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Revision 3
July 2026

Propeller Owner's Manual
and Logbook

Falcon-series Propellers

Models: 3H1-( )( )( )

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

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

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

JJ Frigge
President, Hartzell Propeller LLC

WARNING (Rev. 5)

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

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

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

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

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

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

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

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

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REVISION 3 HIGHLIGHTS

Revision 3, dated July 2026, incorporates the following:

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

Minor language/format changes and renumbering will be marked with a revision bar but not listed in this section.

TESTING AND TROUBLESHOOTING

- Removed the section, "Oil Leakage"

INSPECTION AND CHECK

- Revised the section, "Grease Leakage"

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REVISION 3 HIGHLIGHTS

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

Revision No.	Issue Date	Comments
Original	Jan/25	New Issue
Rev. 1	Mar/25	Minor Revision
Rev. 2	Aug/25	Minor Revision
Rev. 3	Jul/26	Minor Revision

RECORD OF REVISIONS

Rev. No.	Issue Date	Date Inserted	Inserted By
Original	Jan/25	Jan/25	HP
1	Mar/25	Mar/25	HP
2	Aug/25	Aug/25	HP
3	Jul/26	Jul/26	HP

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RECORD OF TEMPORARY REVISIONS

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

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SERVICE DOCUMENTS LIST

CAUTION 1: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF THE SERVICE DOCUMENT. INFORMATION CONTAINED IN A SERVICE DOCUMENT MAY BE SIGNIFICANTLY CHANGED FROM EARLIER REVISIONS. 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

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AIRWORTHINESS LIMITATIONS

Refer to Hartzell Product Support Department for Airworthiness Limitations.

Rev. No.	Description of Revision
Orig.	New Manual

AIRWORTHINESS LIMITATIONS

1. Contact Hartzell Propeller Product support for specific life limits for certain component parts as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.
2. The following data summarizes all current information concerning Hartzell life limited parts, as related to propeller models affected by this manual. These parts are not life limited on other installations; however, time accumulated toward life limit accrues when first operated on aircraft/engine/propeller combinations listed and continues regardless of subsequent installations (that may or may not be life limited).
   A. Propeller models affected by this manual currently do not have any life limited parts.
   B. There are no new (or additional) Airworthiness Limitations associated with this equipment and/or installation.

LIST OF EFFECTIVE PAGES

Chapter	Page	Revision	Date
Cover/Inside Cover	Cover/Inside Cover	Rev. 3	Jul/26
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INTRODUCTION - CONTENTS, continued

1. General (Rev. 2)

   A. Statement of Purpose

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

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

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

      (2) This manual may include multiple design types.

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

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

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

B. Maintenance Practices

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

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

(3) Avoid the use of blade paddles. If blade paddles must be used, use at least two paddles. Put the blade paddle in the thickest area of the blade. Use one blade paddle per blade.

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

(5) Observe applicable torque values during maintenance.

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

(a) Hartzell Propeller statically balances all new propellers.

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

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

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

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

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

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

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

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

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

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

2. Airframe or Engine Modifications (Rev. 2)

A. Propeller Stress Levels

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

B. Engine Modifications

(1) Engine modifications can affect the propeller. The two primary categories of engine modifications are those that affect structure and those that affect power. An example of a structural engine modification is the alteration of the crankshaft or damper of a piston engine. Any change to the weight, stiffness, or tuning of rotating components could result in a potentially dangerous resonant condition that is not detectable by the pilot. Most common engine modifications affect the power during some phase of operation. Some modifications increase the maximum power output, while others improve the power available during hot and high operation (flat rating) or at off-peak conditions.

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

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

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

3. Restrictions and Placards (Rev. 1)

A. Important Information

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

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

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

4. Reference Publications

A. Hartzell Propeller Publications

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

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

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

Manual No. (ATA No.)	Hartzell Propeller Manual Title
n/a	Active Hartzell Propeller Service Bulletins, Service Letters, Service Instructions, and Service Advisories
Manual 159 (61-02-59)	Application Guide
Manual 165A (61-00-65)	Illustrated Tool and Equipment Manual
Manual 170 (61-13-70)	Composite Blade Field Maintenance and Minor Repair Manual
Manual 202A (61-01-02)	Standard Practices Manual, Volumes 1 through 11
Manual 675 (61-10-75)	Falcon Series Propeller Overhaul Manual - For 3H1-( )( )( )

B. Vendor Publications

None.

5. Personnel Requirements
   A. Service and Maintenance Procedures in this Manual
      (1) Personnel performing the service and maintenance procedures in this manual are expected to have the required equipment/tooling, training, and certifications (when required by the applicable Aviation Authority) to accomplish the work in a safe and airworthy manner.
      (2) Compliance to the applicable regulatory requirements is mandatory for anyone performing or accepting responsibility for the inspection and/or repair of any Hartzell Propeller LLC product..
6. Special Tooling and Consumable Materials (Rev. 2)
   A. Special Tooling
      (1) Special tooling may be required for procedures in this manual. For further tooling information, refer to Hartzell Propeller Illustrated Tool and Equipment Manual 165A (61-00-65).
         (a) Tooling reference numbers appear with the prefix “TE” directly following the tool name to which they apply. For example, a template that is reference number 133 will appear as: template TE133.
   B. Consumable Materials
      (1) Consumable materials are referenced in certain sections throughout this manual. Specific approved materials are listed in the Consumable Materials chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).
         (a) Consumable material reference numbers appear with the prefix “CM” directly following the material to which they apply. For example, an adhesive that is reference number 16 will appear as: adhesive CM16. Only the material(s) specified can be used.

7. Safe Handling of Paints and Chemicals (BP-1)
   A. Instructions for Use
      (1) Always use caution when handling or being exposed to paints and/or chemicals during propeller overhaul and/or maintenance procedures.
      (2) Before using paint or chemicals, always read the manufacturer's label on the container(s) and follow specified instructions and procedures for storage, preparation, mixing, and/or application.
      (3) Refer to the product's Material Safety Data Sheet (MSDS) for detailed information about the physical properties, health, and physical hazards of any paint or chemical.
8. Calendar Limits and Long Term Storage (BP-3)
   A. Calendar Limits
      (1) The effects of exposure to the environment over a period of time create a need for propeller overhaul regardless of flight time.
      (2) For calendar limit between overhauls, refer to the section, "Overhaul Periods" in the ASTM Data chapter of this manual.
      (3) Experience has shown that special care, such as keeping an aircraft in a hangar, is not sufficient to permit extension of the calendar limit.
      (4) The start date for the calendar limit is when the propeller is first installed on an engine.
      (5) The calendar limit is not interrupted by subsequent removal and/or storage.
      (6) The start date for the calendar limit must not be confused with the warranty start date, that is with certain exceptions, the date of installation by the first retail customer.
   B. Long Term Storage
      (1) Propellers that have been in storage have additional inspection requirements before installation. Refer to the Packaging and Storage chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

9. Component Life and Overhaul (BP-4)

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

A. Component Life

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

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

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

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

(a) Refer to Hartzell Propeller Service Letter HC-SL-61-61Y for definitions and instructions regarding TSN and TSO.

(b) Refer to the Airworthiness Limitations chapter in the applicable Hartzell Propeller Owner’s Manual for a list of life limited components.

B. Overhaul

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

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

(a) For overhaul intervals, refer to the section, “Overhaul Periods” in the ASTM Data chapter of this manual.

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

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

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

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

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

10. Damage/Repair Types (BP-2)
    A. Airworthy/Unairworthy Damage
        (1) Airworthy damage is a specific condition to a propeller component that is within the airworthy damage limits specified in the applicable Hartzell Propeller component maintenance manual.
            (a) Airworthy damage does not affect the safety or flight characteristics of the propeller and conforms to its type design.
            (b) Airworthy damage does not require repair before further flight, but should be repaired as soon as possible to prevent degradation of the damage.
        (2) Unairworthy damage is a specific condition to a propeller component that exceeds the airworthy damage limits specified in the applicable Hartzell Propeller component maintenance manual.
            (a) Unairworthy damage can affect the safety or flight characteristics of the propeller and does not conform to its type design.
            (b) Unairworthy damage must be repaired before the propeller is returned to service.
    B. Minor/Major Repair
        (1) Minor Repair
            (a) Minor repair is that which may be done safely in the field by a certified aircraft mechanic.
                1 For serviceable limits and repair criteria for Hartzell propeller components, refer to the applicable Hartzell Propeller component maintenance manual.

(2) Major Repair

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

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

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

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

11. Propeller Critical Parts (BP-2)

A. Important Information

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

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

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

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

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

12. Warranty Service (BP-3)
    A. Warranty Claims
        (1) If you believe you have a warranty claim, contact the Hartzell Propeller Product Support Department to request a *Warranty Application* form. Complete this form and return it to Hartzell Propeller Product Support for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the Product Support Department will provide instructions on how to proceed.
            (a) For Hartzell Propeller Product Support Department contact information, refer to the section, “Hartzell Propeller Contact Information” in this chapter.

13. Hartzell Propeller Contact Information (BP-4)

A. Product Support Department

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

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

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

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

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

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

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

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

B. Customer Support

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

Hartzell Propeller LLC
Telephone: 937.778.4200
Fax: 937.778.4215
One Propeller Place
E-mail: manuals@hartzellprop.com
Piqua, Ohio 45356-2634 U.S.A.

C. Recommended Facilities

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

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

14. Definitions (BP-5)

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

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

Term	Definition
Blade Station	Refers to a location on an individual blade for blade inspection purposes. It is a measurement from the blade “zero” station to a location on a blade, used to apply blade specification data in blade overhaul manuals. Note: Do not confuse *blade station* with *reference blade radius*; they may not originate at the same location.
Blemish	An imperfection with visible attributes, but having no impact on safety or utility
Brinelling	A depression caused by failure of the material in compression
Bulge	An outward curve or bend
Camber	The surface of the blade that is directed toward the front of the aircraft. It is the low pressure, or suction, side of the blade. The camber side is convex in shape over the entire length of the blade.
Chord	A straight line distance between the leading and trailing edges of an airfoil
Chordwise	A direction that is generally from the leading edge to the trailing edge of an airfoil
Co-bonded	The act of bonding a composite laminate and simultaneously curing it to some other prepared surface
Composite Material	Kevlar®, carbon, or fiberglass fibers bound together with, or encapsulated within an epoxy resin
Compression Rolling	A process that provides improved strength and resistance to fatigue
Constant Force	A force that is always present in some degree when the propeller is operating
Constant Speed	A propeller system that employs a governing device to maintain a selected engine RPM

Term	Definition
Corrosion (Aluminum)	The chemical or electrochemical attack by an acid or alkaline that reacts with the protective oxide layer and results in damage of the base aluminum. Part failure can occur from corrosion due to loss of structural aluminum converted to corrosion product, pitting, a rough etched surface finish, and other strength reduction damage caused by corrosion.
Corrosion (Steel)	Typically, an electrochemical process that requires the simultaneous presence of iron (component of steel), moisture and oxygen. The iron is the reducing agent (gives up electrons) while the oxygen is the oxidizing agent (gains electrons). Iron or an iron alloy such as steel is oxidized in the presence of moisture and oxygen to produce rust. Corrosion is accelerated in the presence of salty water or acid rain. Part failure can occur from corrosion due to loss of structural steel converted to corrosion product, pitting, a rough etched surface finish and other strength reduction damage caused by corrosion.
Corrosion Product (Aluminum)	A white or dull gray powdery material that has an increased volume appearance (compared to non-corroded aluminum). Corrosion product is not to be confused with damage left in the base aluminum such as pits, worm holes, and etched surface finish.
Corrosion Product (Steel)	When iron or an iron alloy such as steel corrodes, a corrosion product known as rust is formed. Rust is an iron oxide which is reddish in appearance and occupies approximately six times the volume of the original material. Rust is flakey and crumbly and has no structural integrity. Rust is permeable to air and water, therefore the interior metallic iron (steel) beneath a rust layer continues to corrode. Corrosion product is not to be confused with damage left in the base steel such as pits and etched surface finish.

