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Revision 2
April 2026

Propeller Owner's Manual

Ground Adjustable Propellers
5FB-F375A1( ) Model

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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 (BP-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.

REVISION 2 HIGHLIGHTS

Revision 2, dated April 2026, is a complete reissue distributed in its entirety.

REVISION 2 HIGHLIGHTS

1. Introduction

A. General

This is a list of current revisions that have been issued against this manual. Please compare 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 format 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	Jul/25	New Issue
Revision 1	Sep/25	Minor Revision
Revision 2	Apr/26	Reissue

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	Inserted By
Orig	Jul/25	Jul/25	HP
1	Sep/25	Sep/25	HP
2	Apr/26	Apr/26	HP

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RECORD OF TEMPORARY REVISIONS

Update this page to show all temporary revisions inserted into this manual.

Temporary Revision No.	Section/ Page	Issue Date	Date Inserted	Inserted By	Date Removed	Removed By

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SERVICE DOCUMENTS LIST

CAUTION 1: DO NOT USE OBSOLETE OR OUTDATED INFORMATION.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

Service Letter Number	Incorporation Rev./Date

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AIRWORTHINESS LIMITATIONS

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

FAA APPROVED

by: _____ date: _____

Manager, Central Certification Branch
Compliance & Airworthiness Division
Aircraft Certification Service

Rev. No.	Description of Revision

AIRWORTHINESS LIMITATIONS

1. The FAA establishes specific life limits for certain component parts as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.

2. The following data summarizes all current information concerning Hartzell life limited parts, as related to propeller models affected by this manual. These parts are not life limited on other installations; however, time accumulated toward life limit accrues when first operated on aircraft/engine/propeller combinations listed and continues regardless of subsequent installations (that may or may not be life limited).

   A. Propeller models affected by this manual currently do not have any life limited parts.

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

FAA APPROVED

by: _____ date: _____

Manager, Central Certification Branch
Compliance & Airworthiness Division
Aircraft Certification Service

LIST OF EFFECTIVE PAGES

Chapter	Page	Rev. Level	Date
Cover	Cover/Inside Cover	Rev. 2	Apr/26
Message	1 thru 2	Rev. 2	Apr/26
Revision Highlights	1 thru 2	Rev. 2	Apr/26
Record of Revisions	1 thru 2	Rev. 2	Apr/26
Record of Temporary Revisions	1 thru 2	Rev. 2	Apr/26
Service Documents List	1 thru 2	Rev. 2	Apr/26
Airworthiness Limitations	1 thru 2	Rev. 2	Apr/26
List of Effective Pages	1 thru 2	Rev. 2	Apr/26
Table of Contents	1 thru 2	Rev. 2	Apr/26
Introduction	1-1 thru 1-22	Rev. 2	Apr/26
Description and Operation	2-1 thru 2-6	Rev. 2	Apr/26
Installation and Removal	3-1 thru 3-34	Rev. 2	Apr/26
Testing and Troubleshooting	4-1 thru 4-4	Rev. 2	Apr/26
Inspection and Check	5-1 thru 5-18	Rev. 2	Apr/26
Maintenance Practices	6-1 thru 6-16	Rev. 2	Apr/26
Anti-ice and De-ice Systems	7-1 thru 7-6	Rev. 2	Apr/26
Records	8-1 thru 8-10	Rev. 2	Apr/26

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TABLE OF CONTENTS

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INTRODUCTION - CONTENTS

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1. General (BP-2)
   A. Statement of Purpose
      (1) This manual has been reviewed and accepted by the FAA. Additionally, the Airworthiness Limitations section of this manual has been approved by the FAA.

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

      (2) The information in this manual can be used by qualified personnel to install, operate, and maintain the applicable Hartzell propeller assemblies.
         (a) Additional manuals are available that include overhaul procedures and specifications for the propeller.
      (3) This manual may include multiple design types.
         (a) Parentheses shown in the propeller model designations in this or other Hartzell Propeller publications indicate letter(s) and/or number(s) that may or may not be present because of different configurations permitted on the various aircraft installations.
            1 Refer to the Description and Operation chapter of this manual for propeller and blade model designation information.
      (4) Where possible, this manual is written in the format specified by ATA iSpec 2200.
   B. Maintenance Practices
      (1) The propeller and its components are highly vulnerable to damage while they are removed from the engine. Properly protect all components until they are reinstalled on the engine.
      (2) Never attempt to move the aircraft by pulling on the propeller.
      (3) When the propeller preload system is disengaged, propeller blades should rotate freely in the hub.
         (a) If the propeller blades do not rotate freely, the propeller must be sent to Hartzell Propeller Service Center for evaluation.
      (4) Use only the approved consumables, e.g., cleaning agents, lubricants, etc.
      (5) Observe applicable torque values during maintenance.

(6) Before installing the propeller on the engine, the propeller must be statically balanced. New propellers are statically balanced at Hartzell Propeller. Overhauled propellers must be statically balanced by a certified propeller repair station with the appropriate rating before return to service.

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

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

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

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

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

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

(10) 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.

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

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

(13) 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 (BP-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 (BP-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 135F (61-13-35)	Composite Blade Overhaul Manual
Manual 148 (61-16-48)	Composite Spinner Maintenance Manual
Manual 159 (61-02-59)	Application Guide
Manual 165A (61-00-65)	Illustrated Tool and Equipment Manual
Manual 170 (61-13-70)	Composite Blade Field Maintenance and Minor Repair Manual
Manual 180 (30-61-80)	Ice Protection System Manual
Manual 202A (61-01-02)	Standard Practices Manual, Volumes 1 through 11
Manual 525 (61-10-25)	Ground Adjustable Propeller Overhaul Manual

B. Vendor Publications

None.

5. Personnel Requirements (BP-3)

   A. Service and Maintenance Procedures in this Manual

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

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

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

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

6. Special Tooling and Consumable Materials (BP-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) A calendar limit between overhauls is specified in Hartzell Propeller Service Letter HC-SL-61-61Y.

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

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

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

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

   B. Long Term Storage

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

9. Component Life and Overhaul (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.

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

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

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

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

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

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

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

10. Damage/Repair Types (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.

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. Propeller Critical Parts

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

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

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

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

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

12. Warranty Service (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 the 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 Hartzell Propeller 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 Hartzell Propeller 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
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A.

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

C. Recommended Facilities

(1) Hartzell Propeller 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 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
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

Term	Definition
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
Corrosion (Aluminum)	The chemical or electrochemical attack by an acid or alkaline that reacts with the protective oxide layer and results in damage of the base aluminum. Part failure can occur from corrosion due to loss of structural aluminum converted to corrosion product, pitting, a rough etched surface finish, and other strength reduction damage caused by corrosion.
Corrosion (Steel)	Typically, an electrochemical process that requires the simultaneous presence of iron (component of steel), moisture and oxygen. The iron is the reducing agent (gives up electrons) while the oxygen is the oxidizing agent (gains electrons). Iron or an iron alloy such as steel is oxidized in the presence of moisture and oxygen to produce rust. Corrosion is accelerated in the presence of salty water or acid rain. Part failure can occur from corrosion due to loss of structural steel converted to corrosion product, pitting, a rough etched surface finish and other strength reduction damage caused by corrosion.

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

Term	Definition
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
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”.
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15

Term	Definition
Reference Blade Radius	Refers to the propeller reference blade radius in an assembled propeller, e.g., 30-inch radius. A measurement from the propeller hub centerline to a point on a blade, used for blade angle measurement in an assembled propeller. An adhesive stripe (blade angle reference tape CM160) is usually located at the reference blade radius location. Note: Do not confuse *reference blade radius* with *blade station*; they may not originate at the same point.
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up
Scratch	Same as “Nick”
Short Circuit	Connection of low resistance between points on a circuit between which the resistance is normally much greater
Shot Peening	Process where steel shot is impinged on a surface to create compressive surface stress, that provides improved strength and resistance to fatigue
Single Acting	Hydraulically actuated propeller that utilizes a single oil supply for pitch control
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip
Station Line	See "Blade Station"
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM
Synchrophasing	A form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other
Ticking	A series of parallel marks or scratches running circumferentially around the diameter of the blade
Track	In an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly
Trailing Edge	The aft edge of an airfoil over which the air passes last
Trimline	Factory terminology referring to where the part was trimmed to length

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

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

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DESCRIPTION AND OPERATION - CONTENTS

LIST OF FIGURES

LIST OF TABLES

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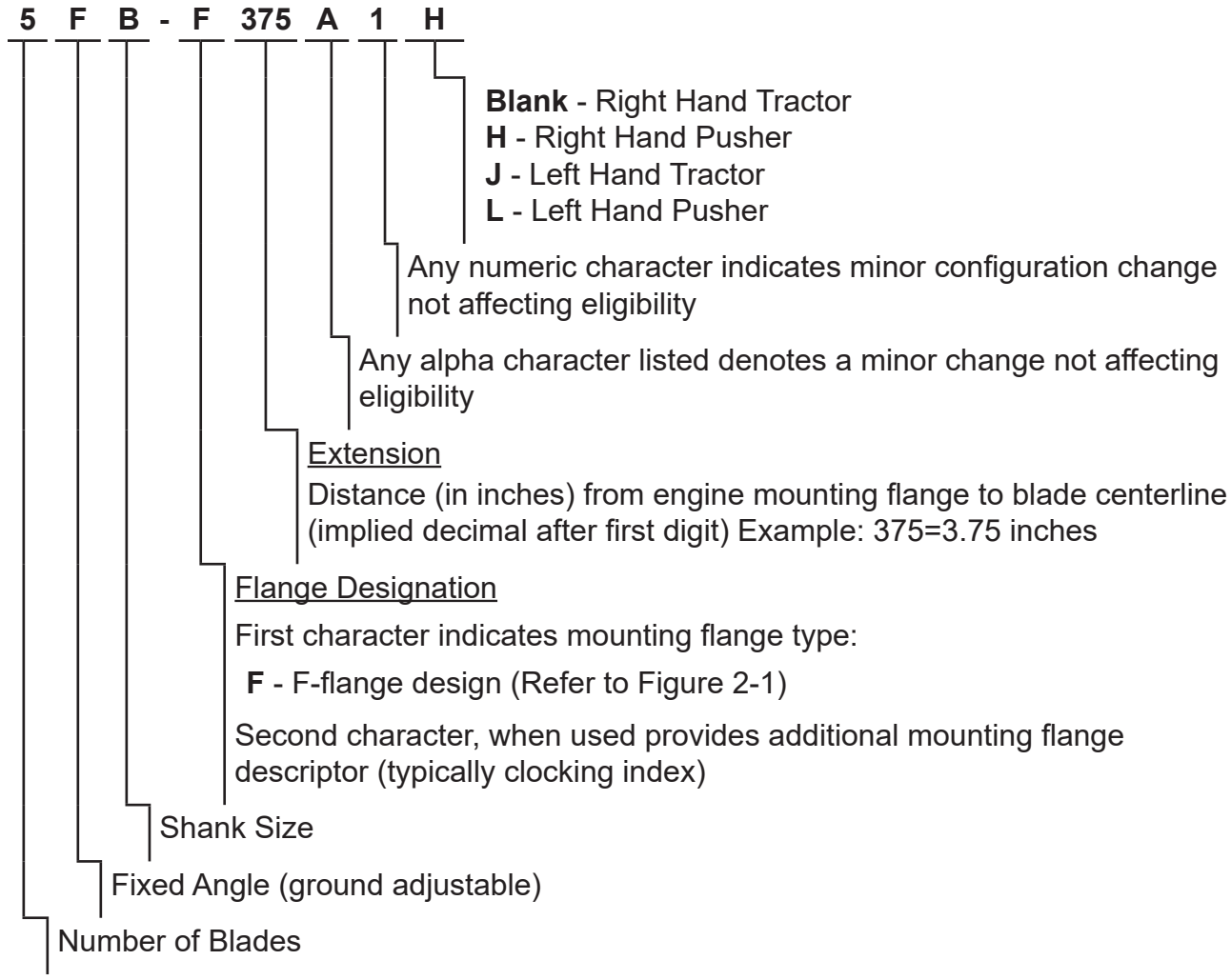
1. Description of Propellers and Systems

   A. Ground Adjustable Propellers

      A ground adjustable propeller is similar to a fixed pitch propeller but has a means to manually change blade angle while the airplane is on the ground and the engine is completely shut off. For procedures on how to adjust blade angles, refer to the section, "Blade Angle Adjustment" in the Maintenance Practices chapter of this manual.

