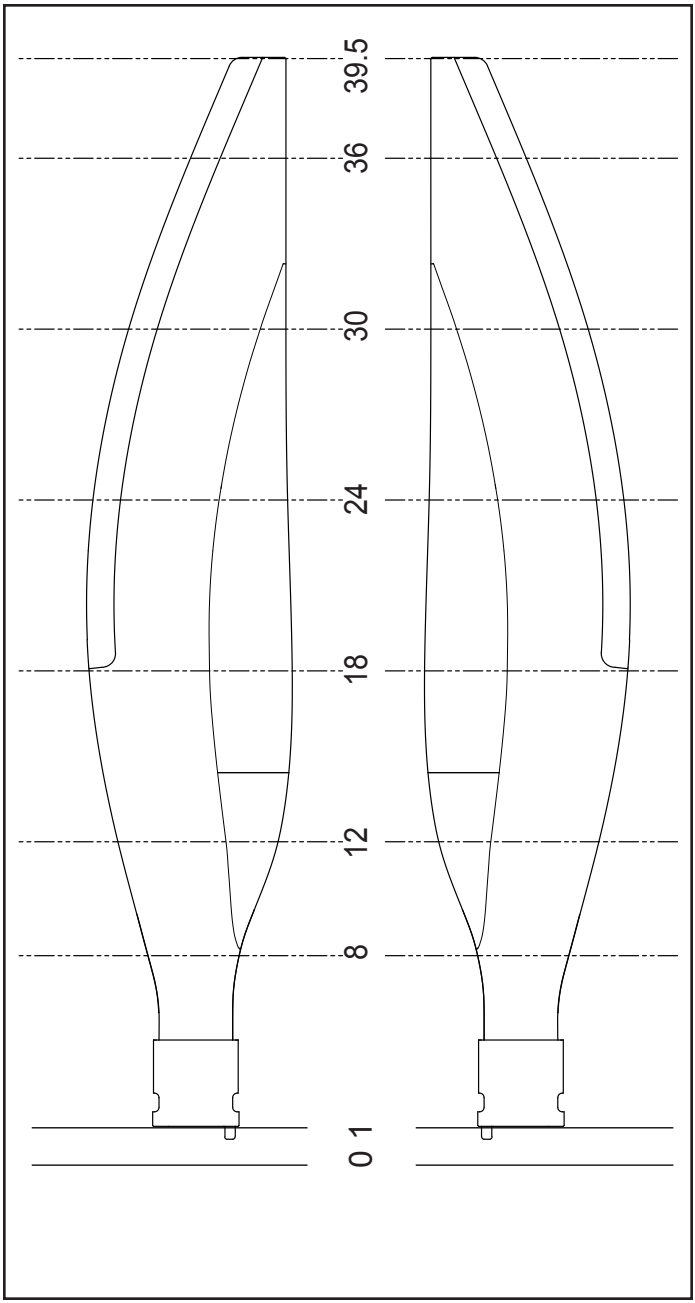

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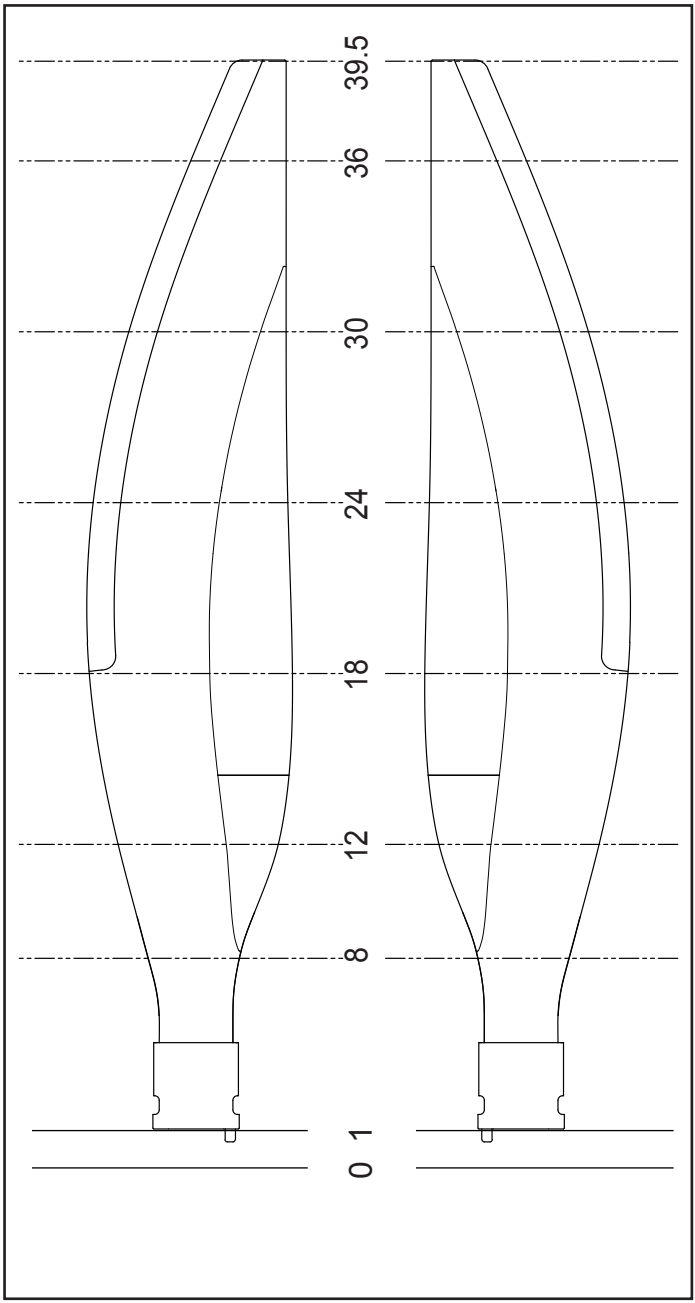

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