Term	Definition
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface
Debond	Separation of two materials that were originally bonded together in a separate operation
Defect	An imperfection that affects safety or utility
Delamination	Internal separation of the layers of composite material
Dent	The permanent deflection of the cross section that is visible on both sides with no visible change in cross sectional thickness
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component
Edge Alignment	Distance from the blade centerline to the leading edge of the blade
Erosion	Gradual wearing away or deterioration due to action of the elements
Exposure	Leaving material open to action of the elements
Face	The surface of the blade that is directed toward the rear of the aircraft. The face side is the high pressure, or thrusting, side of the blade. The blade airfoil sections are normally cambered or curved such that the face side of the blade may be flat or even concave in the midblade and tip region.
Face Alignment	Distance from the blade centerline to the highest point on the face side perpendicular to the chord line
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag
Fraying	A raveling or shredding of material

Term	Definition
Fretting	Damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface
Galling	To fret or wear away by friction
Gouge	Surface area where material has been removed
Hazardous Propeller Effect	The hazardous propeller effects are defined in Title 14 CFR section 35.15(g)(1)
Horizontal Balance	Balance between the blade tip and the center of the hub
Impact Damage	Damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object while in flight or on the ground
Inboard	Toward the butt of the blade
Intergranular Corrosion	Corrosion that attacks along the grain boundaries of metal alloys
Jog	A term used to describe movement up/down, left/right, or on/off in short incremental motions
Laminate	To unite composite material by using a bonding material, usually with pressure and heat
Lengthwise	A direction that is generally parallel to the pitch axis
Loose Material	Material that is no longer fixed or fully attached
Low Pitch	The lowest blade angle attainable by the governor for constant speed operation
Major Propeller Effect	The major propeller effects are defined in Title 14 CFR section 35.15(g)(2)
Minor Deformation	Deformed material not associated with a crack or missing material
Monocoque	A type of construction in which the outer skin carries all or a major part of the load
Nick	Removal of paint and possibly a small amount of material

Term	Definition
Non-Aviation Certified	Intended for non-aircraft application, such as Hovercraft or Wing in Ground Effect (WIG) applications. These products are certificated by an authority other than FAA. The hub and blades will be stamped with an identification that is different from, but comparable to TC and PC.
Non-Aviation Experimental	Intended for non-aircraft application, such as Hovercraft or Wing-In-Ground effect (WIG) applications. Products marked with an “X” at or near the end of the model number or part number are not certified by any authority and are not intended for use on certificated craft.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control/condition lever and the actual engine (propeller) RPM are equal
Open Circuit	Connection of high or infinite resistance between points in a circuit which are normally lower
Outboard	Toward the tip of the blade
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain airworthiness
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control/condition lever
Pitch	Same as “Blade Angle”
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear
Pitting (Linear)	The configuration of the majority of pits forming a pattern in the shape of a line
Porosity	An aggregation of microvoids. See “voids”.

Term	Definition
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15
Reference Blade Radius	Refers to the propeller reference blade radius in an assembled propeller, e.g., 30-inch radius. A measurement from the propeller hub centerline to a point on a blade, used for blade angle measurement in an assembled propeller. An adhesive stripe (blade angle reference tape CM160) is usually located at the reference blade radius location. Note: Do not confuse *reference blade radius* with *blade station*; they may not originate at the same point.
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up
Scratch	Same as “Nick”
Short Circuit	Connection of low resistance between points on a circuit between which the resistance is normally much greater
Shot Peening	Process where steel shot is impinged on a surface to create compressive surface stress, that provides improved strength and resistance to fatigue
Single Acting	Hydraulically actuated propeller that utilizes a single oil supply for pitch control
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip
Station Line	See "Blade Station"
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM

Term	Definition
Synchrophasing	A form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other
Ticking	A series of parallel marks or scratches running circumferentially around the diameter of the blade
Track	In an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly
Trailing Edge	The aft edge of an airfoil over which the air passes last
Trimline	Factory terminology referring to where the part was trimmed to length
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control/condition lever
Unidirectional Material	A composite material in which the fibers are substantially oriented in the same direction
Variable Force	A force that may be applied or removed during propeller operation
Vertical Balance	Balance between the leading and trailing edges of a two-blade propeller with the blades positioned vertically
Voids	Air or gas that has been trapped and cured into a laminate
Windmilling	The rotation of an aircraft propeller caused by air flowing through it while the engine is not producing power
Woven Fabric	A material constructed by interlacing fiber to form a fabric pattern

Term	Definition
Wrinkle (aluminum blade)	A wavy appearance caused by high and low material displacement
Wrinkle (composite blade)	Overlap or fold within the material

15. Abbreviations (BP-3)

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

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

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

DESCRIPTION AND OPERATION - CONTENTS

LIST OF FIGURES

LIST OF TABLES

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1. Description of Propeller and Systems

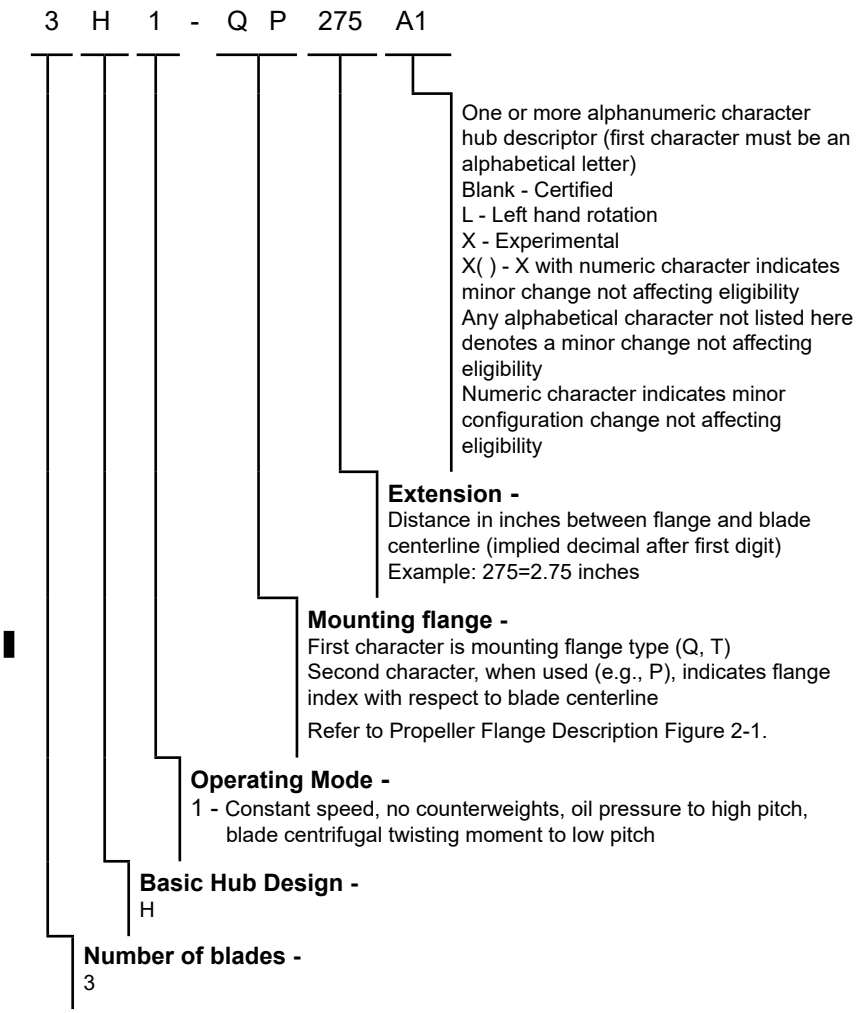
   A. 3H1-( )( )( ) Series Propeller System Overview

      The propellers covered in this manual are constant speed, non-counterweighted propellers. The propellers are capable of blade angles between a low positive pitch (low pitch) and a high positive pitch (high pitch).

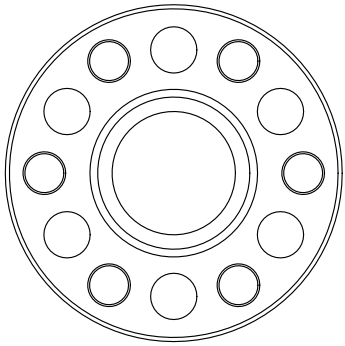
      Centrifugal twisting moment acting on the blades moves the blades to a low blade angle (low pitch) to increase RPM. Since the centrifugal twisting moment is only present when the propeller is rotating, a mechanical spring is installed within the propeller to assist movement of the blades to a lower pitch 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.

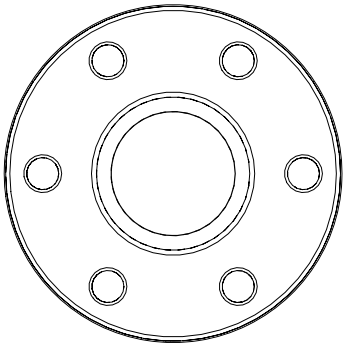


Propeller Model Designations
Table 2-1



Q-flange

TPI-JM-000502

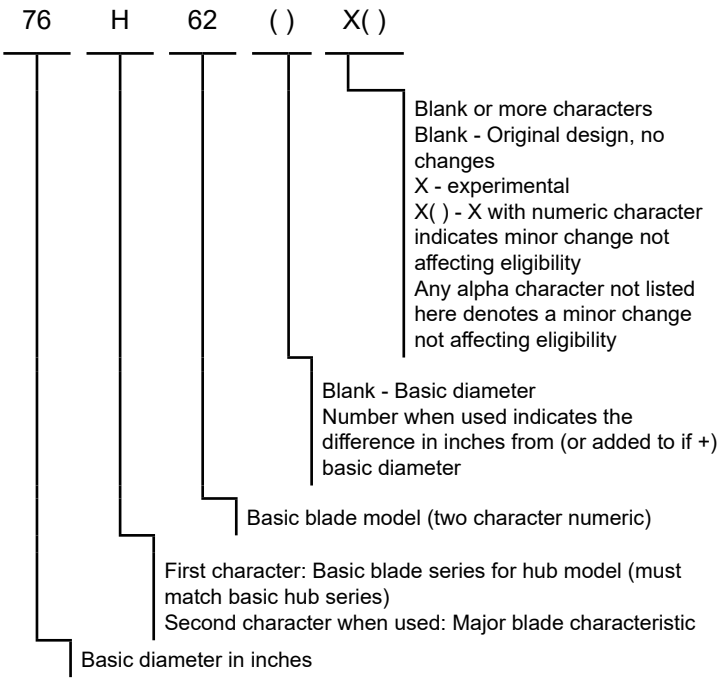


T-flange

TPI-MB-0802

Flange	Bolt Circle	No. of Dowels	No. of Bolts or Studs	Typical Engine
Q	3.150 inch	0	6 (1/2 inch)	Rotax
T	3.150 inch	0	6 (7/16 inch)	Rotax

Propeller Flange Description
Figure 2-1



Blade Type and Blade Model Designations
Table 2-2

2. Propeller Blades

A. Description of Composite Blades

(1) Hartzell Propeller composite blades are constructed by layering composite material over a foam core and a metal blade shank.

(2) A metal erosion shield is bonded to the leading edge of the blade to provide protection from impact and erosion.

(3) Composite blades are identified by direction of rotation, shank design, propeller diameter, and other blade charactieristics.

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

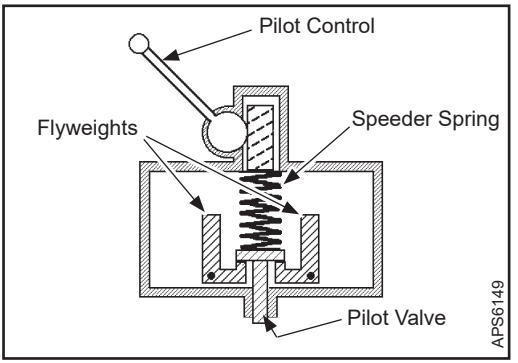
B. Blade Model Designation

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

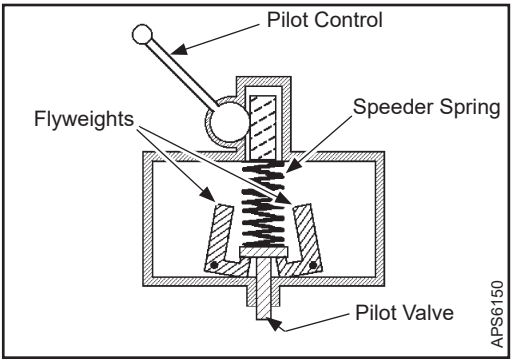
(a) Example: *propeller model number / blade model number*

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

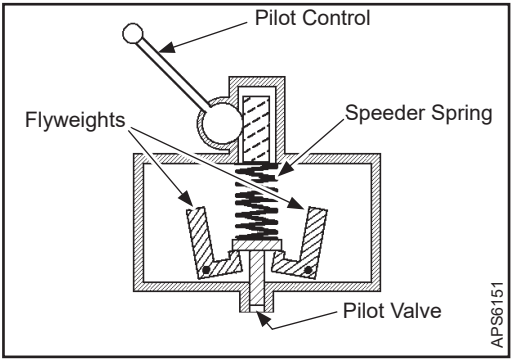
(3) Refer to Table 2-2 for a description of the characters used in the blade model number.