      The ground adjustable propeller blades are retained by a two piece aluminum hub.



Propeller Model Designations
Table 2-1

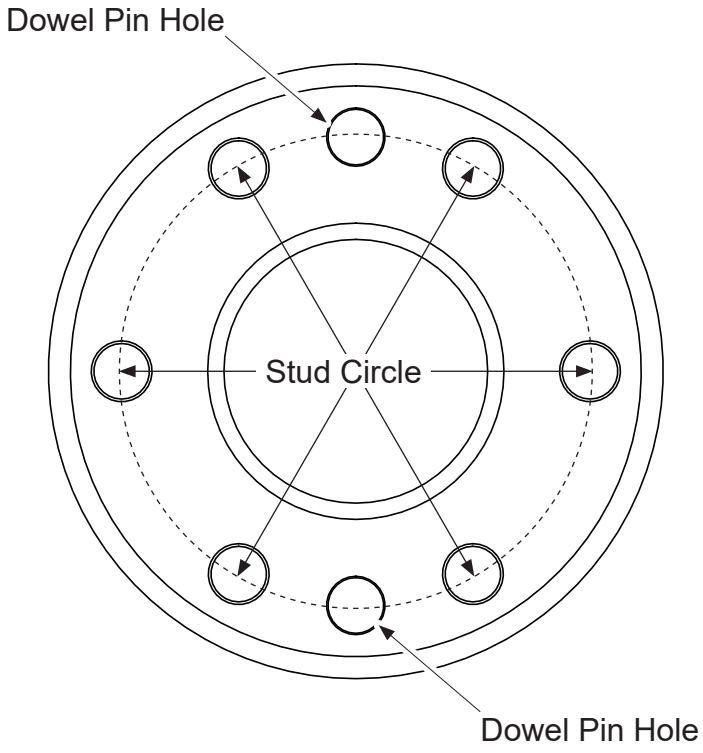
B. Propeller Model Designation

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

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

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

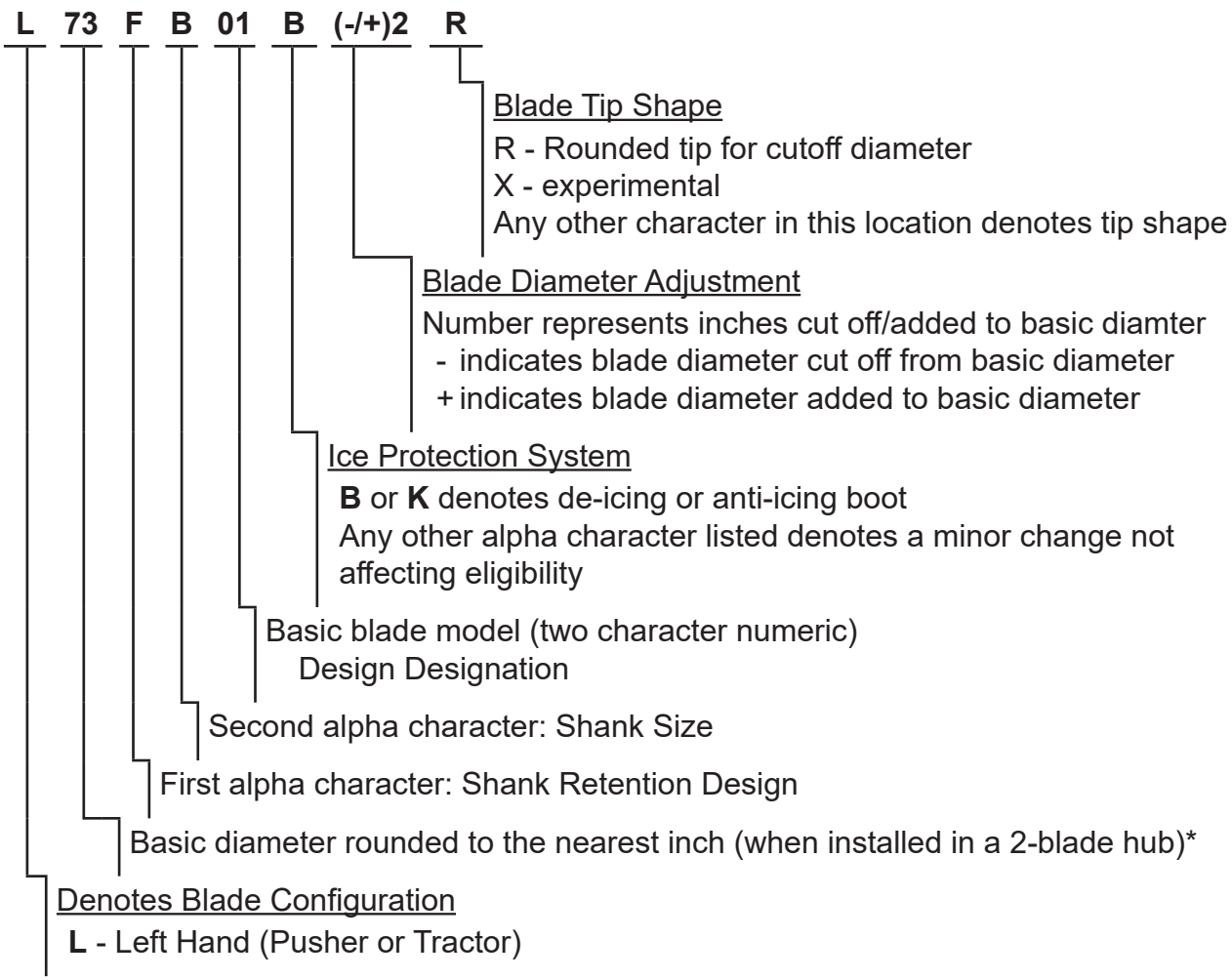
(3) Refer to Table 2-1 for a description of the characters used in the propeller model number.



F-flange

Stud Circle	No. of Dowels	No. of Studs
4.00 inch 101.6 mm	2 (dia.: 0.50 inch)	6 (1/2-20 inch)

Propeller Flange Description
Figure 2-1



* Diameter limits are nominal diameters of the assembled propeller. They do not include the + or - 1/8 inch manufacturing tolerance allowed for propellers with a basic diameter of less than 14 feet.

Blade Type and Blade Model Designations
Table 2-2

2. Propeller Blades

A. Description of Composite Blades

(1) 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 characteristics.

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

B. Blade Model Designation

(1) Hartzell Propeller LLC 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 / blade model*

(2) The blade model number is impression stamped on the base plate of the blade.

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

3. Propeller Ice Protection Systems (BP-1)

A. System Description

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

INSTALLATION AND REMOVAL - CONTENTS

LIST OF FIGURES

LIST OF TABLES

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER 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 OVERHAUL MANUAL 525 FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

1. Tools and Expendables

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

NOTE: The flange type used on a particular propeller installation is indicated in the propeller model identification number stamped on the hub. For example, 5FB-**F**375A1( ) indicates an F-flange. Refer to Table 2-1, “Blade Model Designations” in the Description and Operation chapter of this manual for a description of flange types.

A. Tooling

(1) Tools for Mounting the Bulkhead

CAUTION 1: DO NOT USE AN OPEN END WRENCH TO TORQUE THE HUB CLAMPING NUTS.

CAUTION 2: WHEN USING THE TORQUE WRENCH ADAPTER (TE457), MAKE SURE THAT IT IS CORRECTLY ENGAGED ON THE NUT BEFORE APPLYING TORQUE.

(a) Use torque wrench adapter (TE457) or other applicable torque adapter when torquing the hub clamping bolts.

NOTE: Using a torque wrench adapter other than the recommended TE457 increases the risk of the wrench causing damage to the hub in the areas around the hub clamping bolts.

(2) Tools for Propeller Removal or Installation:

F-flange Propellers

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench (1/2 inch drive)
- Torque wrench adapter (TE150)
- 3/4 inch open end wrench

B. Expendables

- 0.032 inch (0.81 mm) stainless steel aircraft safety wire [Alternate: 0.032 inch (0.81 mm) aircraft safety cable and associated washers and ferrules]
- O-ring, Propeller-to-Engine Seal (see Table 3-1)

2. Pre-Installation (BP-5)

A. Inspection of Shipping Package

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

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

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

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

B. Uncrating

(1) Put the propeller on a firm support.

(2) Remove the banding and any external wood bracing from the 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 “Knockdown” Propeller

(1) Propellers that were disassembled for shipment, must be reassembled by trained personnel in accordance with the applicable propeller maintenance manual.

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

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

3. Propeller Mounting Hardware and Torque Information (BP-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 3-2 to determine the correct torque value.

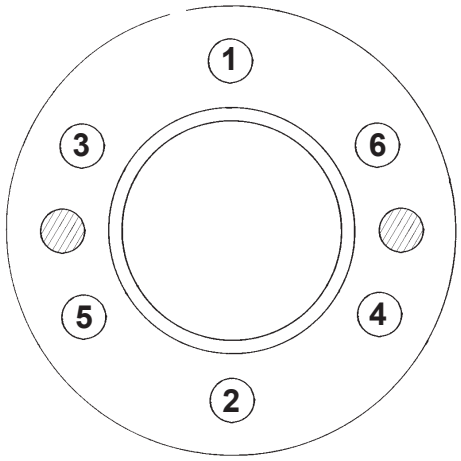
(5) Refer to Figure 3-1 for the proper torquing sequence of the propeller mounting studs/nuts.

Flange	O-ring	Stud	Washer	Nut
F-flange	C-3317-228	A-2429-5	A-1381	A-2044

Propeller/Engine Flange O-rings and 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 3-2 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.	
Hardware	**Torque**
Hub clamping nuts/spinner mounting nuts	27-33 ft-lbs (37-44 N•m)
F-flange propeller mounting nuts	70-80 ft-lbs (95-108 N•m)
Cap screws (for load reaction plate)	75-85 in-lbs (8.4-9.6 N•m)
Jam nuts (for load reaction plate cap screws)	110-130 in-lbs (12.4-14.6 N•m)

Torque Table
Table 3-2

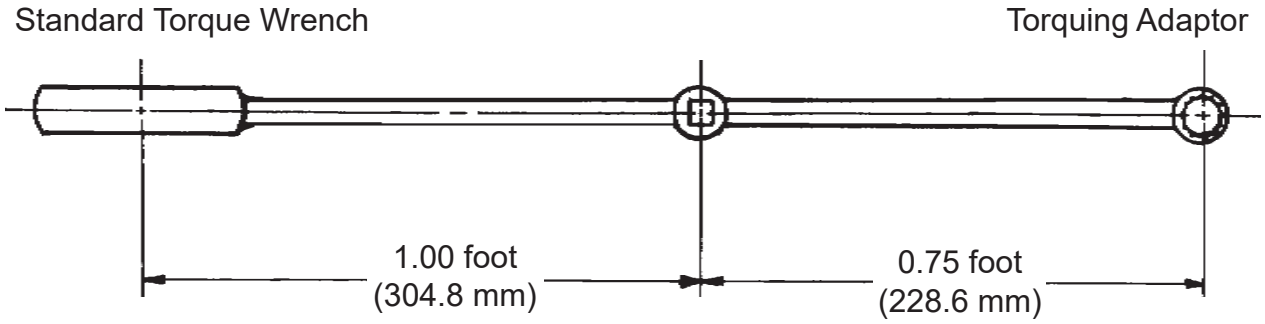


F-flange

Step 1 - Torque all mounting bolts/nuts to 40 Ft-Lbs (54 N•m)

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

Torquing Sequence for Propeller Mounting Bolts/Nuts
Figure 3-1



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

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 Torque Wrench Adapter
Figure 3-2

4. Bulkhead Installation (BP-5)

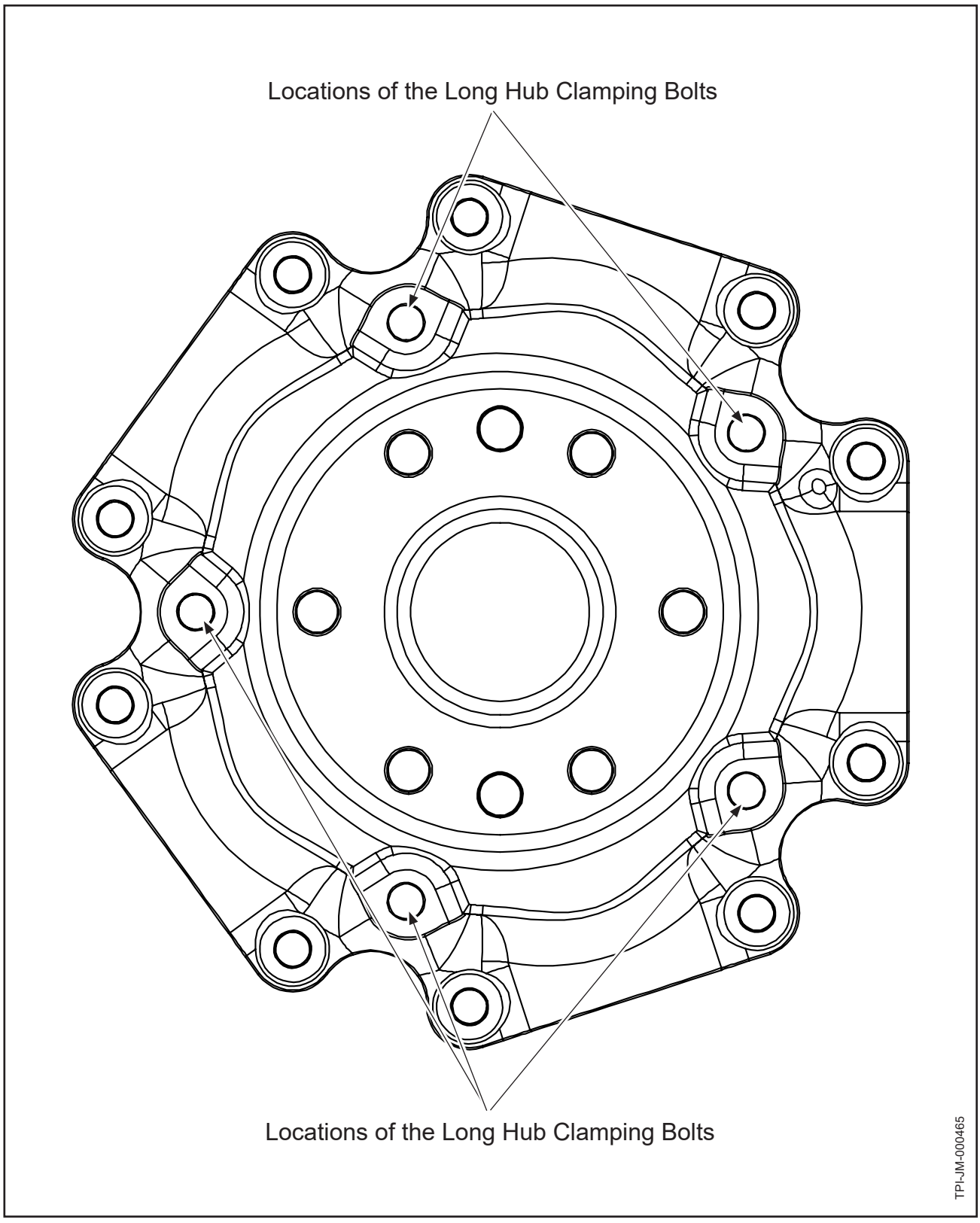
   A. General

      (1) The spinner support must be mounted to the hub before the propeller can be installed on the aircraft.

      (2) The spinner assembly may be supplied with spinner mounting hardware, including long hub clamping bolts, washers, and nuts.

         (a) If the propeller is shipped with longer hub clamping bolts, spinner mounting hardware will not be supplied with the spinner assembly. Refer to Hartzell Propeller Application Guide Manual 159 (61-02-59) for the applicable installation.

         (b) On some installations, it may be necessary to install spacers and/or washers under the head of the hub clamping bolt to avoid interference with the aircraft cowling.



Locations for the Long Hub Clamping Bolts
Figure 3-3

B. Installation of a Composite Bulkhead

CAUTION: REMOVE THE NUTS AND WASHERS FROM THE HUB CLAMPING BOLTS CENTERED IN THE HUB SHOULDER. DO NOT REMOVE THE HUB CLAMPING BOLTS.

(1) Remove five spinner mounting nuts from the five long hub clamping bolts, located between the propeller blades centered in the hub shoulder. Refer to Figure 3-3.

(2) Remove flat washer “D” from each hub clamping bolt.

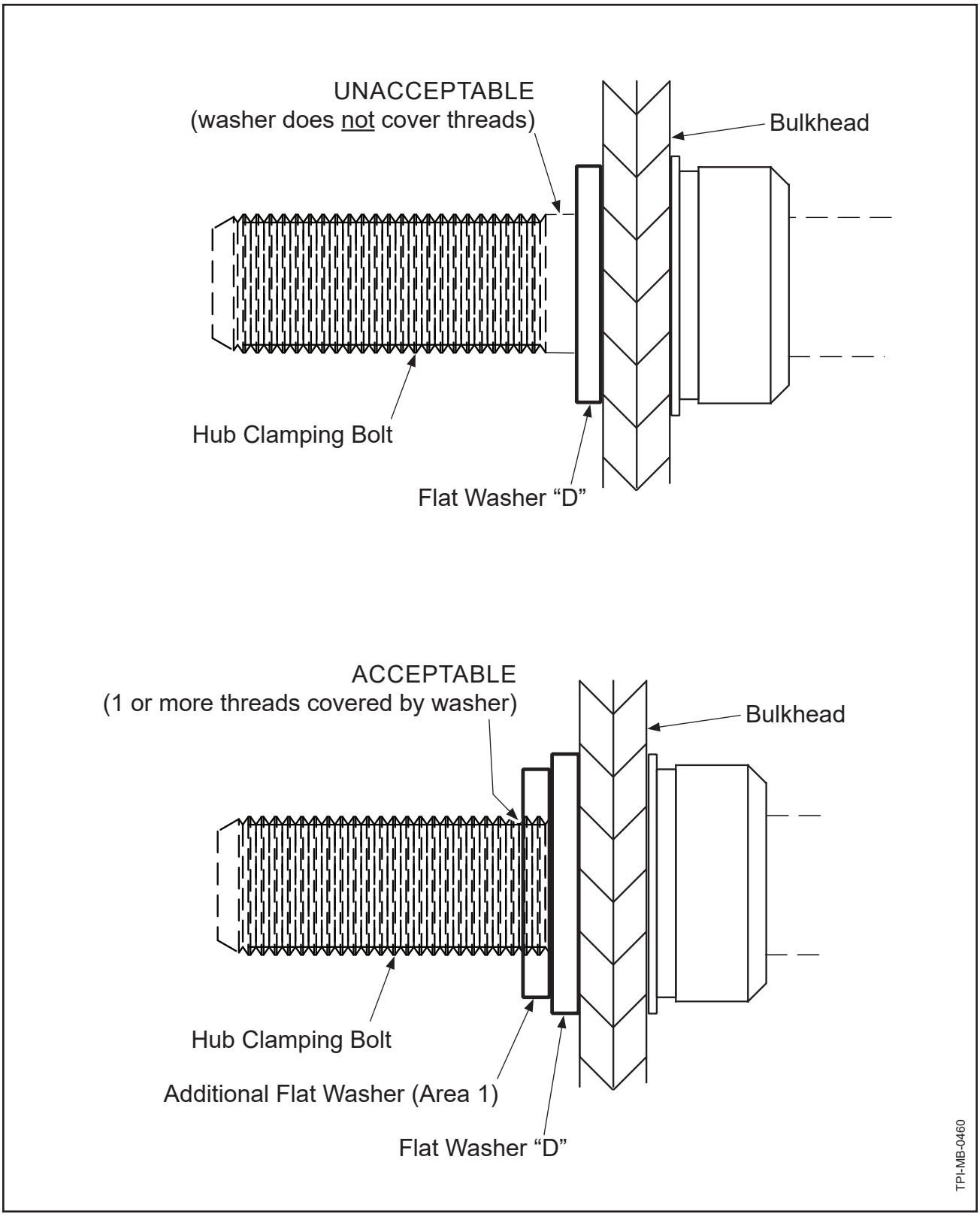
CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD. EXCEPTIONS MAY BE REQUIRED IF PROPELLER APPLICATIONS HAVE DE-ICE OR ANTI-ICE APPLICATIONS. REFER TO HARTZELL PROPELLER ICE PROTECTION SYSTEM MANUAL 180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

CAUTION 2: INSTALL THE SPINNER MOUNTING HARDWARE STACK-UP IN THE CORRECT SEQUENCE TO GET PROPER HUB CLAMPING AND TO PREVENT CRUSHING OF THE BULKHEAD.

CAUTION 3: DO NOT LET THE SPINNER BULKHEAD TOUCH THE HUB. TO MAINTAIN BULKHEAD TO HUB CLEARANCE, ADDITIONAL FLAT WASHER(S) OR SPACER(S) MAY BE REQUIRED.

(3) Install the spinner mounting kit hardware.

(4) Install the spinner bulkhead onto the hub clamping bolts.



Thread Coverage: Composite Bulkhead
Figure 3-4

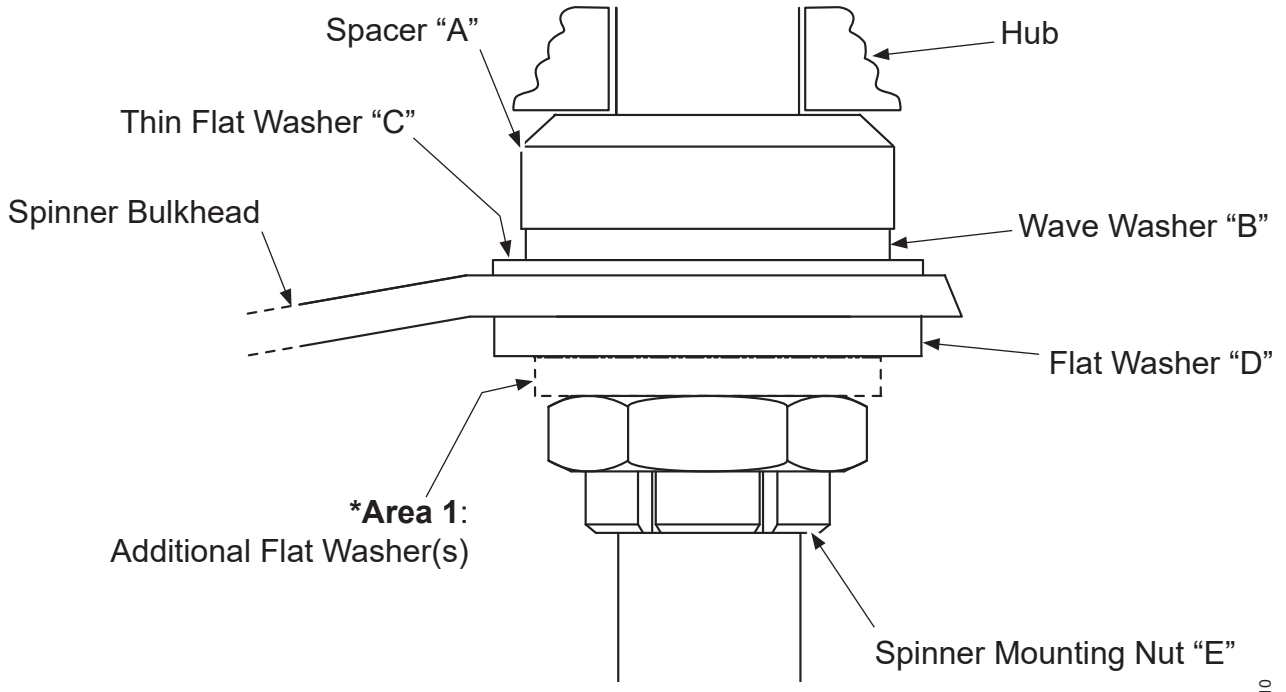
CAUTION: A MINIMUM OF ONE THREAD MUST BE COVERED BY FLAT WASHER “D” AND/OR ADDITIONAL FLAT WASHER(S) TO MAKE SURE THE SPINNER MOUNTING NUT “E” DOES NOT BOTTOM OUT ON THE NON-THREADED AREA OF THE HUB CLAMPING BOLT. REFER TO FIGURE 3-4 FOR ILLUSTRATIONS OF ACCEPTABLE/UNACCEPTABLE THREAD COVERAGE.