Governor in Onspeed Condition
Figure 2-2



Governor in Underspeed Condition
Figure 2-3



Governor in Overspeed Condition
Figure 2-4

3. Governors (Rev. 3)

A. Theory of Operation

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

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

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

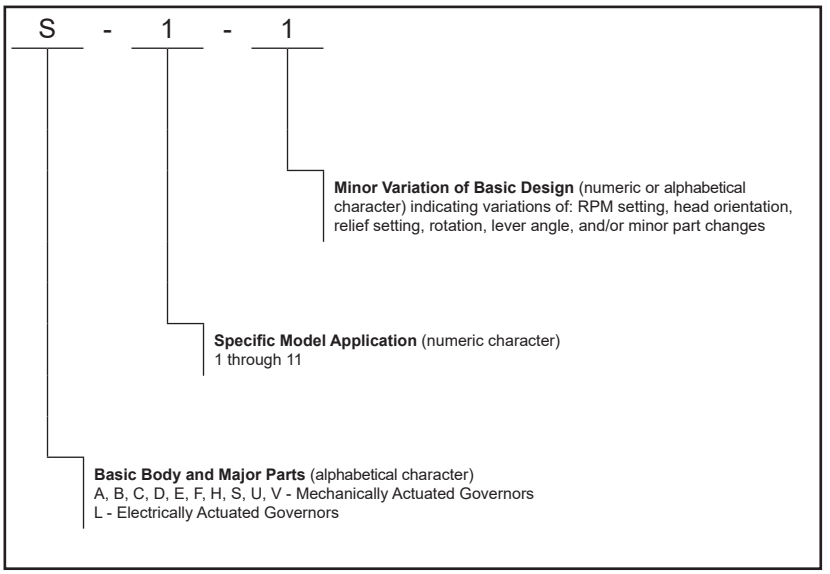
(4) When the engine is operating above the RPM set by the pilot using the cockpit control, the governor is operating **overspeed**. Refer to Figure 2-4. In an overspeed condition, the centrifugal force acting on the flyweights is greater than the speeder spring force. The flyweights tilt outward, and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

B. Governor Model Designation

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

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

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



Governor Model Designations
Table 2-3

INSTALLATION AND REMOVAL - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Tools, Consumables, and Expendables

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

   A. Tooling

   - Safety wire pliers (Alternate: Safety cable tool)
   - Torque wrench (1/2 inch drive)
   - Torque wrench adapter (Hartzell Part Number BST-2860)
   - 3/4 inch open end wrench (Q-flange)
   - 5/8 inch open end wrench (T-flange)

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

   B. Consumables

   - Quick Dry Stoddard Solvent or MEK

   C. Expendables

   - 0.032 inch (0.81 mm) stainless steel aircraft safety wire (Alternate: 0.032 inch [0.81 mm] aircraft safety cable and associated hardware)
   - O-ring (Refer to Table 3-1)

2. Pre-Installation

   A. Inspection of Shipping Package

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

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

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

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

B. Uncrating

(1) Put the propeller on a firm support.

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

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

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

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

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

C. Inspection after Shipment

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

D. Reassembly of a 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.

3. Propeller Mounting Hardware and Torque Information (Rev. 1)

A. Propeller Mounting Hardware

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

B. Torque Information

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

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

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

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

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

(3) Refer to Table 3-2 for the torque values to use when installing a Hartzell propeller.

(4) When an adapter is used with a torque wrench, use the equation in Figure 3-1 to determine the correct torque value.

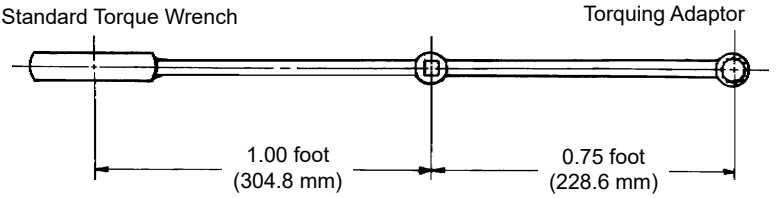
(5) Refer to Figure 3-2 for the proper torquing sequence of the propeller mounting bolts/nuts.

Flange	O-ring	Stud	Nut	Washer
Q	C-3317-225-1	A-2429-( )	A-2044	103555
T	C-3317-225-1	100041	A-1373	A-965

Propeller Mounting Hardware
Table 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.	
Hub clamping bolt	27-33 Ft-Lbs (37-44 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)
T-flange propeller mounting nuts	Initial torque: 30 Ft-Lbs (54 N•m) Final torque: 50-55 Ft-Lbs (67-74 N•m)
Low pitch stop jam nut p/n A-2043-1	13-17 Ft-Lbs (18-23 N•m)
Spinner Mounting Nut	72-96 In-Lbs (9-10 N•m)

Torque Table
Table 3-2



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

EXAMPLE:

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

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

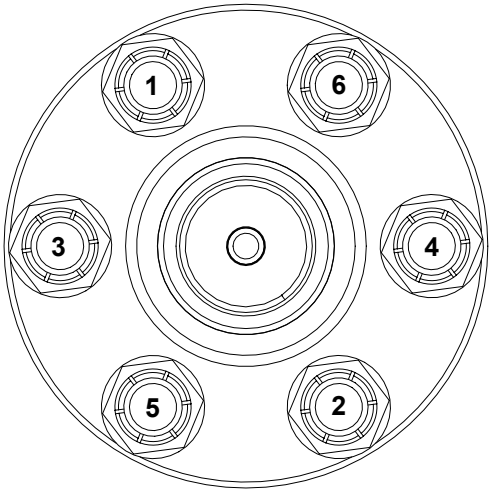
APS212

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

Q-flange and T-flange

Step 1 - Torque all mounting nuts to the Initial Torque specified in Table 3-2. Torque the nuts in the sequence shown in this Figure.

Step 2 - Torque all mounting nuts to the Final Torque specified in Table 3-2. Torque the nuts in the sequence shown in this Figure.



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Torquing Sequence for Propeller Mounting Hardware
Figure 3-2

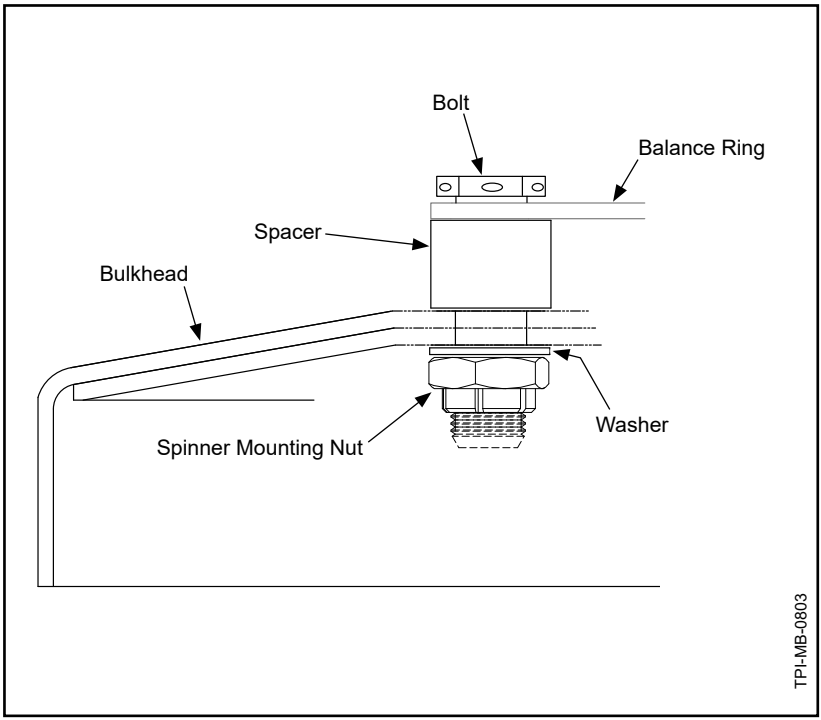
4. Bulkhead Installation

A. Installation of a Bulkhead

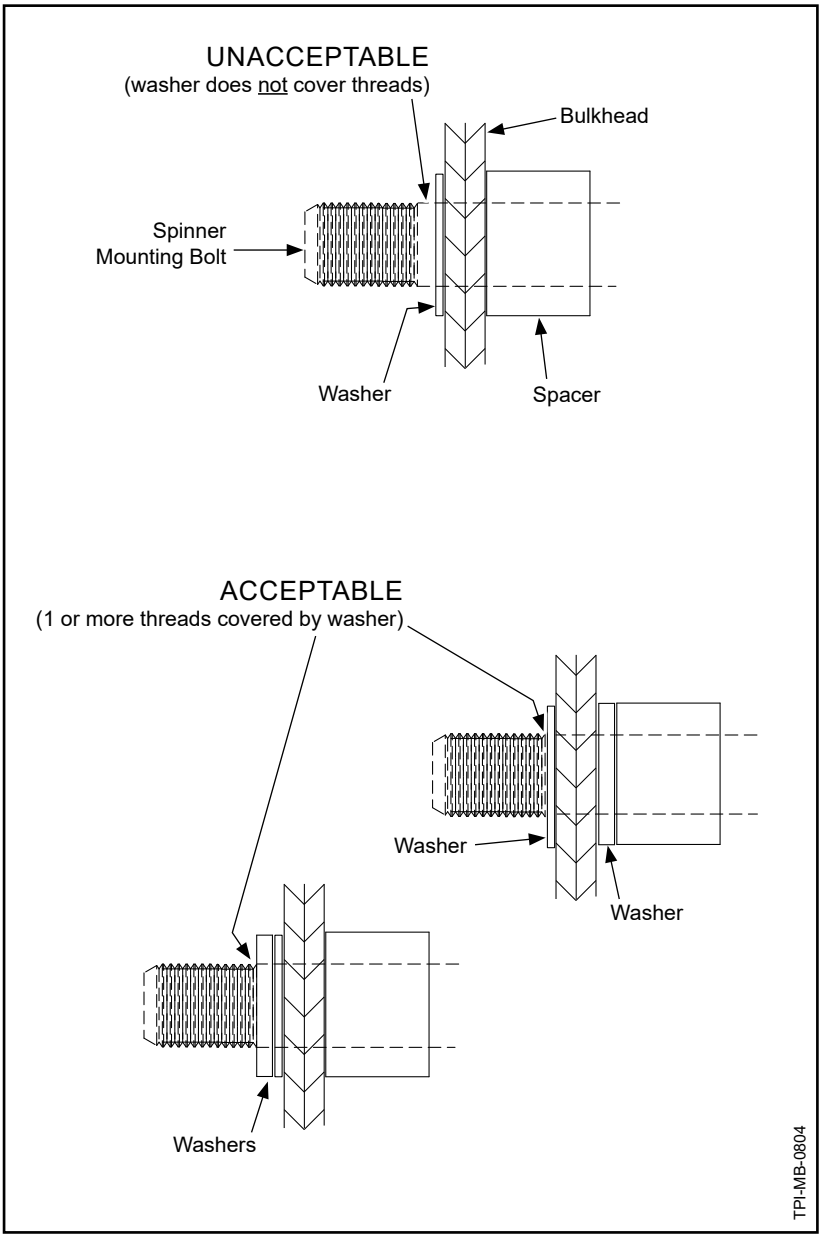
NOTE 1: Refer to Hartzell Propeller Application Guide 159 (61-02-59) for the applicable spinner mounting kit and the spinner mounting kit parts list.

NOTE 2: Hartzell spinner mounting kits include flat washers of different thickness that can be arranged to adjust bulkhead spacing and ensure sufficient thread engagement.

(1) Install the spinner mounting bolts through the balance ring, then install the spacer, and the bulkhead onto the bolts in accordance with Figure 3-3.



Bulkhead Mounting
Figure 3-3



Spinner Mounting Bolt Thread Coverage
Figure 3-4

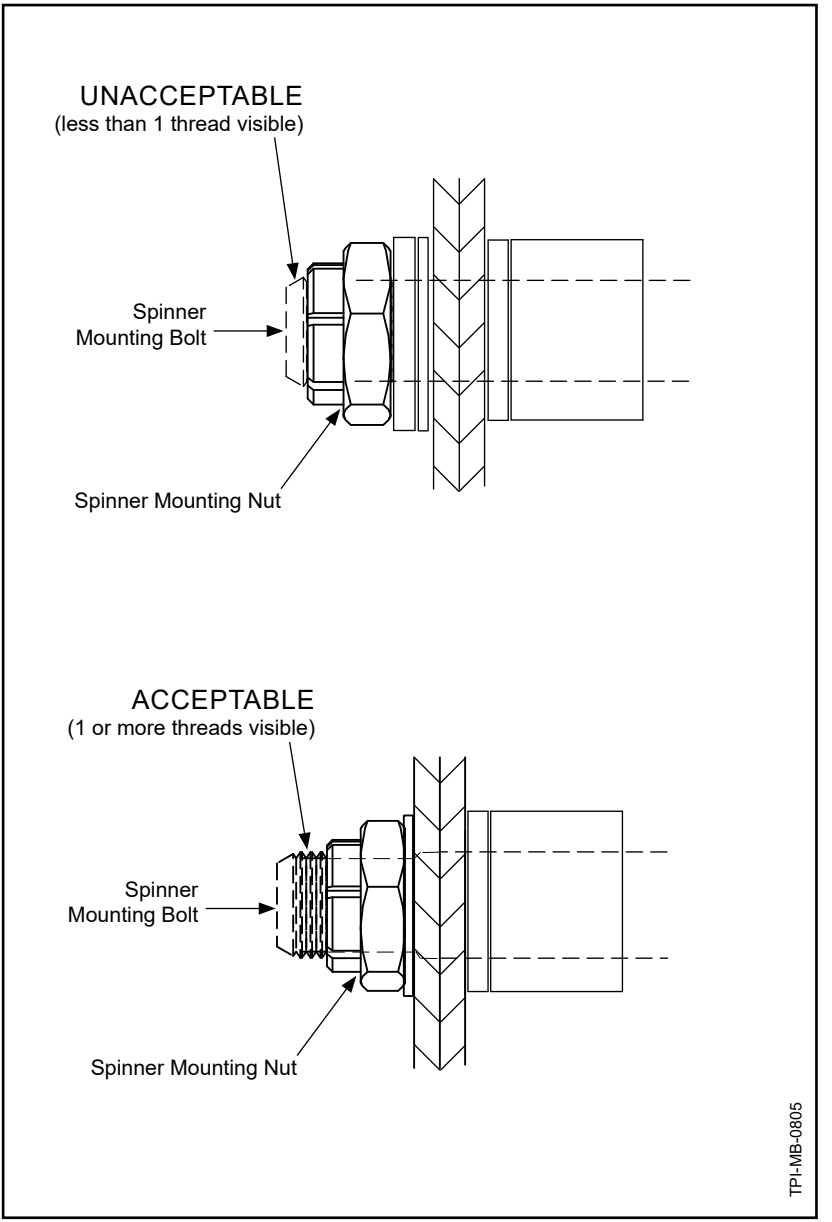
CAUTION: A MINIMUM OF ONE THREAD MUST BE COVERED BY THE WASHER(S) TO MAKE SURE THE SPINNER MOUNTING NUT WILL NOT BOTTOM OUT ON THE NON-THREADED AREA OF THE BOLT. REFER TO FIGURE 3-4 FOR ILLUSTRATIONS OF ACCEPTABLE AND UNACCEPTABLE THREAD COVERAGE.