(5) Install flat washer “D” onto each hub clamping bolt, then check the thread coverage on the hub clamping bolts in accordance with Figure 3-4.

(a) If washer “D” covers a minimum of one thread on the hub clamping bolt, go to step (6) of this procedure.

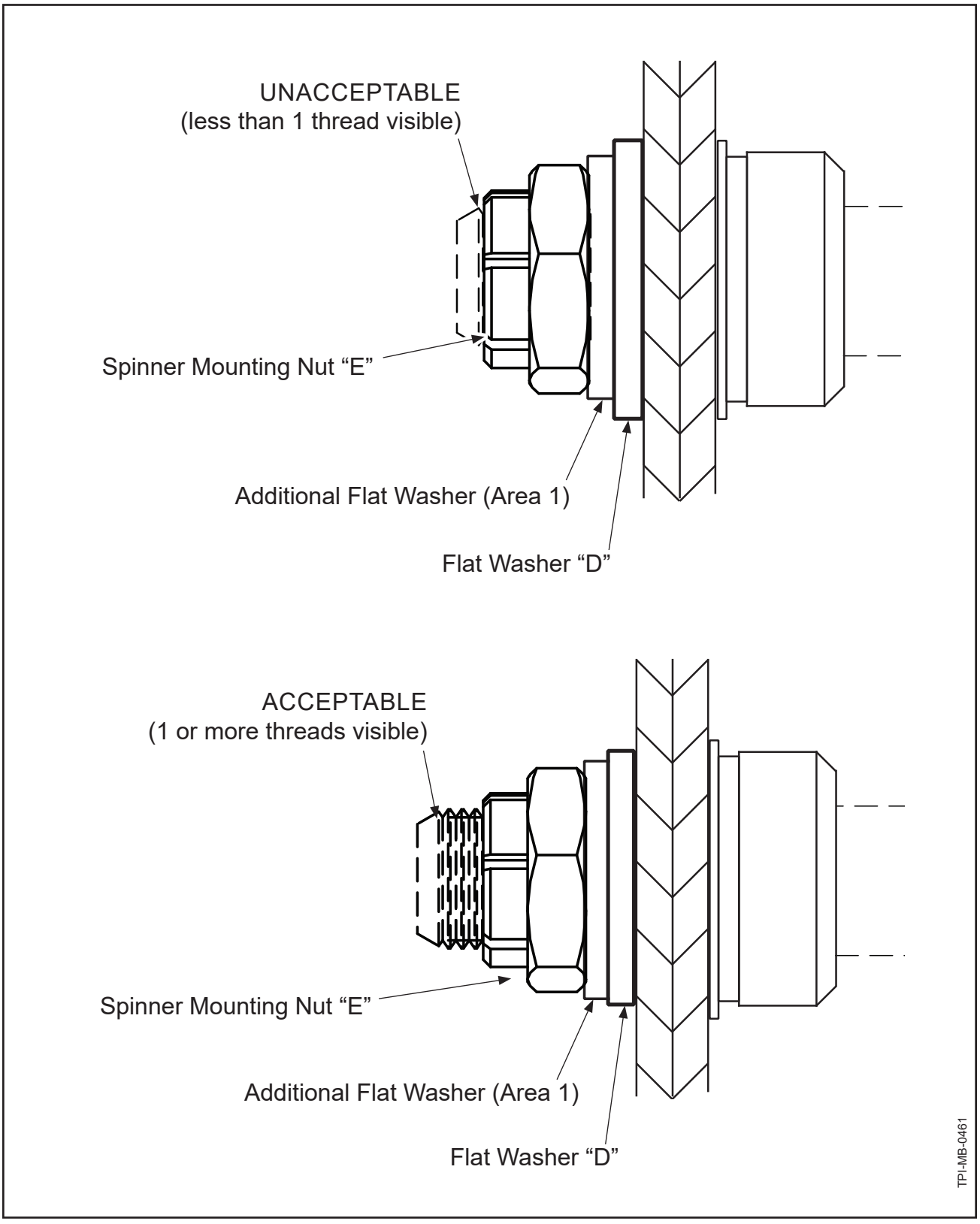
(b) If washer “D” does not cover at least one thread on the hub clamping bolt, install additional
B-3834-0632 flat washer(s) or equivalent in accordance with Figure 3-4.

1 Up to three flat washers may be installed in Area 1 to get proper thread coverage Refer to Figure 3-4 and Figure 3-5.



* Up to three washers can be installed in **Area 1** to get proper thread engagement.

Composite Bulkhead Mounting
Figure 3-5



Thread Exposure: Composite Bulkhead
Figure 3-6

CAUTION: AT LEAST ONE THREAD OF THE HUB CLAMPING BOLT MUST BE VISIBLE BELOW THE SPINNER MOUNTING NUT. REFER TO FIGURE 3-6 FOR ILLUSTRATIONS OF ACCEPTABLE AND UNACCEPTABLE THREAD EXPOSURE.

(6) Install spinner mounting nut “E” onto each hub clamping bolt.

(a) Torque each spinner mounting nut in accordance with Table 3-2.

1 If using a torque wrench adapter during torque, refer to Figure 3-2.

(b) If there is less than one hub clamping bolt thread visible below the spinner mounting nut “E”, remove one of the additional flat washers added in Area 1, then reinstall/torque the spinner mounting nut and check the thread exposure. Refer to Figure 3-6.

1 Flat washer “D” is required in Area 1.

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

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

C. Installation of a Metal Bulkhead

CAUTION: REMOVE THE NUTS AND WASHERS FROM THE HUB CLAMPING BOLTS CENTERED IN THE HUB SHOULDER. DO NOT REMOVE THE HUB CLAMPING BOLTS.

(1) Remove five spinner mounting nuts from the five long hub clamping bolts, located between the propeller blades. Refer to Figure 3-3.

NOTE: Additional washers/spacers may have been used during assembly of the propeller for hub clamping purposes. These additional washers/spacers may not be components of the applicable spinner mounting kit.

CAUTION 1: USE ONLY WASHERS/SPACERS FROM THE APPLICABLE SPINNER MOUNTING KIT TO INSTALL THE SPINNER BULKHEAD.

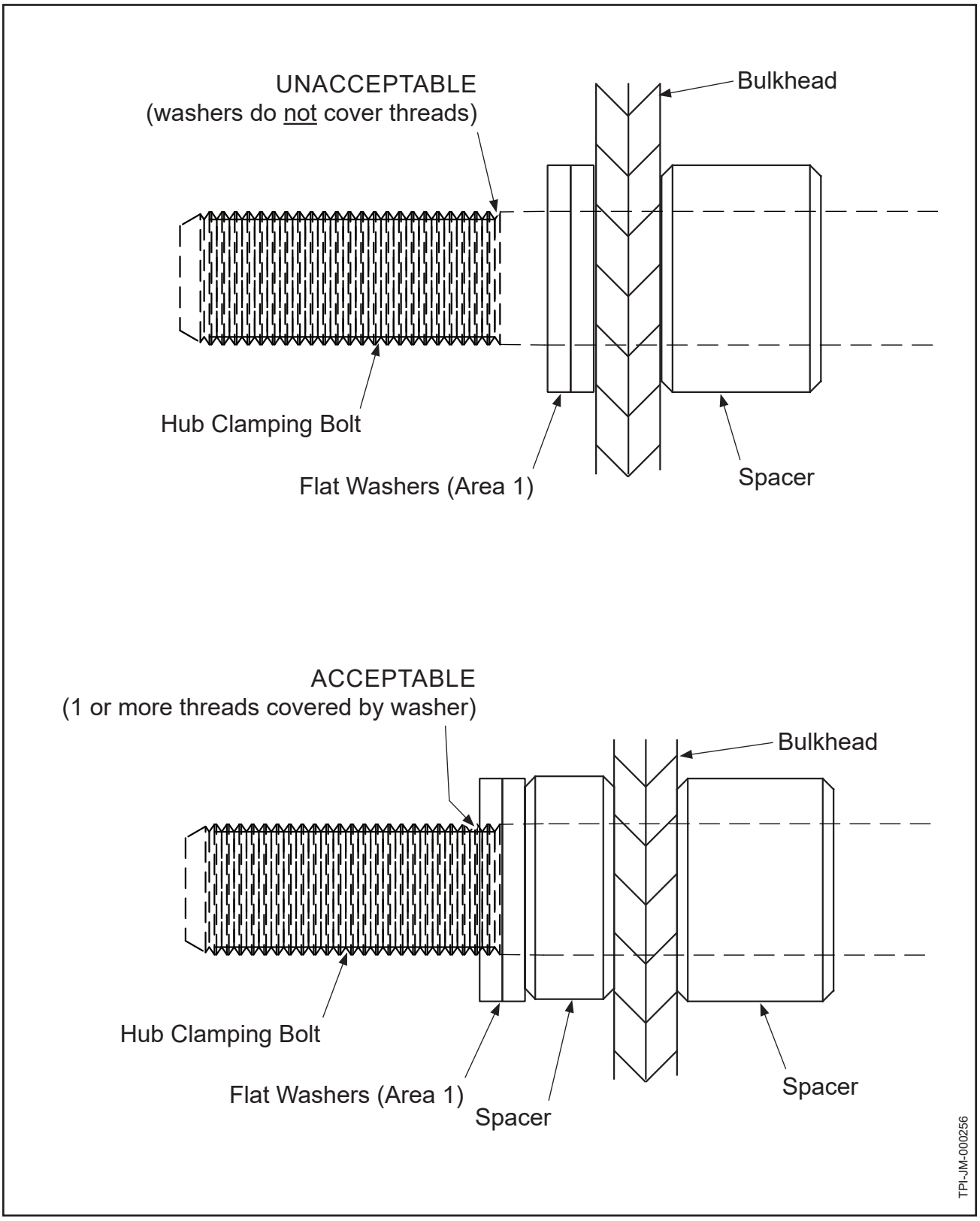
CAUTION 2: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING BOLT MUST BE THE SAME. VARIANCES BETWEEN STACK-UPS CAN CAUSE CRACKING OF THE SPINNER BULKHEAD.

CAUTION 3: DO NOT LET THE SPINNER BULKHEAD TOUCH THE HUB. TO MAINTAIN BULKHEAD TO HUB CLEARANCE, ADDITIONAL FLAT WASHER(S) OR SPACER(S) MAY BE REQUIRED.

(2) If applicable, install the spacer(s) onto the hub clamping bolts, then install the spinner bulkhead onto the hub clamping bolts.

(a) For applications that do not use spacers, install a minimum of two flat washers between the spinner bulkhead and the propeller hub.