(3) Install one washer on each of the bolts then check the thread coverage on the bolts in accordance with Figure 3-4.

(a) If the washer covers a minimum of one thread on the spinner mounting bolt, go to step (4) of this procedure.

(b) If the washer does not cover at least one thread on the spinner mounting bolt, install additional washer(s) from the spinner mounting kit until there is acceptable thread coverage.

NOTE: Washer(s) can be added on either side of the bulkhead as shown in Figure 3-4.



Spinner Mounting Bolt Thread Engagement
Figure 3-5

CAUTION: AT LEAST ONE THREAD OF THE SPINNER MOUNTING BOLT MUST BE VISIBLE AFTER THE SPINNER NUT IS TORQUED. REFER TO FIGURE 3-5 FOR ILLUSTRATIONS OF ACCEPTABLE AND UNACCEPTABLE THREAD ENGAGEMENT.

(4) Install a spinner mounting nut on each of the spinner mounting bolts.

(a) Torque each spinner mounting nut in accordance with Table 3-2, “Torque Table” in this chapter.

1 If one or more threads of the spinner mounting bolt are visible, go to step (5) of this procedure.

2 If less than one thread of the spinner mounting bolt is visible, remove one washer from the spinner mounting bolt.

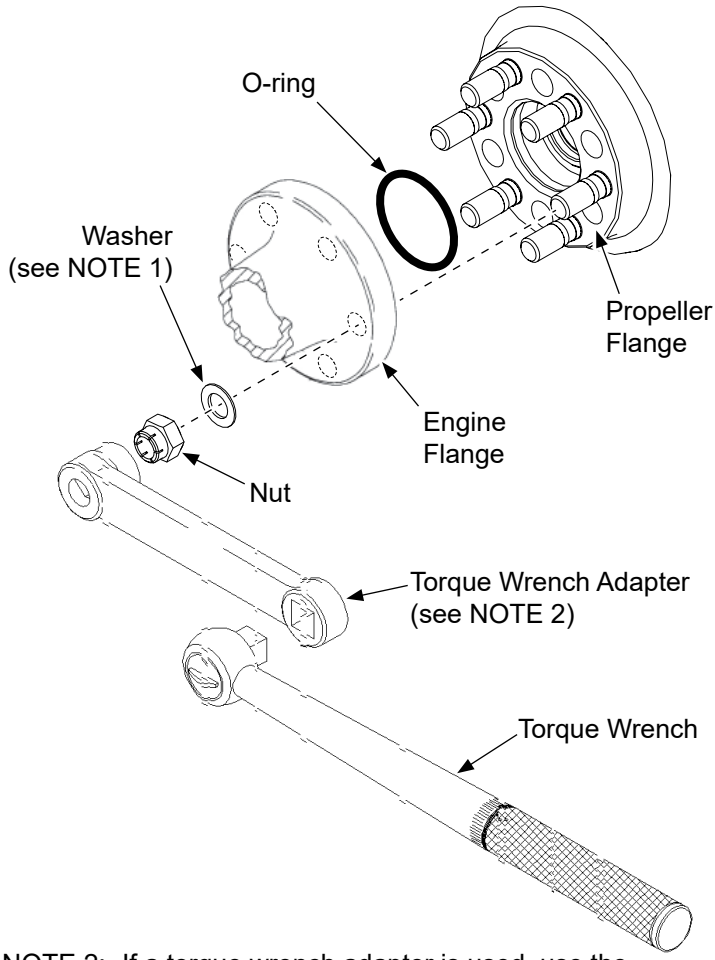
NOTE: A minimum of one washer is required between the spinner mounting nut and the bulkhead.

a Reinstall/torque the spinner mounting nut and check the thread exposure.

(5) Refer to the section, “Spinner Assembly Clearance Checks” in this chapter.

(6) To adjust the position/spacing of the spinner bulkhead, refer to the section, “Bulkhead Spacing Adjustments” in this chapter.

NOTE 1: If installing washer p/n 103555, install washer with chamfer toward the engine flange.



NOTE 2: If a torque wrench adapter is used, use the calculation in Figure 3-1 to determine correct torque wrench setting.

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Q-flange and T-flange Propeller Mounting
Figure 3-6

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) The flange type is indicated in the propeller model number that is stamped on the hub. For example, 3H1-QP275 indicates a “Q” flange.

(2) Refer to the section, “Propeller Model Designation” in the Description and Operation chapter of this manual for a description of the flange(s).

B. Installation of Q-flange and T-flange Propellers

(1) Perform the applicable steps under Bulkhead 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) Lubricate the mounting flange O-ring with engine oil, then install the O-ring in the O-ring groove in the hub bore as shown in Figure 3-6.

(a) Refer to Table 3-1 for the applicable O-ring and mounting hardware.

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

WARNING: MAKE SURE THAT ANY EQUIPMENT USED TO INSTALL THE PROPELLER IS 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) 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.

(5) Install the propeller on the engine flange.

(6) If applicable, install the washer, P/N 103555, with the chamfer side towards 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) and torque in accordance with Table 3-2, Figure 3-1, and Figure 3-2.

(8) Install the propeller spinner dome in accordance with the section, “Spinner Installation” in this chapter.

6. Spinner Dome Installation (Rev. 2)

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

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

NOTE: The following instructions relate to Hartzell Propeller spinners only.

A. Installing the Spinner Dome

(1) Using both hands, place the spinner dome over the spinner bulkhead.

CAUTION: MAKE SURE OF PROPER THREAD ENGAGEMENT FOR THE SCREWS IN THE NUTPLATES. APPROXIMATELY 1 TO 1 1/2 THREADS MUST EXTEND PAST THE BULKHEAD NUTPLATES. TO AVOID DAMAGING THE AIRCRAFT COWLING, THE SCREWS MUST NOT EXTEND MORE THAN THREE THREADS PAST THE BULKHEAD NUTPLATES.

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

Spinner Dome	Washer	Screw
Composite Dome	B-3860-10L Dimpled, 100°, Cres.	B-3867-272 10-32, 100° Head, Cres.

Spinner Dome Mounting Hardware
Table 3-3

(a) Install a screw in the hole(s) centered between each two adjacent blade cutouts.

1 If the centerline between the adjacent blade cutouts does not align with a mounting hole, install screws in the two holes closest to the centerline.

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

(b) Tighten the screws until snug, then turn an additional 1/8 rotation.

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

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

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

7. Spinner Assembly Clearance Checks

A. Clearance Checks - Refer to Figure 3-7

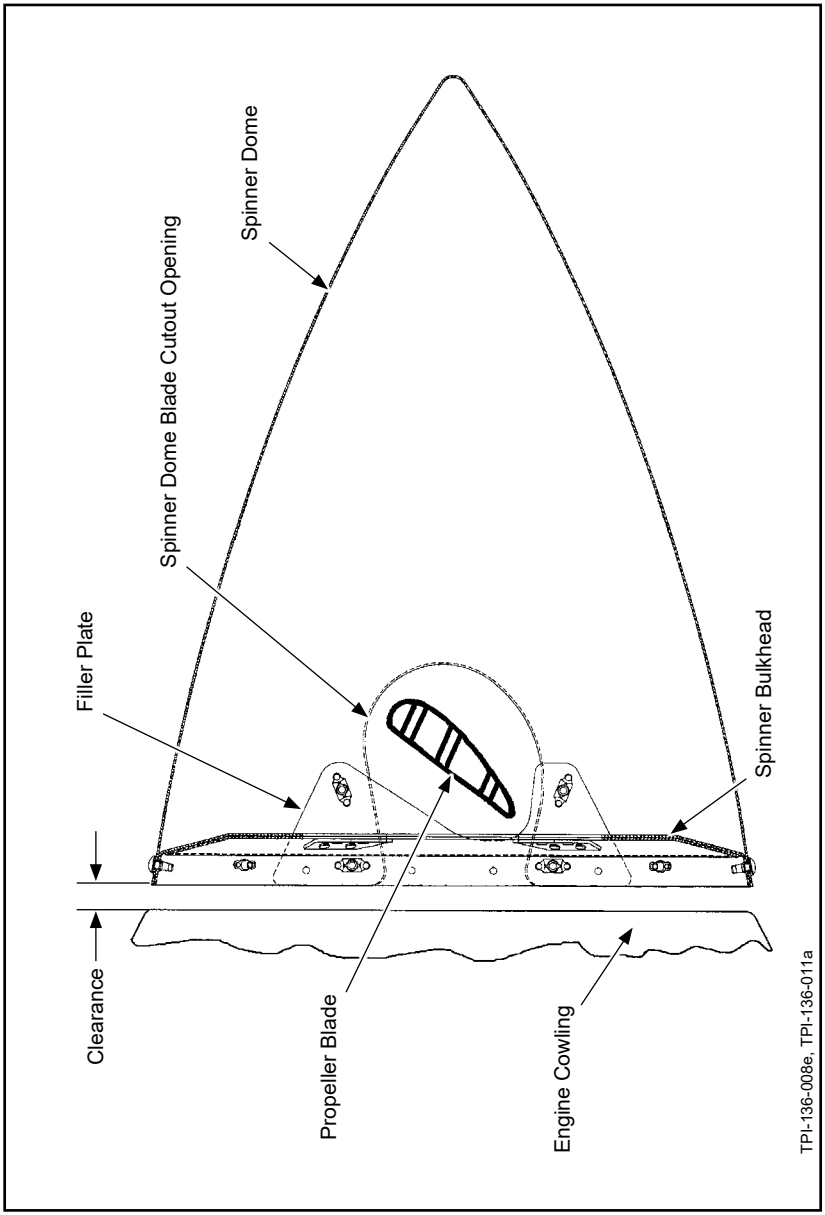
(1) The spinner bulkhead must be spaced between the propeller hub and the engine cowling to prevent contact between the spinner assembly and the propeller blades throughout the full range of blade travel.

(2) The spinner assembly and the hub clamping bolts must not touch any of the following components/areas or cause interference during propeller/engine operation:

(a) Engine cowling

(b) Any non-rotating part of the aircraft

(c) Mounting hardware



Spinner Assembly Clearance
Figure 3-7

8. Bulkhead Spacing Adjustments

A. Bulkhead Toward the Cowling

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

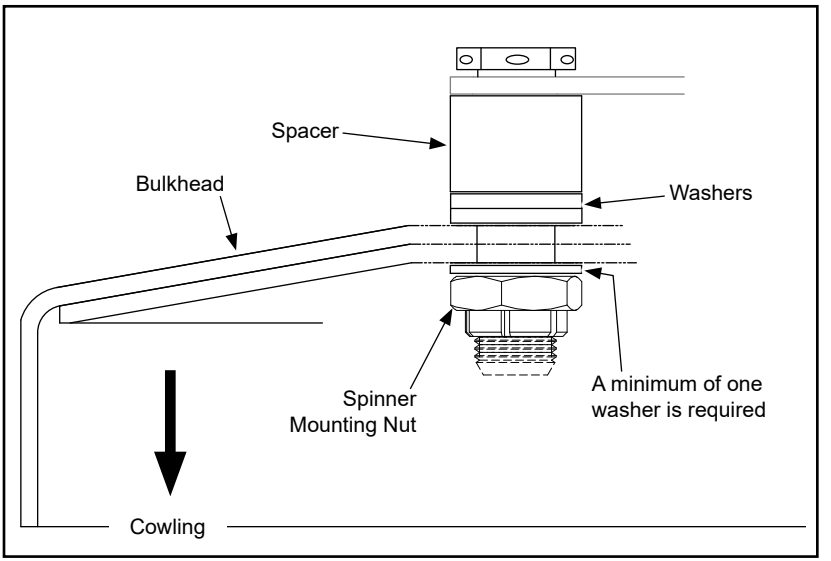
CAUTION 2: A MINIMUM OF ONE WASHER IS REQUIRED BETWEEN THE SPINNER MOUNTING NUT AND THE BULKHEAD.