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



Thread Coverage: Metal Bulkhead
Figure 3-7

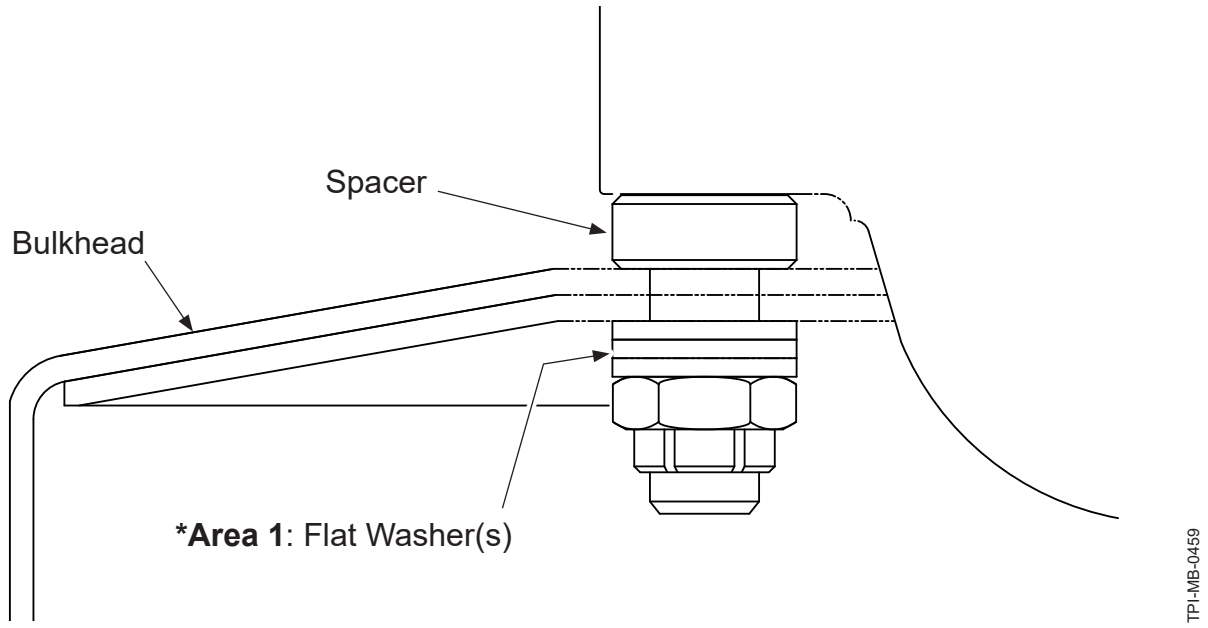
CAUTION: A MINIMUM OF ONE THREAD MUST BE COVERED BY FLAT WASHER(S)TO MAKE SURE THE SPINNER MOUNTING NUT WILL NOT BOTTOM OUT ON THE NON-THREADED AREA OF THE HUB CLAMPING BOLT. REFER TO FIGURE 3-7 FOR ILLUSTRATIONS OF ACCEPTABLE/UNACCEPTABLE THREAD COVERAGE.

(3) Install one flat washer and/or spacer (if applicable) onto the hub clamping bolts, then check the thread coverage on the hub clamping bolts in accordance with Figure 3-7.

(a) If the washer/spacer covers a minimum of one thread on the hub clamping bolt, go to step (4) of this procedure.

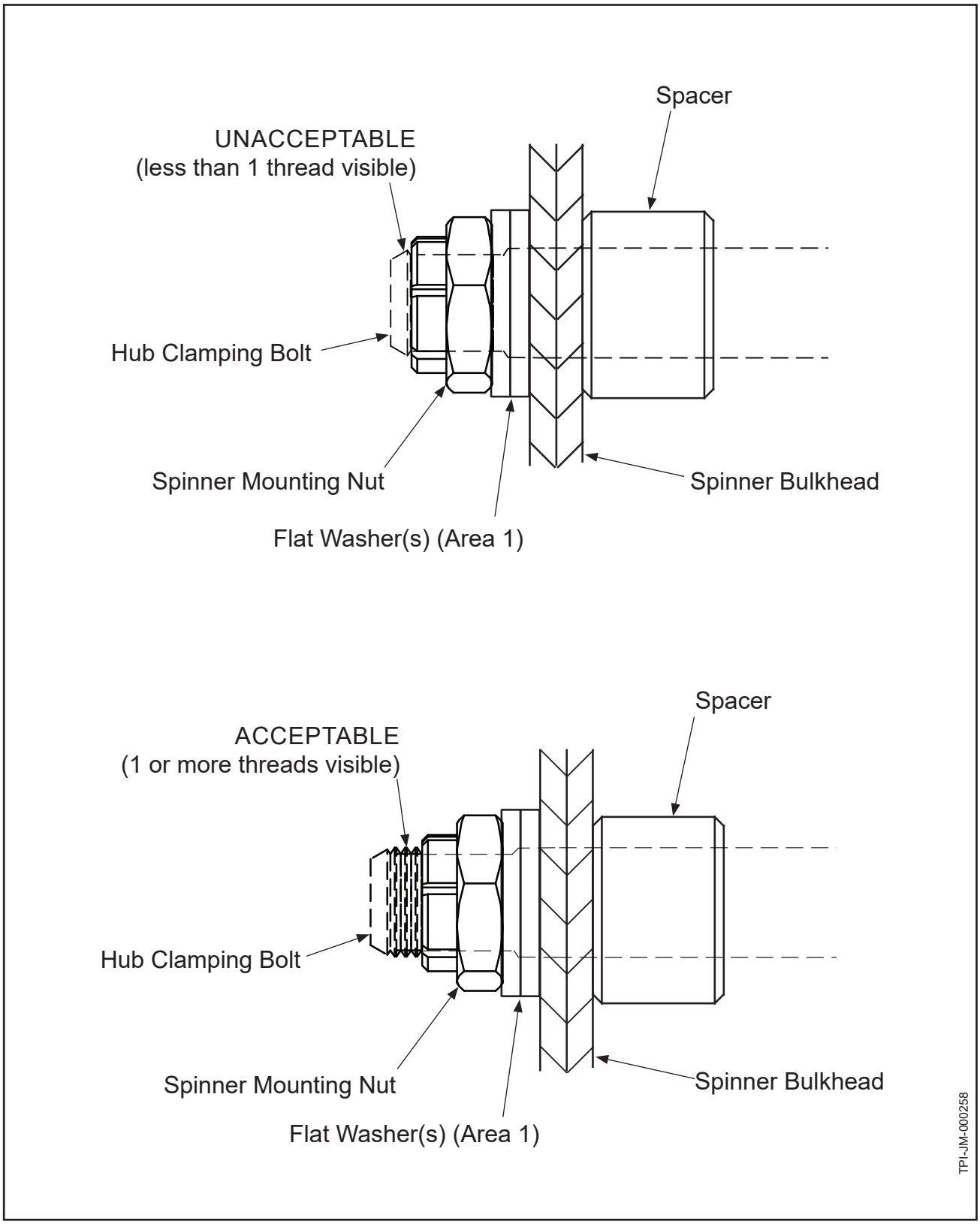
(b) If the washer/spacer does not cover at least one thread on the hub clamping bolt, install additional flat washer(s) from the spinner mounting kit in accordance with Figure 3-7.

1 Up to three flat washers can be installed in Area 1 to get proper thread coverage. Refer to Figure 3-7 and Figure 3-8.



* Up to three flat washers can be installed in **Area 1** to get proper thread engagement.

Metal Bulkhead Mounting
Figure 3-8



Thread Exposure: Metal Bulkhead
Figure 3-9

CAUTION: AT LEAST ONE THREAD OF THE HUB CLAMPING BOLT MUST BE VISIBLE BELOW THE SPINNER MOUNTING NUT. REFER TO FIGURE 3-9 FOR ILLUSTRATIONS OF ACCEPTABLE AND UNACCEPTABLE THREAD EXPOSURE.

(4) Install a spinner mounting nut on each of the hub clamping bolts used to mount the spinner bulkhead.

(a) Torque each spinner mounting nut in accordance with Table 3-2.

1 If using a torque wrench adapter during torque, refer to Figure 3-2.

(b) If there is less than one hub clamping bolt thread visible below the spinner mounting nut, remove one of the additional washers added in Area 1, then reinstall/torque the spinner mounting nut and check the thread exposure.

1 A minimum of one washer is required in Area 1.

(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, “Metal Bulkhead Spacing Adjustments” in this chapter.

5. Propeller Installation

A. Precautions

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

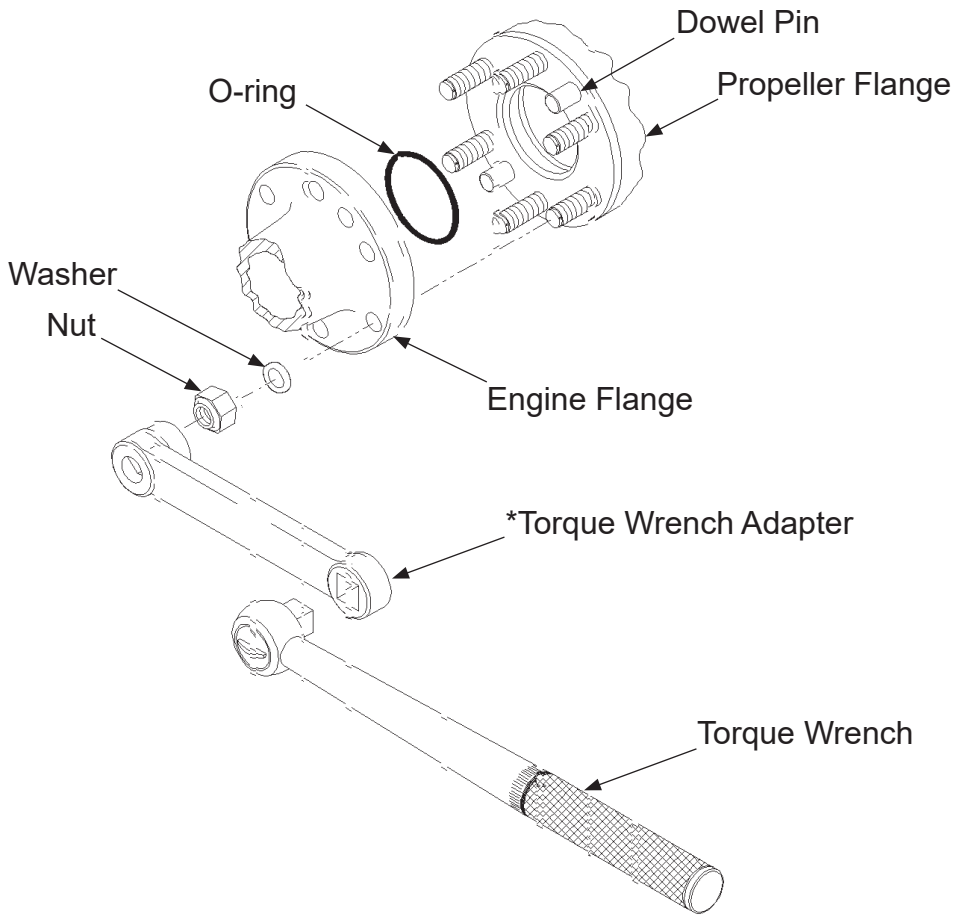
WARNING 2: WHEN INSTALLING THE PROPELLER, FOLLOW THE AIRFRAME MANUFACTURER’S MANUALS AND PROCEDURES, AS THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS OWNER’S MANUAL.

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

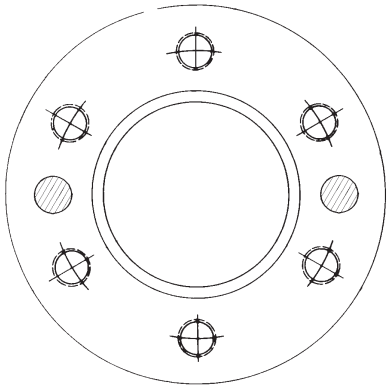
(2) Follow the airframe manufacturer’s instructions for installing the propeller.

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

(b) In addition to propeller installation procedures, items such as rigging and preflight testing of flight idle blade angle, and propeller synchronization devices are normally found in the airframe manufacturer’s manuals.



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



F-flange

Installing Propeller on Engine Flange
Figure 3-10

B. Installing 5FB-F375A1( ) Propellers on the Aircraft Engine

(1) General

(a) An F-flange propeller has six 1/2 inch studs configured in a four inch circle.

(b) Two dowel pins are also provided to transfer torque and index the propeller with respect to the engine crankshaft. Refer to Figure 3-10.

(2) Perform the applicable steps under Bulkhead Installation within this chapter.