(1) Install washer(s) from the spinner mounting kit between the spacer and the bulkhead as shown in Figure 3-8 to get the desired bulkhead spacing.

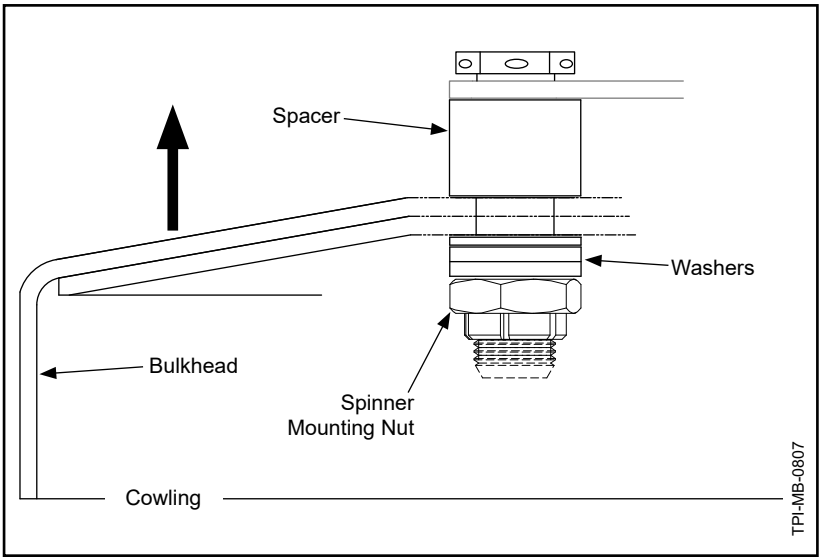
NOTE: The thickness of the washer(s) added between the bulkhead and the spacer, is the distance the bulkhead will move toward the cowling.

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

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



Bulkhead Toward the Cowling
Figure 3-8



Bulkhead Away From the Cowling
Figure 3-9

B. Bulkhead Away From the Cowling

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

(1) Install washer(s) from the spinner mounting kit between the bulkhead and the spinner mounting nut as shown in Figure 3-9 to get the desired bulkhead spacing.

NOTE: The thickness of the washer(s) added between the bulkhead and the spinner mounting nut, is the distance the bulkhead will move away from the cowling.

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

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

9. Post-Installation Checks
   A. Important Information
      (1) Refer to the airframe manufacturer's instructions for post-installation checks.
      (2) Perform the "Hydraulic Low Pitch Stop Setting" in accordance with the Maintenance Practices chapter of this manual.

10. Spinner Removal

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

    A. Removing the Spinner Dome.
       (1) Remove the screws and washers that attach the spinner dome to the spinner bulkhead.
       (2) Remove the spinner dome.

11. Propeller Removal

    A. Removal of Q-flange and T-flange Propellers
       (1) Remove the spinner dome in accordance with the section "Spinner Removal" in this chapter.

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

       (2) Support the propeller assembly with a sling.

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

       (3) 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.

(4) 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.

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

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

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TESTING AND TROUBLESHOOTING - CONTENTS

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

2. Troubleshooting

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

   A. Hunting and Surging (Rev. 2)
      (1) General
         (a) Hunting is characterized by a cyclic variation in engine speed above and below desired speed. Surging is characterized by a large increase/decrease in engine speed, followed by a return to set speed after one or two occurrences.
         (b) If the propeller is hunting, a certified airframe and powerplant mechanic with the appropriate rating or a certified propeller repair station with the appropriate rating should check:
            1 Governor
            2 Fuel control

(2) If the propeller is surging:

(a) Perform the “Initial Run-Up” in accordance with the Inspection and Check chapter of this manual to release trapped air from the propeller.

1 If surging reoccurs it is most likely due to a faulty governor.

a Have the governor tested by a certified propeller repair station with the appropriate rating.

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

1 To isolate these faults, the propeller must be tested on a test bench at a certified propeller repair station with the appropriate rating.

B. Engine Speed Varies with Flight Altitude (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 3H1 propellers:

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 3H1 propellers:

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

(4) Increase in engine speed while decreasing airspeed:

(a) Non-feathering 3H1 propeller:

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

(5) Decrease in engine speed while decreasing airspeed:
  (a) Non-feathering 3H1 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 - 3H1 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
      5 Propeller to engine flange seal
    (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 (Rev. 1)

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

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

(1) Check:

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

(b) Isolation of engine controls and lines

(c) Engine mount wear

(d) Uneven or over lubrication of propeller

(e) Proper engine/propeller flange mating

(f) Blade track:

1 Refer to the section, “Blade Track” in the Inspection and Check chapter of this manual.

(g) Blade angles:

1 Blade angles must be within specified tolerance between blades.

a Refer to a certified propeller repair station with the appropriate rating to check/adjust blade angles.

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

(i) Static balance

(j) Propeller installation

1 Remove the propeller, rotate clockwise (to the next mounting studs), then reinstall the propeller.

(k) Hub damage or cracking

(l) Grease or oil leakage

(m) Blade deformation

(2) Dynamic Balance

(a) Dynamic balancing is recommended after installing or performing maintenance on a propeller. While this is normally an optional task, it may be required by the engine or airframe manufacturer to make certain the propeller/engine combination is balanced properly before operation.

1 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 - 3H1-( )( )( ) propellers only

1 Oil starvation

2 Governor failure

(e) Oil leaking past the piston causing the hydraulic lock of the piston in the cylinder - 3H1-( )( )( ) propellers only.

F. Overspeed Avoidance (Operational)
- 3H1-( )( )( ) Propellers:

(1) Hartzell Propeller 3H1-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) Blade bearing stuck

(c) Governor oil pressure high

(d) Governor oil return passage clogged

INSPECTION AND CHECK - CONTENTS

INSPECTION AND CHECK - CONTENTS, continued

LIST OF FIGURES

1. Pre-Flight Checks (Rev. 5)

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

A. Important Information

(1) Follow propeller pre-flight inspection procedures specified in the Pilot Operating Handbook (POH) in addition to the inspections specified in this section.

(2) Defects or damage found during the pre-flight inspection must be evaluated in accordance with the applicable section in the Testing and Troubleshooting chapter and/or the Maintenance Practices chapter of this manual.

B. Propeller Blades

(1) Visually examine the entire blade (leading edge, trailing edge, face, and camber sides) for nicks, gouges, erosion, cracks, and debonds (composite blades only).

(a) Normal erosion (sand-blasted appearance) on the leading edge of the blade is permitted and does not require removal before further flight.

(2) Visually examine the blades for lightning strike indications in accordance with the section, “Lightning Strike” in this chapter.

(3) Check the blades for radial play or movement of the blade tip (in-and-out, fore-and-aft, and end play).

(a) Refer to the section, “Blade Tolerances” in this chapter for blade play limits.

(4) Composite Blades Only:

(a) Composite blades that do not have an anti-icing or de-ice boot installed may require erosion tape on the leading edge of the blade.

1 Refer to the section, “Erosion Tape Installation” in the Maintenance Practices chapter of this manual for requirements and instructions.

C. Spinner Assembly and Blade Retention Components

(1) Inspect the spinner and the visible blade retention components for damage and/or cracks.

(a) Repair or replace components as required before further flight.

D. Hardware

(1) Check for loose or missing hardware.

(a) Retighten or reinstall as necessary.

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

E. Grease/Oil Leakage

(1) Examine the face and camber-sides of the blades for evidence of grease/oil leakage.

(2) Using an appropriate light source, examine the propeller through the blade cut-outs in the spinner for signs of grease/oil leakage.

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

(b) If grease/oil leakage is found, refer to the section, “Inspection Procedures” in this chapter.

F. Initial Run-Up

(1) Perform the Initial Run-Up procedure in accordance with the section, “Operational Checks” in this chapter.

G. Additional Information

(1) Refer to the airframe manufacturer's manual for additional pre-flight checks.

(2) Refer to the section, "Inspection Procedures" in this chapter for additional inspection/repair information.

2. Operational Checks (Rev. 4)

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

A. Initial Run-Up

(1) Following propeller installation and before flight, perform the Initial Run-Up procedure in accordance with the instructions in this section.

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

(2) Perform engine start and warm-up in accordance with the Pilot's Operating Handbook (POH).

CAUTION: AIR TRAPPED IN THE PROPELLER HYDRAULIC CYLINDER WILL CAUSE PITCH CONTROL TO BE IMPRECISE AND CAN CAUSE PROPELLER SURGING.

(3) Cycle the propeller control through the operating blade range from low pitch to high pitch (or as specified in the POH).

(a) Repeat this step at least three times.

NOTE: Cycling the propeller control purges air from the propeller hydraulic system and introduces warm oil to the cylinder.

(4) Check the propeller speed control and operation from low pitch to high pitch using the procedure specified in the POH.

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

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

(5) Check for any abnormal vibration during this run-up.

(a) If vibration occurs, shut the engine down, determine the cause, and correct it before further flight.

1 Refer to the section, “Vibration” in the Testing and Troubleshooting chapter of this manual to determine the cause/correction for the vibration.

(6) Shut down the engine in accordance with the POH.

(7) For additional inspection information (including possible corrections), refer to the section, “Inspection Procedures” in this chapter, and/or the Testing and Troubleshooting chapter of this manual.

(8) Refer to the POH and the airframe manufacturer’s manual for additional operational checks.

B. Static RPM Check ***(For mechanically actuated governors)***

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

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

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

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

(3) Start the engine.

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

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

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

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

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

(7) Stop the engine.

(8) Return the Maximum RPM Stop on the governor to the original position.

(9) Test fly the aircraft to confirm the maximum rated RPM specified in the aircraft TC or STC is achieved.

(a) Adjust the governor to the rated RPM with the Maximum RPM Stop screw.

1 If the governor is adjusted to the rated RPM with the maximum RPM stop screw, hold the maximum RPM stop screw in place and torque the maximum RPM stop locking nut in accordance with Table 3-1, "Torque Table".

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

C. Post-Run Check

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

3. Required Periodic Inspections and Maintenance (Rev. 3)

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

A. Periodic Inspection

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

(a) Inspection and maintenance specified by an airframe manufacturer’s maintenance program and approved by the applicable airworthiness agency may not coincide with the inspection time intervals specified.

1 In this situation, the airframe manufacturer’s schedule may be applied as long as the calendar limit for the inspection interval does not exceed twelve (12) months.

(b) For additional inspection information (including possible corrections), refer to the section, “Inspection Procedures” in this chapter, and/or the Testing and Troubleshooting chapter of this manual.

(2) Remove the spinner dome.

(3) Visually examine the propeller blades (lead edge, trail edge, face, and camber sides) for nicks, gouges, erosion, cracks, etc.

(a) Refer to the section, "Composite Blades" in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

(4) Examine the propeller for oil leakage in accordance with the section, “Oil Leakage” in this chapter.

(5) Visually inspect all propeller parts for cracks, wear, or unsafe conditions.

(6) If a blade track problem is suspected, check the blade track in accordance with the section, “Blade Track” in this chapter.

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

B. Periodic Coin-Tap Inspections for Composite Blades

(1) Perform a coin-tap inspection of the exposed section of the blade at intervals not to exceed 1200 flight hours.

(2) Perform a coin-tap inspection of the erosion shield surface at 600 hour intervals, not to exceed 12 months.

(3) Refer to Hartzell Propeller Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70) for the coin-tap inspection procedure.

C. Airworthiness Limitations

(1) Certain components, as well as the entire propeller may have specific life limits. Such limits call for 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. Contact Hartzell Propeller Product Support Department for life limited components times.

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

D. Overhaul Periods

(1) In flight, the propeller is constantly subjected to vibration from the engine and the airstream, as well as high centrifugal forces.

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

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

(a) For propeller overhaul periods, refer to the section, "Overhaul Periods" in the ASTM Data chapter of this manual.

4. Inspection Procedures

A. Blade Damage (Rev. 1)

(1) Refer to the section, "Composite Blades" in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

B. Grease Leakage (BP-2)

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

(1) Important Information

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

(b) Leakage that persists beyond the first ten hours of operation on a new or newly overhauled propeller, or occurs on a propeller that has been in service for some time will require repair.

1 A determination should be made as to the source of the leak. If the source of the leak is the O-ring seal between the engine and the propeller flange or a lubrication fitting, field repair is permitted.

2 All other leakage repairs should be referred to a certified propeller repair station with the appropriate rating.

3 If abnormal leakage is detected, inspect the propeller assembly using the Inspection Procedure steps in this section.

(c) Grease Leakage - Probable Cause:

1 Loose/defective lubrication fitting

2 Damaged blade to hub O-ring seal

3 Damaged hub seal (at hub parting line)

4 Damaged hub/engine flange interface O-ring

5 Cracked hub

(2) Inspection Procedure

(a) Remove the spinner dome.