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

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

(4) Refer to Figure 3-10. Install the O-ring in the O-ring groove in the hub bore. 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 RATED UP TO 200 LBS (90 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION. ONE PERSON MUST NEVER ATTEMPT TO INSTALL AN UNSUPPORTED PROPELLER BY HIMSELF, REGARDLESS OF THE SIZE OR WEIGHT OF THE PROPELLER. MANUALLY LIFTING THE PROPELLER ONTO THE ENGINE CAN RESULT IN PERSONAL INJURY.

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

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

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

(6) Install the propeller on the engine flange.

NOTE: Make certain to align the dowel pins in the propeller hub mounting flange with the corresponding holes in the engine mounting flange.

(a) The propeller may be installed on the engine flange in a given position, or 180 degrees from that position. Check the engine and airframe manuals to determine if either manual specifies a propeller mounting position.

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 1/2 inch propeller mounting nuts (dry) with washers. Refer to Table 3-1.

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

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

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

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

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

6. Spinner Dome Installation

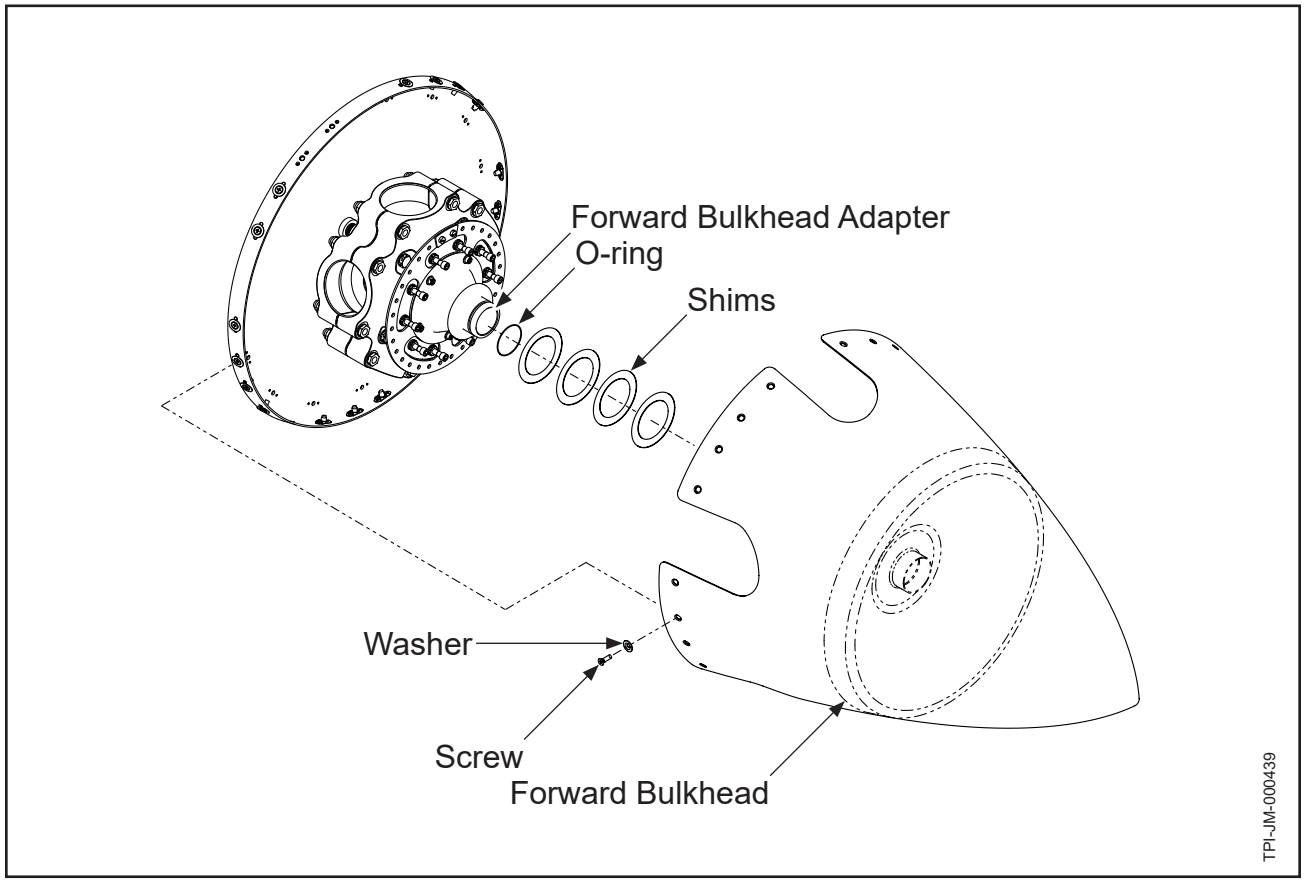
CAUTION 1: TO PREVENT DAMAGE TO THE BLADE AND BLADE PAINT, WRAP THE BLADE SHANKS IN SEVERAL LAYERS OF MASKING OR DUCT TAPE BEFORE INSTALLING THE SPINNER DOME. REMOVE THE TAPE AFTER THE SPINNER IS INSTALLED.

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

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

NOTE 2: Hartzell Propeller ground adjustable propellers use a spinner dome with a bonded forward bulkhead. The forward bulkhead is an internal support that encircles the forward bulkhead adapter.

NOTE 3: Refer to the applicable installation instructions for the type of dome/forward bulkhead being installed.



Spinner Dome Installation
Figure 3-11

A. Installation of a Spinner Dome with a Bonded Forward Bulkhead

(1) Lubricate the O-ring with CM12 or equivalent.

(2) Install the O-ring onto the forward bulkhead adapter. Refer to Figure 3-11 and Table 3-3.

(3) Install shims onto the forward bulkhead adapter. Refer to Figure 3-11 and Table 3-3.

CAUTION: THE FORWARD BULKHEAD MUST FIT SNUGLY ON THE FORWARD BULKHEAD ADAPTER. AN IMPROPERLY SUPPORTED DOME COULD CAUSE FORWARD BULKHEAD ADAPTER DAMAGE OR A CRACK IN THE DOME OR BULKHEAD.

(4) Install the spinner dome.

(a) Using both hands, grasp the spinner dome in the approximate location of the forward bulkhead and press the spinner dome to align the dome mounting holes with the bulkhead mounting holes.

NOTE: The dome should have a firm feel prior to installing the mounting screws.

1 If the dome mounting holes are short of lining up with the bulkhead mounting holes, remove spacers as needed.

2 If the dome mounting holes align past the bulkhead mounting holes, add shims as needed.

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.

(5) Attach the spinner dome to the spinner bulkhead with the supplied screws and washers. Refer to Table 3-3 and Figure 3-11.

(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.

Spinner Dome	Washer	Screw	Shim	O-ring
Composite	B-3860-10L	B-3867-272	105542-1	C-3317-129

Spinner Dome, Shims, Mounting Hardware, and O-ring
Table 3-3

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

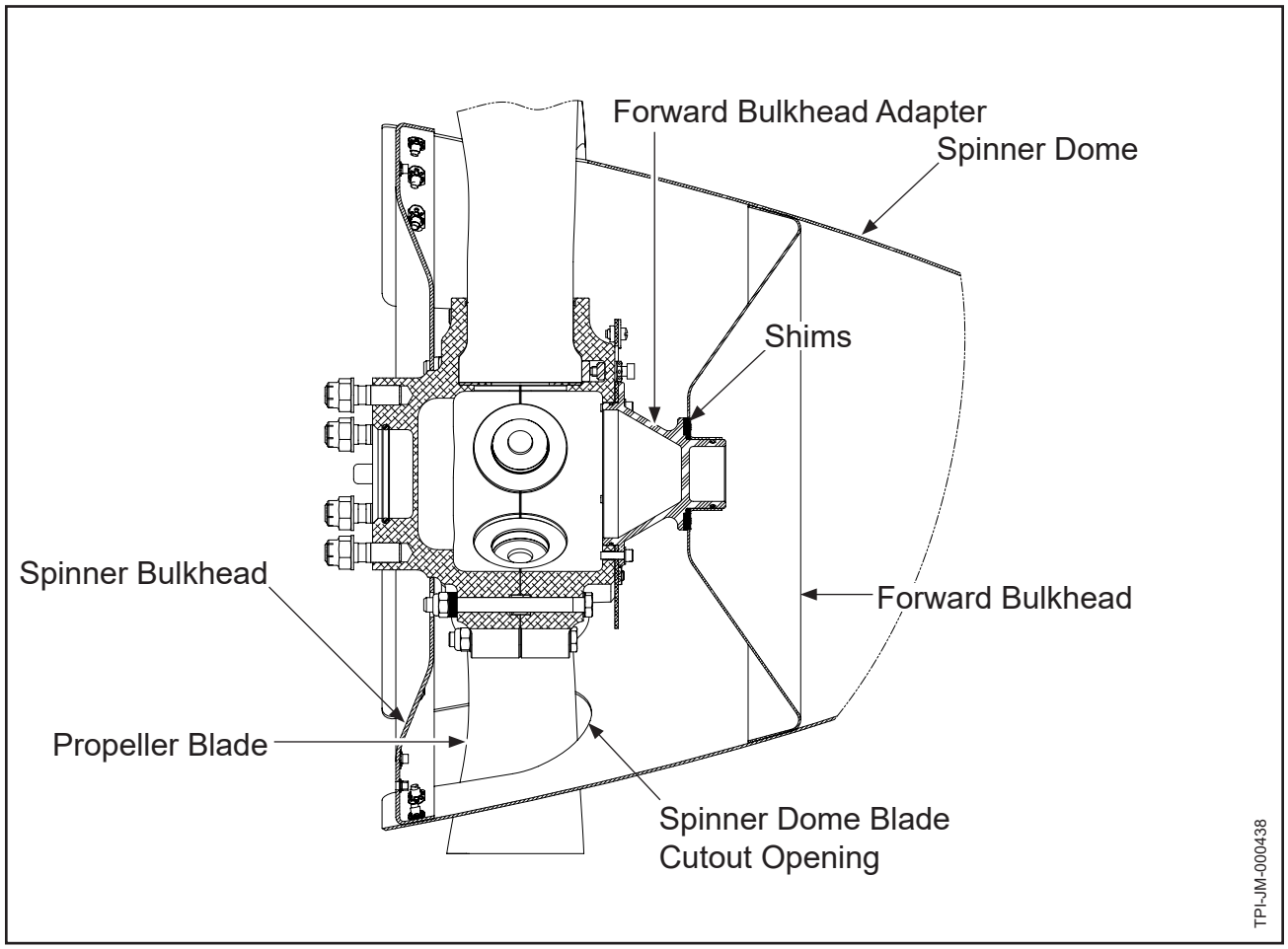
(b) Tighten the screws until snug, then turn an additional 1/8 rotation.

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.

(6) If the spinner loosens in service, add one or more spacer to the forward bulkhead adapter until the spinner fits snug.



Spinner Assembly
Figure 3-12

7. Spinner Assembly Clearance Checks (BP-2)

CAUTION: CLEARANCE BETWEEN THE BULKHEAD AND THE ENGINE COWLING MAY CHANGE DURING AIRCRAFT OPERATION.

A. Clearance Checks - Refer to Figure 3-12

(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.

(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) Ice protection system components (wire harnesses, anti-ice tubes, etc.)

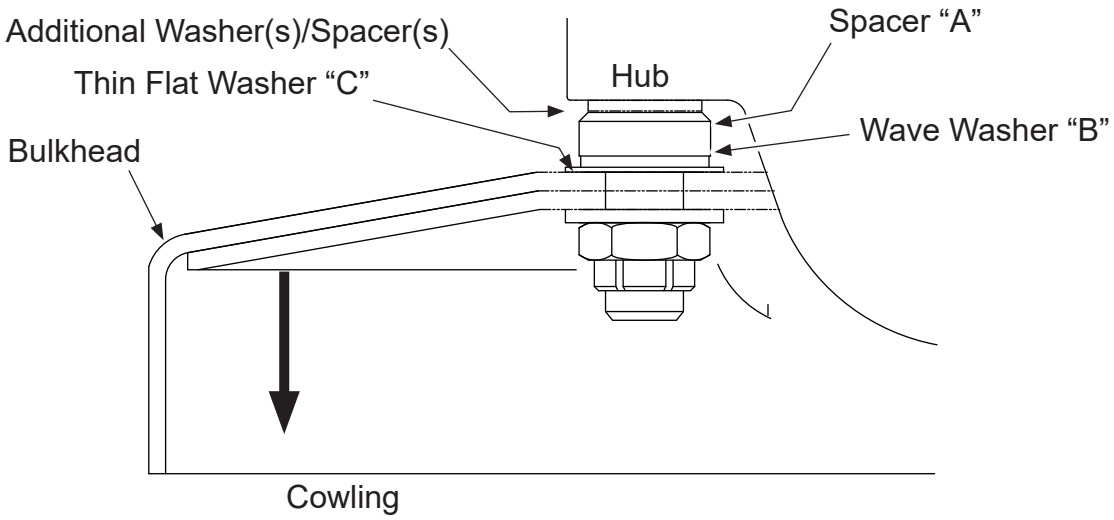
(d) Mounting hardware

(3) For spinner domes with a bonded forward bulkhead, make sure the flange on the forward bulkhead does not bottom out on the flared radius of the forward bulkhead adapter.