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

(b) Perform a visual inspection of the hub, blades, and blade retention areas to locate the source of the grease leak.

1 If the source of the grease leak is a blade O-ring or the hub parting line, repairs can be accomplished during scheduled maintenance as long as flight safety is not compromised.

a To repair a grease leak from a blade O-ring, or hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating.

2 If the source of the grease leak is a component or location other than a blade O-ring or the hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating before further flight.

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

1 Extra attention should be given to the blade retention area of the hub.

2 A crack may be visible or may be indicated by grease leaking from a seemingly solid surface.

(d) If cracks are suspected, additional inspections to verify the condition must be performed before further flight.

1 Inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.

a These inspections must be performed by a certified propeller repair station with the appropriate rating.

(e) If cracks or failing components are found, these parts must be replaced before further flight.

1 Report such occurrences to the appropriate airworthiness authorities and to Hartzell Propeller Product Support.

C. Vibration (Rev. 3)

NOTE: Vibration may originate in the engine, propeller, or airframe. Troubleshooting procedures typically begin with an investigation of the engine. Airframe components, such as engine mounts or loose landing gear doors, can also be the source of vibration. When investigating an abnormal vibration, the blades and the blade retention components should be considered as potential sources of the vibration.

(1) Important Information

(a) Instances of abnormal vibration should be investigated immediately. If the cause of the vibration is not readily apparent, examine the propeller in accordance with the instructions in this section.

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

(c) Refer to the section, "Vibration" in the Testing and Troubleshooting chapter of this manual.

1 Perform the checks to determine possible cause of the vibration.

a If no cause is found, the propeller could be the source of the vibration. Examine the propeller in accordance with the Inspection steps in this section.

(2) Inspection

(a) Remove the spinner dome.

(b) Visually examine the hub and blades for cracks.

1 Pay particular attention to the blade retention areas of an aluminum hub.

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

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

1 These inspections typically include disassembly of the propeller, followed by inspection of parts, using nondestructive methods in accordance with published procedures.

2 These inspections must be performed at a certified propeller repair station with the appropriate rating.

(d) Inspect the play of the propeller blades in accordance with the section, “Blade Tolerances” in this chapter.

(e) Inspect blade track in accordance with the section, “Blade Track” in this chapter.

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

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

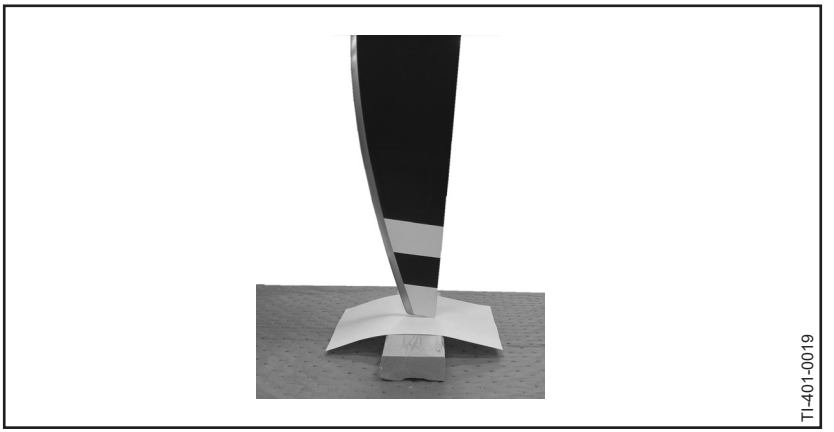
2 Visually check for damaged blades.

(f) If abnormal blade conditions or damage are found, additional inspections must be performed to evaluate the condition before further flight.

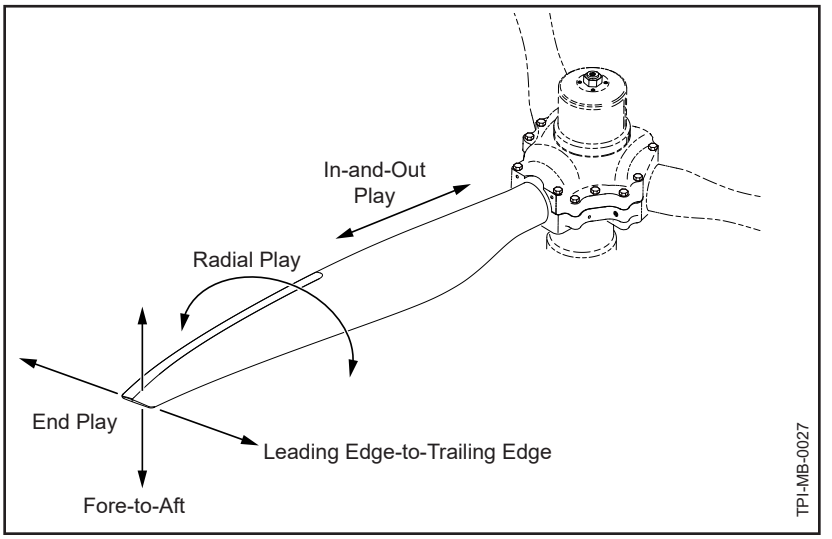
1 These inspections must be performed at a certified propeller repair station with the appropriate rating.

(g) If cracks or failing components are found, these parts must be replaced before further flight.

1 Report such occurrences to airworthiness authorities and Hartzell Propeller Product Support.



Checking Blade Track
Figure 5-1



Blade Play
Figure 5-2

D. Blade Track

(1) Check blade track as follows:

(a) Chock the aircraft wheels securely.

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

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

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

(c) Rotate the propeller by hand, in accordance with engine manufacturer operating manual, until a blade points directly at the paper.

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

(e) Repeat this procedure with the remaining blades.

(f) Tracking tolerance is ±0.125 inch (±3.17 mm) or 0.250 inch (6.35 mm) total.

(2) Possible Correction

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

1 Examine the engine and propeller flanges for damage.

2 Repair any damage to the engine or propeller flange. If necessary, contact Hartzell Propeller Product Support.

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

E. Blade Tolerances (Rev. 3)

(1) Limits for blade play are specified below. Refer to Figure 5-2.

(a) End Play:

1	Leading Edge-to-Trailing Edge	±0.095 inch (2.41 mm) Total: 0.190 inch (4.82 mm)
2	Fore-to-Aft (face to camber)	±0.190 inch (4.82 mm) Total: 0.380 inch (9.65 mm)

(b) In-and-Out Play — None permitted

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

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

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

(2) Limits for Blade Track are specified below:

(a) Composite Blades — ±0.125 inch (3.17 mm)
Total: 0.250 inch (6.35 mm)

F. Corrosion (Rev. 1)

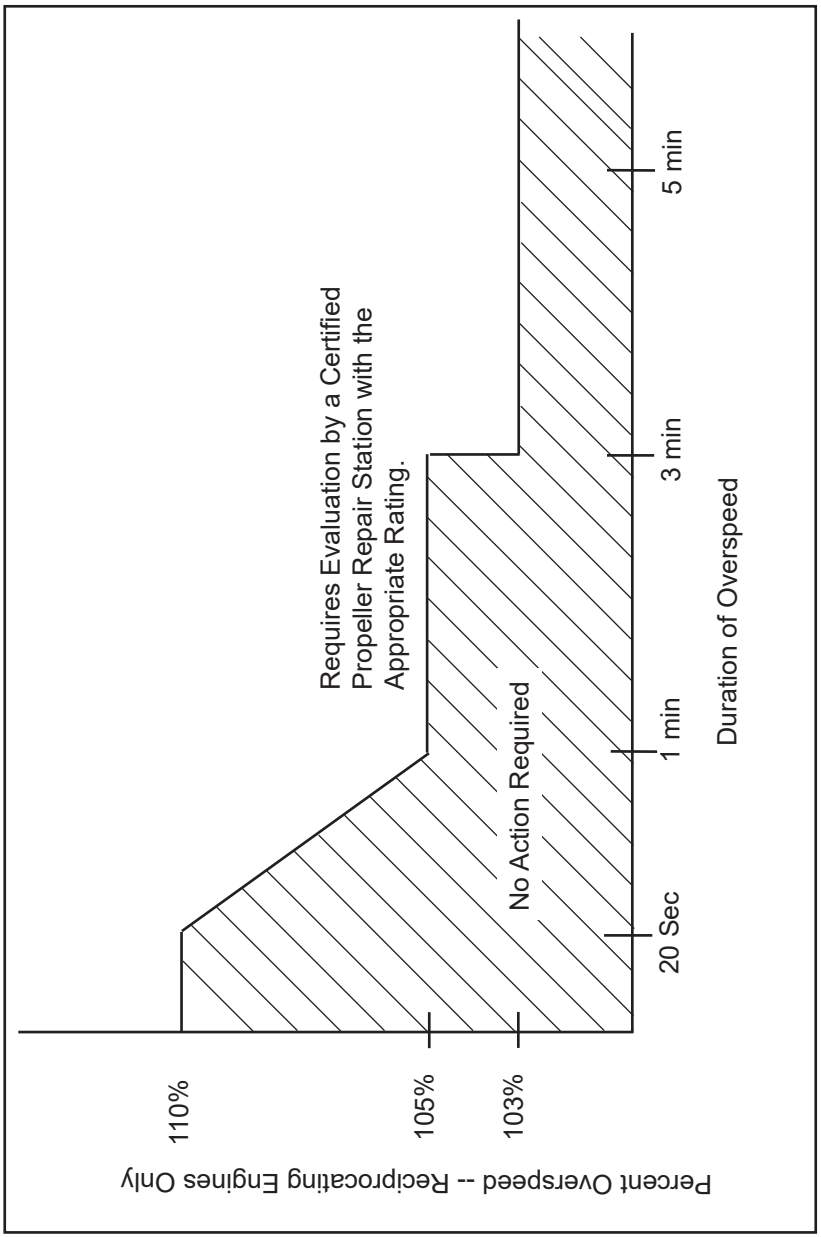
WARNING: REPAIR THAT INVOLVES COLD WORKING THE METAL, RESULTING IN CONCEALMENT OF A DAMAGED AREA IS NOT PERMITTED.

(1) Corrosion of any type on the hub or heavy corrosion on other parts that results in severe pitting must be referred to a certified propeller repair station with the appropriate rating.

G. Spinner Damage

(1) Inspect the spinner for cracks, missing hardware, or other damage.

(a) For damage evaluation and repair information, contact Hartzell Product Support.



Reciprocating Engine Overspeed Limits
Figure 5-3

5. Special Inspections (Rev. 2)

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

A. Overspeed

(1) An overspeed occurs when the propeller RPM exceeds the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. The duration of time and magnitude of overspeed for a single event determines the corrective action that must be taken to make sure no damage to the propeller has occurred.

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

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

(b) If an overspeed requiring propeller evaluation occurs on an aircraft using a Hartzell Propeller governor, the governor must be evaluated by a certified propeller repair station with the appropriate rating.

(c) Make a record of the overspeed event in the propeller logbook, indicating any corrective action(s) taken.

B. Lightning Strike - Propeller Asssembly

CAUTION 1: REFER TO THE ENGINE AND AIRFRAME MANUFACTURER'S MANUALS FOR ADDITIONAL INSPECTIONS TO PERFORM AFTER A PROPELLER LIGHTNING STRIKE.

CAUTION 2: A COMPOSITE BLADE SUSPECTED OF LIGHTNING STRIKE MUST BE INSPECTED AND MAY REQUIRE OVERHAUL.

NOTE: Lightning usually enters the propeller through the metal erosion shield or the stainless steel mesh (if applicable) 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) General

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

(b) If the propeller meets the requirements of the "Temporary Operation Inspection" in this section, 10 hours of operation is permitted before propeller disassembly/inspection must be performed.

(2) Temporary Operation Inspection

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

1 A lightning strike indication may appear as a darkened area in proximity of the tip and at the most inboard end of the metal erosion shield.

2 Other indications include: debonding, lifting or buckling of the erosion shield, and splitting or delamination of the composite material.

(b) Perform visual and coin-tap inspections of the blades that have lightning strike indications in accordance with Hartzell Propeller Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

1 If the damage is within the airworthy damage limits specified in Manual 170, temporary operation for up to 10 flight hours is permitted before propeller disassembly and inspection.

2 If the damage is not within the airworthy damage limits specified in Manual 170, temporary operation is not permitted. The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating before further flight.

(c) Make a record of the lightning strike in the propeller logbook, indicating any corrective action(s) taken.

(3) For flight beyond the 10-hour temporary operation limit:

(a) The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating.

C. Foreign Object/Ground Strike (Rev. 3)

(1) General

(a) A foreign object/ground strike can include a broad spectrum of damage, from a minor stone nick to severe ground impact damage.

1 A conservative approach in evaluating the damage is required because there may be hidden damage that is not readily apparent during an on-wing, visual inspection.

(b) A foreign object/ground strike is defined as:

1 Any incident, whether or not the engine is operating, that requires repair to the propeller other than minor dressing of the blades.

a Examples of a foreign object/ground strike include situations where an aircraft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade(s).

b These cases should be handled as foreign object/ground strikes because of potentially severe side loading on the propeller hub, blades, and retention bearings.

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

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

(c) In the event of a foreign object/ground strike, an inspection is required before further flight.

(2) Inspection Procedure

(a) Examine the propeller assembly for damage related to the foreign object/ground strike.

(b) If any of the following indications are found, the propeller must be removed from the aircraft, disassembled, and overhauled by a certified propeller repair station with the appropriate rating.

1 Blade(s) damaged, bent, or out of track/angle

2 Blade(s) loose in the hub

a Refer to the section, “Blade Tolerances” in this chapter for the permitted limits of blade play.

3 Any noticeable or **suspected** damage to the pitch change mechanism

4 Any blade diameter reduction

5 Bent, cracked, or failed engine shaft

6 Vibration during operation (that was not present before the event)

(c) Composite Blades: Perform a thorough visual inspection and a coin-tap inspection of each blade (including the metal erosion shield) in accordance with Hartzell Propeller Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

1 If the blade damage is not within the airworthy damage limits, the blade(s) must be repaired before further flight.

(d) Engine mounted components - such as governors, pumps, etc. may be damaged by a foreign object strike, especially if the strike resulted in a sudden stoppage of the engine.

1 These components should be inspected, repaired, or overhauled as recommended by the applicable component maintenance manual.

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

D. Fire/Heat Damage (Rev. 1)

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

(1) A propeller that has been exposed to fire or high temperatures, such as an engine or hangar fire, must be inspected by a certified propeller repair station with the appropriate rating before further flight.

E. Sudden Stoppage (Rev. 1)

(1) When there is a propeller sudden stoppage because of catastrophic engine failure or seizure, the propeller and any engine driven/powered accessory must be inspected and repaired in accordance with the applicable component maintenance manual.

(2) If the sudden stoppage was caused by a foreign object strike, refer to the section, “Foreign Object/Ground Strike” in this chapter.

F. Engine Oil Contamination (Rev. 1)

(1) Following an incident of oil contamination, the components of the propeller that were exposed to oil contamination must be removed, cleaned, and inspected.

(a) A propeller that was exposed to oil contamination must be removed and sent to a certified propeller repair station with the appropriate rating for disassembly, cleaning, and inspection.

(b) A governor that was exposed to oil contamination must be inspected and repaired in accordance with the applicable component maintenance manual.

6. Long Term Storage (Rev. 1)

   A. Important Information

      (1) Parts shipped from Hartzell Propeller LLC are not shipped or packaged in a container that is designed for long term storage.

      (2) Long term storage procedures may be obtained by contacting a Hartzell distributor, or the Hartzell Propeller Product Support Department.

         (a) Refer to the Introduction chapter of this manual for contact information.

         (b) Storage information is also detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).

      (3) Information regarding the return of a propeller assembly to service after long term storage may be obtained by contacting a Hartzell distributor, or the Hartzell Propeller Product Support Department.

         (a) Refer to the Introduction chapter of this manual for contact information.

         (b) This information is also detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).

   B. Composite Blades

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

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MAINTENANCE PRACTICES - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Cleaning (Rev. 2)

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

CAUTION 2: BEFORE CLEANING THE PROPELLER, BE SURE THE PROPELLER HAS BEEN INSPECTED IN ACCORDANCE WITH THE REQUIRED PERIODIC INSPECTIONS SPECIFIED IN THIS MANUAL. CLEANING THE PROPELLER PRIOR TO INSPECTION MAY REMOVE EVIDENCE OF A CONDITION THAT REQUIRES CORRECTIVE ACTION.

CAUTION 3: DO NOT USE PRESSURE WASHING EQUIPMENT TO CLEAN THE PROPELLER OR CONTROL COMPONENTS. PRESSURE WASHING CAN FORCE WATER AND/OR CLEANING SOLVENTS PAST SEALS, AND CAN LEAD TO INTERNAL CORROSION OF PROPELLER COMPONENTS.

A. General Cleaning

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

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

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

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

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

(2) Using a clean cloth dampened with stoddard solvent CM23 or equivalent, wipe the inside of the spinner dome to remove grease, oil, and other residue.

   (a) Immediately dry the inside of the spinner dome using a clean dry cloth.

(3) Using a clean cloth dampened with stoddard solvent CM23 or equivalent, wipe the accessible surfaces of the hub, counterweight clamps, slip ring, and bulkhead to remove grease, oil, and other residue.

(4) Fill a tank sprayer with a non-caustic/non-acidic soap solution.

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

CAUTION: DO NOT LET THE SOAP SOLUTION DRY ON THE SURFACES OF THE HUB, BULKHEAD, OR SLIP RING.

(5) Using the tank sprayer, apply a fine mist of the soap solution to the surfaces of the downward facing blades, and the hub, bulkhead, and slip ring around the downward facing blades.

   (a) Use a cloth or soft nylon brush to loosen dirt and unwanted material on the surfaces where the soap solution was applied, particularly on the inboard surface of the counterweight clamp.

(6) Using clean potable water at low pressure, rinse the surfaces where the soap solution was applied to remove dirt, unwanted material, and soap residue.

(7) Use a clean dry cloth to dry the surfaces cleaned in the previous steps.

(8) Rotate the propeller so that the next blade(s) to be cleaned are pointing downward.

(a) Repeat steps 5 thru 8 until all blades have been cleaned and dried.

(9) Let the propeller dry.

(10) Install the spinner dome in accordance with the Installation and Removal chapter in this manual.

B. Spinner Cleaning and Polishing

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

2. Composite Blades

A. Inspection Requirements

(1) Perform inspections (pre-flight, periodic, lightning strike, etc.) in accordance with the Inspection and Check chapter of this manual.

B. Damage Evaluation and Repair Limits

(1) Any defects or damage to a composite blade must be evaluated in accordance with Hartzell Propeller Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70) to determine if repairs are required before further flight.

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

(b) Unairworthy damage must be repaired before further flight.

C. Blade Repairs

(1) For personnel requirements and procedures for composite blade repairs, refer to Hartzell Propeller Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70).

Vendor	Color/Type	Vendor P/N	Hartzell Propeller Inc. P/N
Tempo	Epoxy Black	A-150	A-6741-145-2
Tempo	Epoxy Gray	A-151	A-6741-146-2
Tempo	Epoxy White (tip stripe)	A-152	A-6741-147-2
Tempo	Epoxy Red (tip stripe)	A-153	A-6741-149-2
Tempo	Epoxy Yellow (tip stripe)	A-154	A-6741-150-2
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1
Sherwin-Williams	Gray	F75KXA10445-4311	A-6741-146-1
Sherwin-Williams	Gray Metallic	F75KXM9754-4311	A-6741-148-1
Sherwin-Williams	White (tip stripe)	F75KXW10309-4311	A-6741-147-1
Sherwin-Williams	Red (tip stripe)	F75KXR12320-4311	A-6741-149-1
Sherwin-Williams	Yellow (tip stripe)	F75KXY11841-4311	A-6741-150-1
Sherwin-Williams	Silver Metallic	F63TXS30880-4311	A-6741-163-1
Sherwin-Williams	Silver	F75KXS13564-4311	A-6741-190-1
Sherwin-Williams	Bright Red	1326305 or F63TXR16285-4311	A-6741-200-5
Sherwin-Williams	Bright Yellow	1326313 or F63TXY16286-4311	A-6741-201-5
Sherwin-Williams	Bright Silver	1334259	A-6741-203-5
Sherwin-Williams	Prop Gold	F63TXS17221-4311	A-6741-204-5

Touch-up Paints
Table 6-1

3. Blade Paint Touch-Up (Rev. 2)

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

A. Important Information

(1) Blade paint touch-up on Hartzell propeller blades may be permitted when performed in accordance with the instructions in this section.

(a) Composite Blades Only:

1 If the area to be painted is less than 10 sq.inches (6451.6 sq. mm), blade paint touch-up is permitted.

2 If the area to be painted is greater than 10 sq. inches (6451.6 sq. mm), blade paint touch-up is not permitted.

a Areas greater than 10 sq. inches (6451.6 sq. mm) require the entire blade to be repainted by a certified propeller repair station with the appropriate rating.

B. Paint

(1) The paints listed in Table 6-1 have been tested by Hartzell Propeller and are recommended for blade touch-up.

(a) Alternate paints may be used for blade touch-up, but Hartzell Propeller accepts no responsibility for wear or adhesion-related issues.

(2) Touch-up paint manufacturer's contact information:

(a) **Tempo Products Company**
A Plasti-kote Company
1000 Lake Road
Medina, OH 44256
Tel: 800.321.6300
Fax: 216.349.4241
Cage Code: 07708

(b) **Sherwin-Williams Company**
Refer to the Sherwin-Williams
Product Finishes Global Finishes Group website at:
http://oem.sherwin-williams.com

C. Procedure

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

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

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

(2) Permit the solvent to evaporate.

CAUTION 1: EXCESSIVE SANDING ON COMPOSITE BLADES WILL CAUSE "FUZZING" OF THE KEVLAR® MATERIAL. THIS CAN RESULT IN A ROUGH FINISH AND/OR DAMAGE TO THE BLADE.

CAUTION 2: BE SURE TO SAND/FEATHER THE EXISTING COATINGS TO PREVENT EXCESSIVE PAINT BUILDUP.

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

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

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

(5) Permit the solvent to evaporate.

(6) Apply masking material to the erosion shield and tip stripes, as needed.

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

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

(8) Apply a sufficient amount of finish coating to achieve 2 to 4 mils thickness when dry.
   (a) Re-coat before 30 minutes, or after 48 hours.
   (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.

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

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

(11) Remove the masking material immediately from the tip stripes, if applicable.

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

4. 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. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) 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 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.

B. Inspection Procedures Before Balancing

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

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

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

(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 oil leakage is evident, determine the location of the leak and correct before dynamic balancing.

(3) Before dynamic balancing, record the number and location of all balance weights.

C. Placement of Balance Weights for Dynamic Balance

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

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

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

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

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

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

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

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

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

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

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

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

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

5. 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 Hartzell Propeller in accordance with the aircraft TC or STC Holder's requirements and should not require any additional adjustment.

(2) The TC or STC Holder provides the required low pitch stop blade angle and may also provide the acceptable RPM range for a maximum power static condition.

(a) 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.

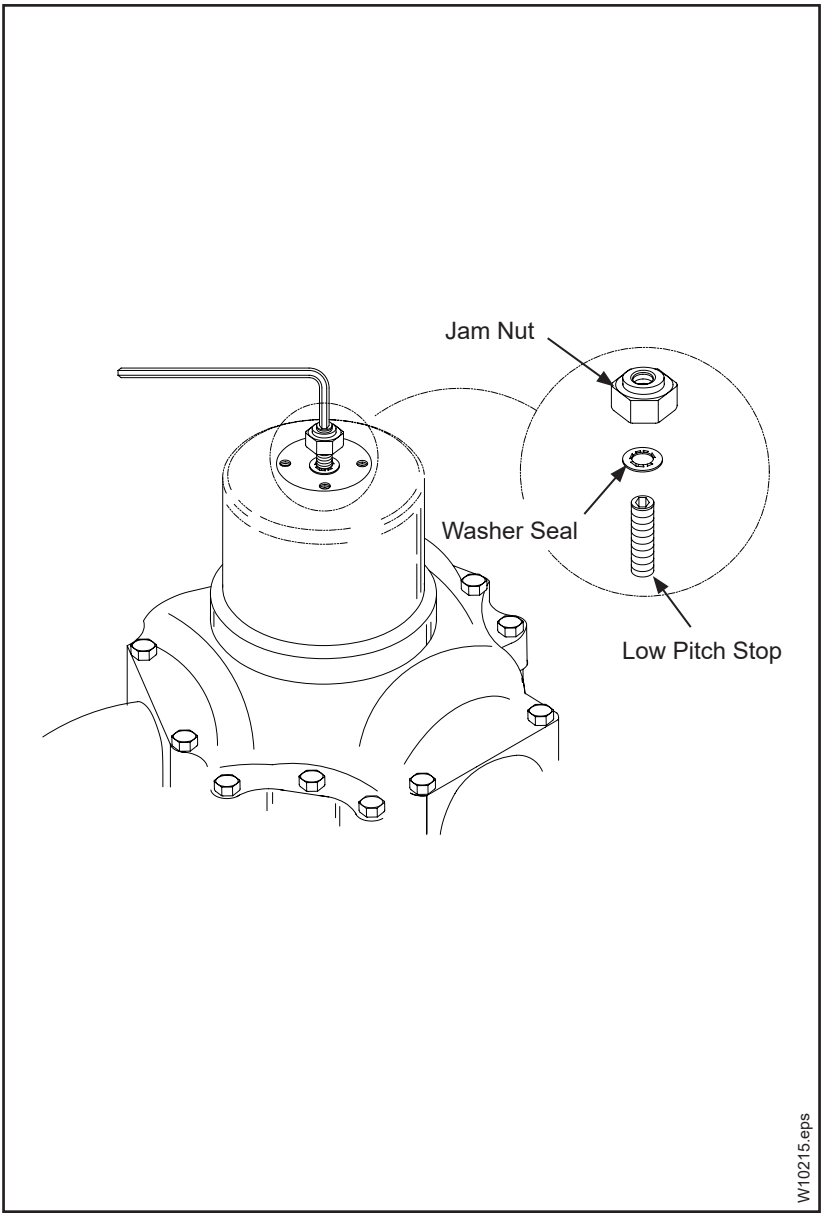
(3) An overspeed at the maximum power static condition may indicate that the propeller low-pitch blade angle is set too low and that the governor is improperly adjusted.