(a) Using both hands, grasp the spinner dome in the approximate location of the forward bulkhead and apply horizontal force.

1 If there is horizontal movement: Refer to the section, “Spinner Dome Installation” in this chapter.

(4) If there is any spinner assembly interference, refer to the section, “Composite Bulkhead Spacing Adjustment” in this chapter.



NOTE: Maintain cowling clearance when making adjustments.

TPI-MB-0458

Composite Bulkhead Toward the Cowling
Figure 3-13

8. Composite Bulkhead Spacing Adjustments (BP-2)

A. To Move the Bulkhead Toward the Cowling

CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING 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: INSTALL THE SPINNER MOUNTING HARDWARE STACK-UP IN THE CORRECT SEQUENCE TO GET PROPER HUB CLAMPING AND PREVENT CRUSHING OF THE BULKHEAD.

CAUTION 3: THE COMBINED THICKNESS OF ADDITIONAL WASHERS/SPACERS MUST BE LESS THAN OR EQUAL TO 0.125 INCH (3.17 MM). IF MORE ADJUSTMENT IS NEEDED, CONTACT THE HARTZELL PROPELLER PRODUCT SUPPORT DEPARTMENT.

(1) Install additional washer(s)/spacer(s) between spacer “A” and the hub to get the desired bulkhead spacing. Refer to Figure 3-13.

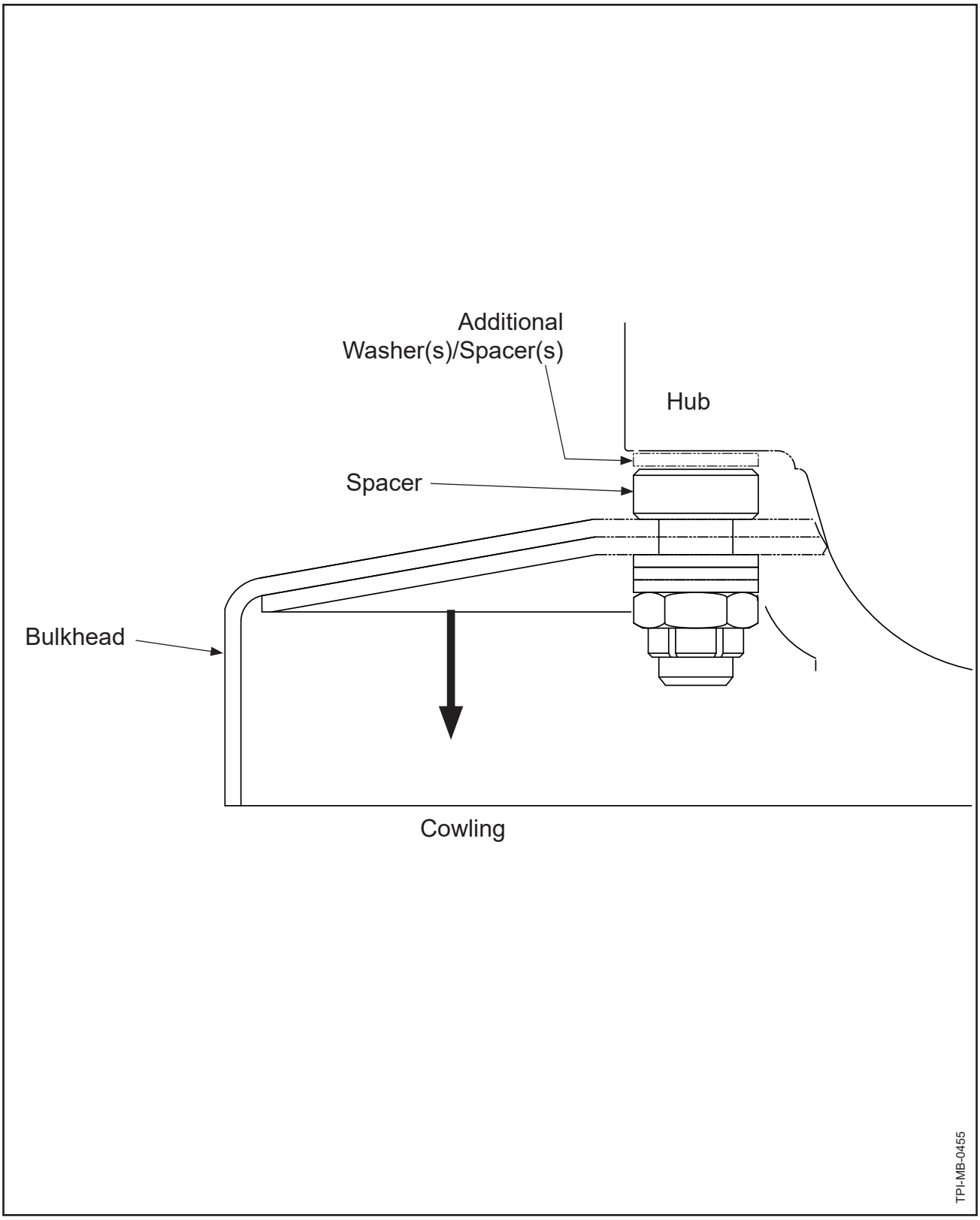
CAUTION: THREAD COVERAGE/ENGAGEMENT REQUIREMENTS SPECIFIED IN THE “BULKHEAD INSTALLATION” SECTION MUST BE MET.

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

B. To Move the Bulkhead Away From the Cowling

(1) If the bulkhead is too close to the cowling, contact the Hartzell Propeller Product Support Department.

(a) Refer to the section, “Hartzell Propeller Contact Information” in the Introduction chapter of this manual.



Metal Bulkhead Toward the Cowling
Figure 3-14

9. Metal Bulkhead Spacing Adjustments (BP-2)

A. To Move the Bulkhead Toward the Cowling

CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING 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.

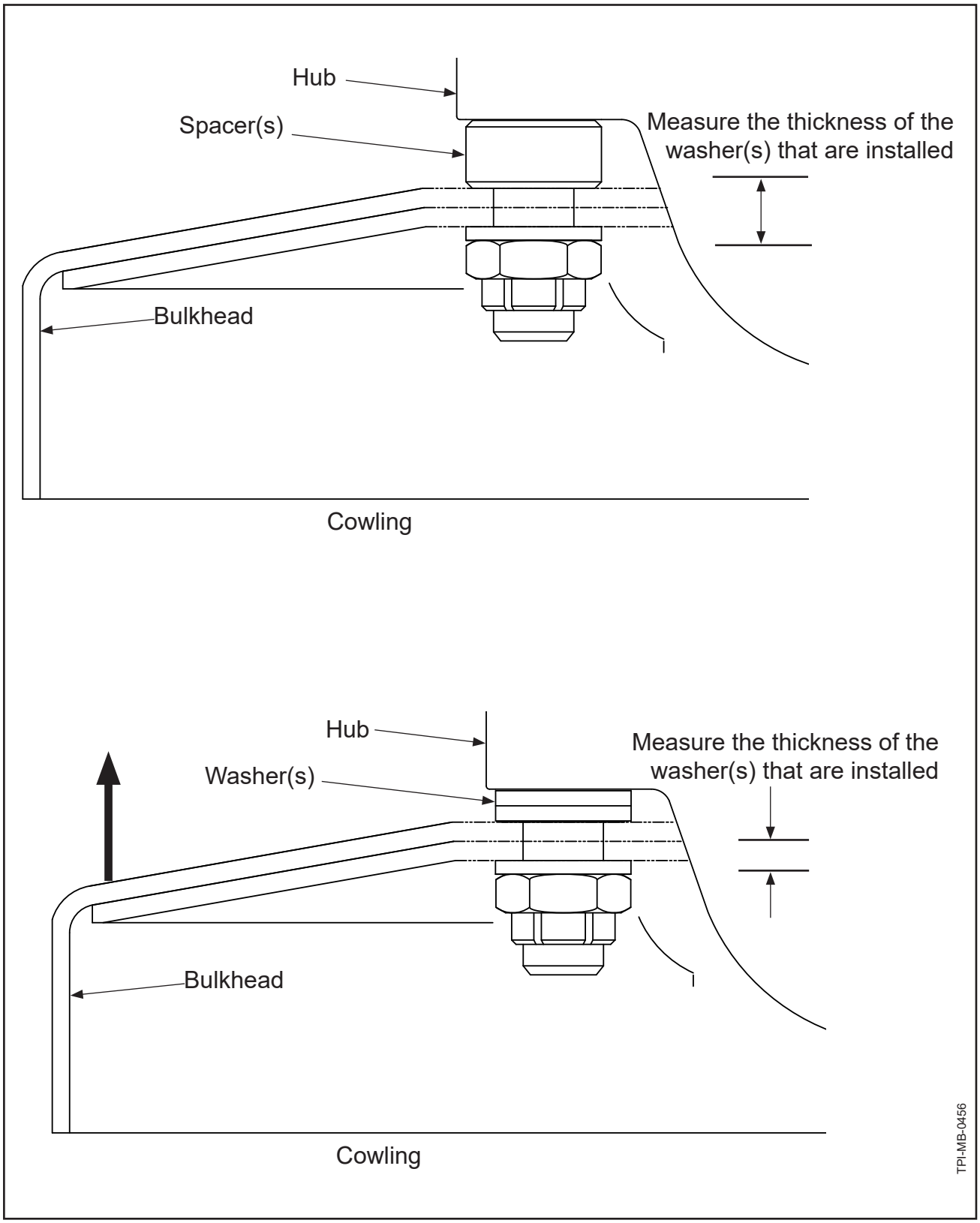
CAUTION 2: INSTALL THE SPINNER MOUNTING HARDWARE STACK-UP IN THE CORRECT SEQUENCE TO GET PROPER HUB CLAMPING AND PREVENT CRUSHING OF THE BULKHEAD.

CAUTION 3: THE COMBINED THICKNESS OF ADDITIONAL WASHERS/SPACERS MUST BE LESS THAN OR EQUAL TO 0.125 INCH (3.17 MM). IF MORE ADJUSTMENT IS NEEDED, CONTACT THE HARTZELL PRODUCT SUPPORT DEPARTMENT.

(1) Put additional washer(s)/spacer(s) between the spacer and the hub as shown in Figure 3-14 to get the desired bulkhead spacing.

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.



Metal Bulkhead Away From the Cowling
Figure 3-15

B. To Move the Bulkhead Away From the Cowling

CAUTION 1: THE STACK-UP SEQUENCE FOR EACH HUB CLAMPING 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: INSTALL THE SPINNER MOUNTING HARDWARE STACK-UP IN THE CORRECT SEQUENCE TO GET PROPER HUB CLAMPING AND PREVENT CRUSHING OF THE BULKHEAD.

CAUTION 3: THE MAXIMUM PERMITTED BULKHEAD ADJUSTMENT AWAY FROM THE COWLING IS 0.125 INCH (3.17 MM). IF MORE ADJUSTMENT IS NEEDED, CONTACT THE HARTZELL PRODUCT SUPPORT DEPARTMENT.

(1) Remove the spacer(s)/washer(s) between the bulkhead and the hub. Refer to Figure 3-15.