(4) An underspeed during the maximum power static condition may be caused by any one or a combination of the following:

(a) The propeller low pitch blade angle is too high

(b) The governor is improperly adjusted

(c) The engine is not producing rated power



Low Pitch Stop Adjustment
Figure 6-1

B. Maximum RPM (Static) Low Pitch Stop Adjustment - For Non-Feathering 3H1 Propellers

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

(1) 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. Refer to Figure 6-1.

(2) 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.

(a) Turning the stop 3/4 of a turn (0.030 inch [0.76 mm] of linear travel) will change the blade pitch by approximately one degree. One degree of blade pitch will change propeller RPM by approximately 140-150 RPM.

(b) 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 a propeller 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.

(3) When the low pitch stop is adjusted, torque the low pitch stop jam nut in accordance with Table 3-2, "Torque Table" in the Installation and Removal chapter of this manual.

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

6. Propeller High Pitch Settings (Rev. 1)
   A. High Pitch (Minimum RPM) Stop Adjustment
      (1) The high pitch stop is set by Hartzell Propeller in accordance with the aircraft manufacturer's recommendations.
      (2) The high pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.
7. Erosion Tape Installation
   A. General
      (1) Some composite blades require erosion tape on the leading edge if there is no de-ice/anti-ice boot installed.
      (2) Refer to the Minor Repair chapter of Hartzell Propeller Composite Blade Field Maintenance and Minor Repair Manual 170 (61-13-70) for the following information:
         (a) Composite blade models that require erosion tape if no de-ice or anti-ice boot is installed
         (b) Erosion tape installation instructions

8. Tachometer Calibration (Rev. 2)

WARNING: OPERATION WITH AN INACCURATE TACHOMETER CAN CAUSE RESTRICTED RPM OPERATION AND DAMAGING HIGH STRESSES. PROPELLER LIFE WILL BE SHORTENED AND COULD CAUSE CATASTROPHIC FAILURE.

A. Important Information

(1) All engine/propeller combinations have operating conditions at which the propeller blade stresses begin to reach design limits.

(a) In most cases, these conditions occur above the maximum rated RPM of the engine.

(b) Some engine/propeller combinations have certain ranges of RPM that are less than maximum engine speed, where stresses are at a level considered too high for continuous operation. This results in a restricted operating range where continuous operation is not permitted. A placard on the instrument panel or yellow arc on the tachometer will inform the pilot to avoid operation in this range.

(c) In other cases, the limiting condition occurs at an RPM only slightly above the maximum engine RPM.

(d) For these reasons, it is very important to accurately monitor engine speed.

(2) The accuracy of the tachometer is critical to the safe operation of the aircraft.

(a) Some tachometers have been found to be in error by as much as 200 RPM.

(b) Operating the aircraft with an inaccurate tachometer could cause continued operation at unacceptably high stresses, including repeatedly exceeding the maximum engine RPM.

(c) Continuous operation in a restricted RPM range subjects the propeller to stresses that are higher than the design limits.

(d) Stresses that are higher than the design limits will shorten the life of the propeller and could cause a catastrophic failure.

B. Tachometer Calibration

(1) Hartzell Propeller LLC recommends that propeller owners/operators calibrate the engine tachometer in accordance with the National Institute of Standards and Technology (NIST) or similar national standard (traceable).

(2) Contact Hartzell Propeller LLC if the propeller was operated in a restricted RPM range because of a tachometer error.

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ASTM DATA - CONTENTS

LIST OF TABLES

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Propeller Model	Blade Model	Diameter (in.)	Engine Make/Model	Maximum Engine Power (HP)	Maximum Propeller RPM	Operating Restrictions
3H1-QP275( )1X	76H62X( )	76	Rotax 916 iSc A	160	2279	None

ASTM F2506 Propeller/Engine Capability
Table 7-1

Propeller	Diameter (in.)	Polar Moment slug x ft^2 (kg x cm^2)
3H1-QP275( )1X/76H62X( )	76	0.617 (8365)

Polar Moment Data
Table 7-2

Propeller Model	Blade Model	Diameter (in.)	Maximum Continuous HP/RPM	Takeoff HP/RPM	Approximate Weight lbf (kg)
3H1-QP275( )1X	76H62X( )	76	160/2279	160/2279	20 (9)

Basic Propeller Limitations
Table 7-3

1. ASTM F2506 Approved Engine/Propeller Combinations
   This data meets the standard defined in ASTM F2506. This approval does not extend beyond this scope. These limitations are for the propeller in combination with the engine and may be different from the maximum for the propeller as a stand alone component. Refer to Table 7-1.
   A. Aircraft Applicability
      (1) The following data is applicable to usage on single engine, tractor, non-aerobatic aircraft only.
   B. Diameter
      (1) Diameter data is either provided as a range, indicating any diameter within that range is acceptable, or as discrete values, indicating that only those specific diameters comply.
   C. Engine Applicability
      (1) The engine models listed in Table 7-1 are the configurations on the engine type certificate, or ASTM compliant engine, unless specifically stated otherwise. Modifications to the engine or airframe that alter the power of the engine models listed in Table 7-2 during any phase of operation have the potential to increase propeller stresses and are not approved by this list. Refer to the section, “Airframe or Engine Modifications” in the Introduction chapter of this manual.

2. Mass Moment of Inertia Data
   Table 7-2 provides data for the mass moment of inertia (polar moment) for the propeller about itsrotational axis.

3. Propeller Limitations
   This data meets the standard defined in ASTM F2506. This approval does not extend beyond this scope. The limitations in Table 7-3 are for the propeller as a stand alone component only and do not apply to any specific aircraft or engine.

4. Overhaul Periods

CAUTION: 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.

A. Overhaul Periods

(1) Propellers must be overhauled at 500 hours or 60 months, whichever occurs first.

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RECORDS - CONTENTS

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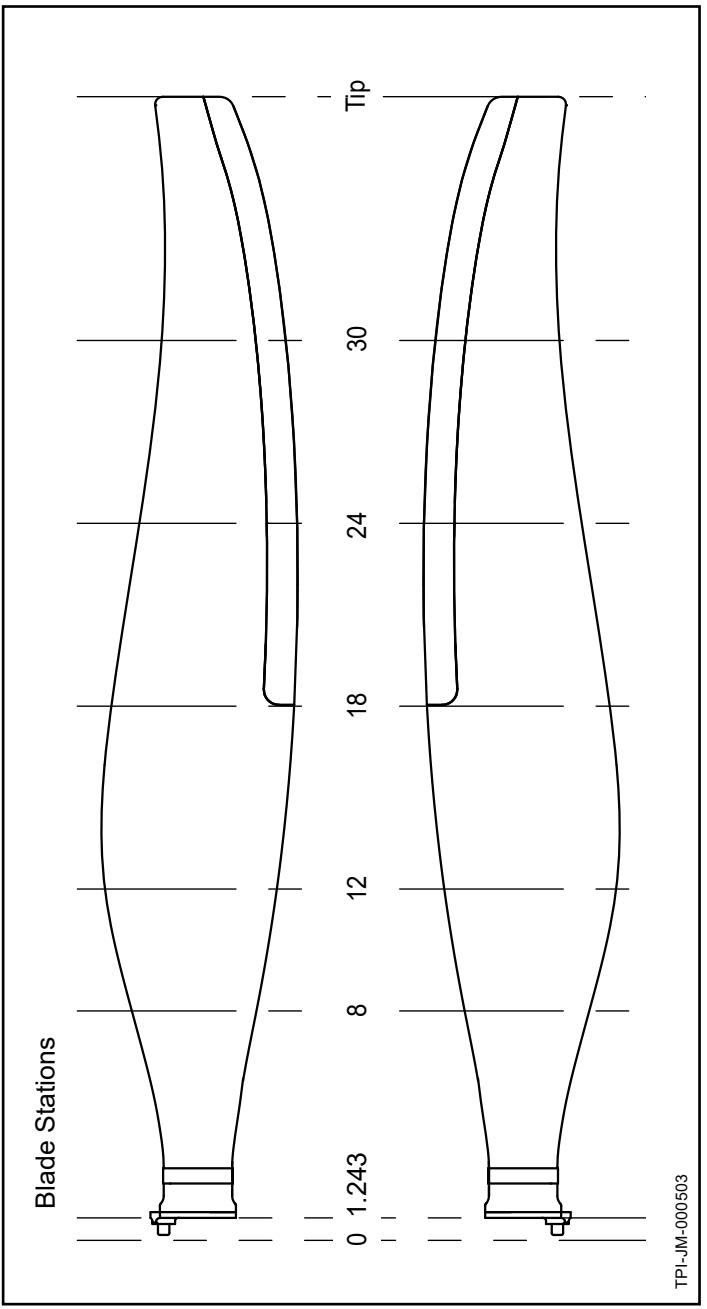
1. Record Keeping (Rev. 1)
   A. General
      (1) It is required to keep a record of any repairs, adjustments, maintenance, or required inspections performed on a propeller or propeller system.
   B. Information to be Recorded
      (1) The logbook may be used to record required information.
      (2) Below is a list of information that must be recorded:
         (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).
   C. Blade Damage Repair Sheets
      NOTE: The use of the Blade Damage Repair Sheets in this chapter is at the discretion of the user.

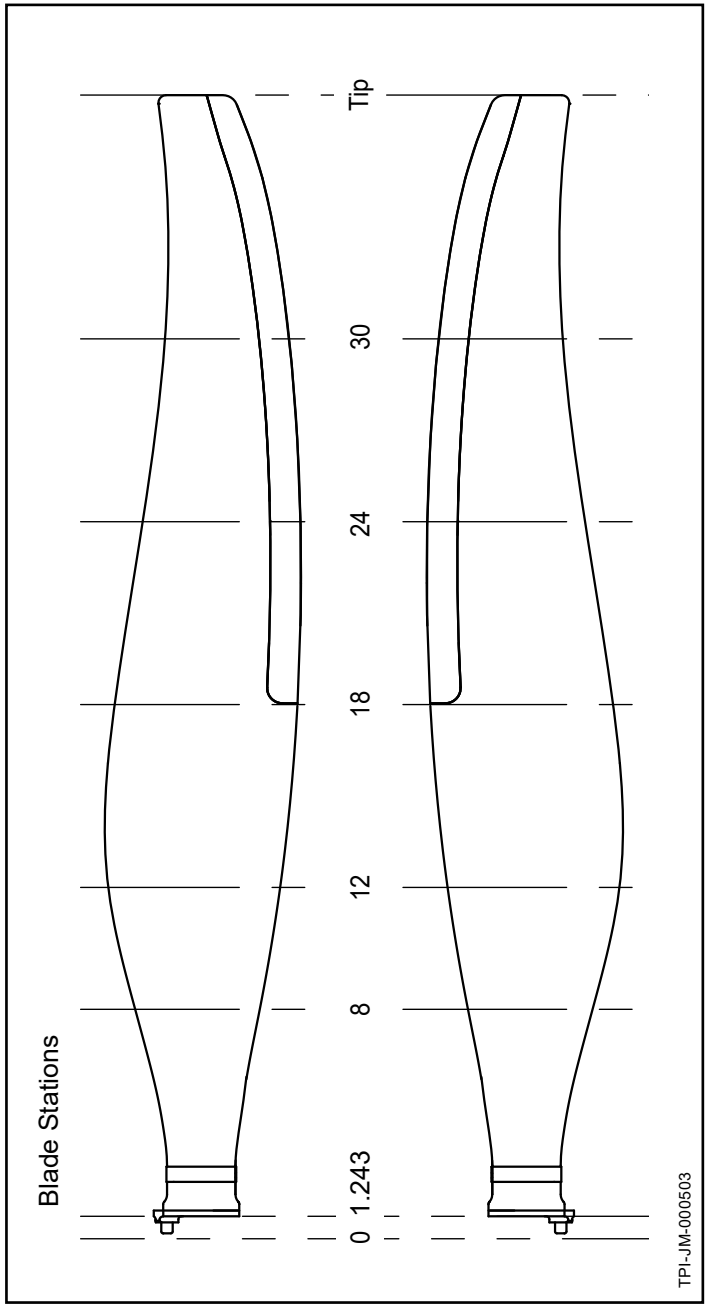
Record of ( )76H62( ) Composite Blade Damage Repair

Blade Serial No. _____



Record of ( )76H62( ) Composite Blade Damage Repair

Blade Serial No. _____



Record of ( )76H62( ) Composite Blade Damage Repair

Blade Serial No. _____