(a) Measure the combined thickness of the spacer(s)/washer(s) that were removed.

(2) Install washer(s) and/or spacer(s) between the bulkhead and the hub to get the desired bulkhead spacing.

(a) Measure the combined thickness of the washer(s)/spacers that were installed.

(b) The difference between the thickness of the washer(s)/spacer(s) that were removed, and the thickness of the washer(s)/spacer(s) that were installed must be 0.125 inch (3.17 mm) or less.

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

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

10. Post-Installation Checks

A. Procedure

(1) Refer to the airframe manufacturer’s instructions for post-installation checks.

11. Spinner Dome Removal

A. Procedure

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

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

(2) Remove the spinner dome.

12. Propeller Removal

A. Removal of 5FB-F375A1( ) Propellers

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

(2) Remove the ice protection system (if applicable) in accordance with Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.

(3) Cut and remove the safety wire/cable on the propeller mounting studs (if installed).

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

WARNING 2: DURING PROPELLER REMOVAL, AIRFRAME MANUFACTURER’S MANUALS AND PROCEDURES MUST BE FOLLOWED BECAUSE THEY MAY CONTAIN ISSUES VITAL TO AIRCRAFT SAFETY THAT ARE NOT CONTAINED IN THIS MANUAL OR THE HARTZELL PROPELLER OVERHAUL MANUAL 525 (61-10-25).

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 200 LBS (90 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(4) Support the propeller assembly with a sling.

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

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

NOTE: This will prevent dynamic imbalance.

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

(6) Remove the six 1/2 inch mounting nuts.

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

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

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

(8) Remove and discard propeller mounting O-ring.

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

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TESTING AND TROUBLESHOOTING - CONTENTS

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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.

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

2. Propeller Ice Protection Systems (BP-2)

   WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

   A. Operational Checks and Troubleshooting
      (1) Refer to the Anti-ice and De-ice Systems chapter of this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.

3. Troubleshooting
   A. Vibration

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

      CAUTION 2: VIBRATION PROBLEMS BECAUSE OF PROPELLER SYSTEM IMBALANCE ARE NORMALLY FELT THROUGHOUT THE RPM RANGE, WITH THE INTENSITY OF VIBRATION INCREASING WITH RPM. VIBRATION PROBLEMS THAT OCCUR IN A NARROW RPM RANGE ARE A SYMPTOM OF RESONANCE THAT IS POTENTIALLY HARMFUL TO THE PROPELLER. AVOID OPERATION UNTIL THE PROPELLER CAN BE CHECKED 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) Proper engine/propeller flange mating

(e) Blade track:

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

(f) Blade angles:

1 Blade angles must be within specified tolerance between blades.

a To check/adjust blade angle, refer to the section, "Blade Angle Adjustment" in the Maintenance Practices chapter of this manual.

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

(h) Static balance

(i) Hub damage or cracking

(j) 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.

B. Propeller Overspeed

(1) Check:

(a) Tachometer error.

C. Propeller Underspeed

(1) Check:

(a) Tachometer error.

INSPECTION AND CHECK - CONTENTS

LIST OF FIGURES

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER 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.

1. Pre-Flight Checks (BP-5)

   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 play of the blade tip (in-and-out, fore-and-aft, and end play).

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

      (4) If an ice protection system is installed, visually examine the anti-icing or de-ice boot for damage.

         (a) Refer to the Anti-ice and De-ice Systems chapter in this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.

      (5) 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.

E. Initial Run-Up

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

F. 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

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).

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.

(3) Check for any abnormal vibration.

(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.

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

(5) 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.

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

B. Propeller Ice Protection System

(1) Refer to the Anti-ice and De-ice Systems chapter in this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.

3. Required Periodic Inspections and Maintenance (BP-3)

A. Periodic Inspection

(1) Perform the following inspection procedures at 100 hour intervals, not to exceed 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 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) Verify the torque on the jam nuts and cap screws after the first 5 hours of operation and once every 100 hours thereafter in accordance with Table 3-2, “Torque Table”.

(5) 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 established as part of the certification by the FAA. Such limits require mandatory replacement of specified parts after a defined number of hours and/or cycles of use.

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

(3) Operators are urged to keep informed of airworthiness information via Hartzell Propeller Service Bulletins and Service Letters, which are available from Hartzell distributors or from Hartzell by subscription. Selected information is also available on the Hartzell Propeller 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 and your investment, and to maximize the safe operating lifetime of your propeller, it is essential that a propeller be properly maintained and overhauled according to the recommended service procedures.

(a) For Hartzell Propeller propeller overhaul periods, refer to Hartzell Propeller Service Letter HC-SL-61-61Y.

4. Inspection Procedures

A. Blade Damage (BP-1)

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

B. Vibration

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.

(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-to-Hub Fit” in this chapter.

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

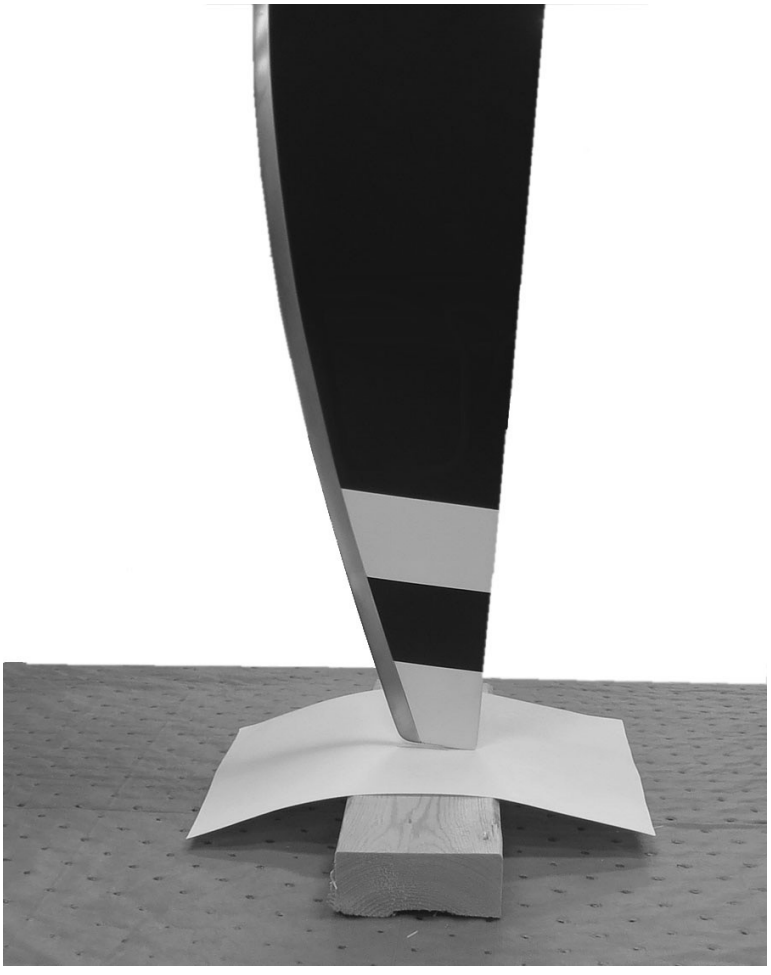
1 Visually check for damaged blades.

(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 the Hartzell Propeller Product Support.



Checking Blade Track
Figure 5-1

C. Blade Track

(1) Check blade track as follows:

(a) Chock the aircraft wheels securely.

(b) Refer to Figure 5-1. Put a fixed reference point beneath the propeller, within 0.25 inch (6.00 mm) of the lowest point of the propeller arc.

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

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

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

(d) Repeat this procedure with the remaining blades.

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

(f) Possible Correction

1 Remove foreign matter from the propeller mounting flange.

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

D. Blade-to-Hub Fit

(1) Blades need to be tight in the propeller.

(a) When the preload system is engaged:

1 Make sure there is no rotation of the blade in the hub pocket. If there is rotation of the blade, the propeller must be referred to a certified propeller repair station with the appropriate rating.

2 Make sure there is no play of the blade tip (in-and-out, fore-and-aft, and end play). If there is play of the blade tip, the propeller must be referred to a certified propeller repair station with the appropriate rating.

E. Corrosion (BP-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.

F. Spinner Damage (BP-4)

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

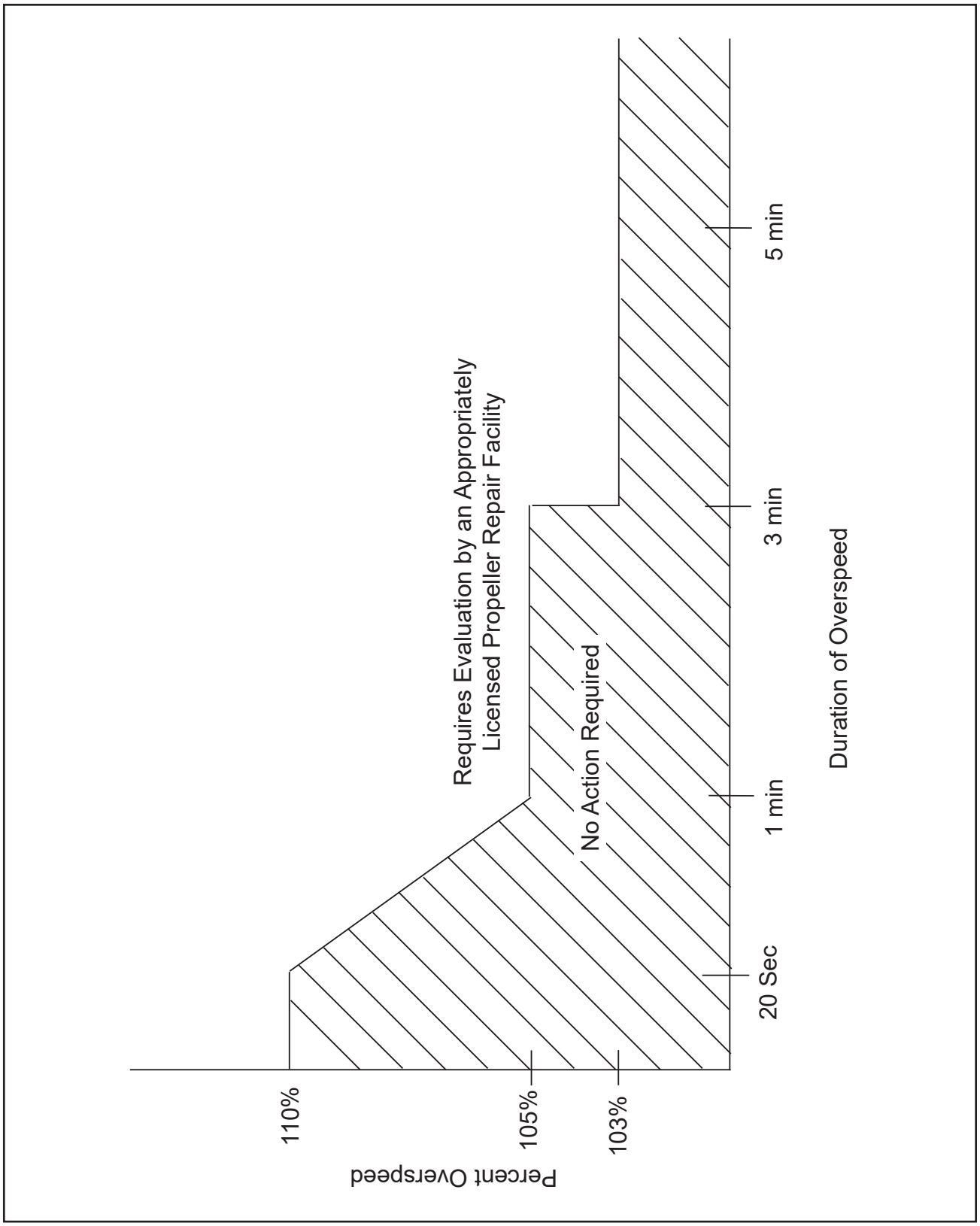
(a) Composite Spinners

1 For damage evaluation and repair information, refer to Hartzell Propeller Composite Spinner Maintenance Manual 148 (61-16-48) or a certified propeller repair station with the appropriate rating.

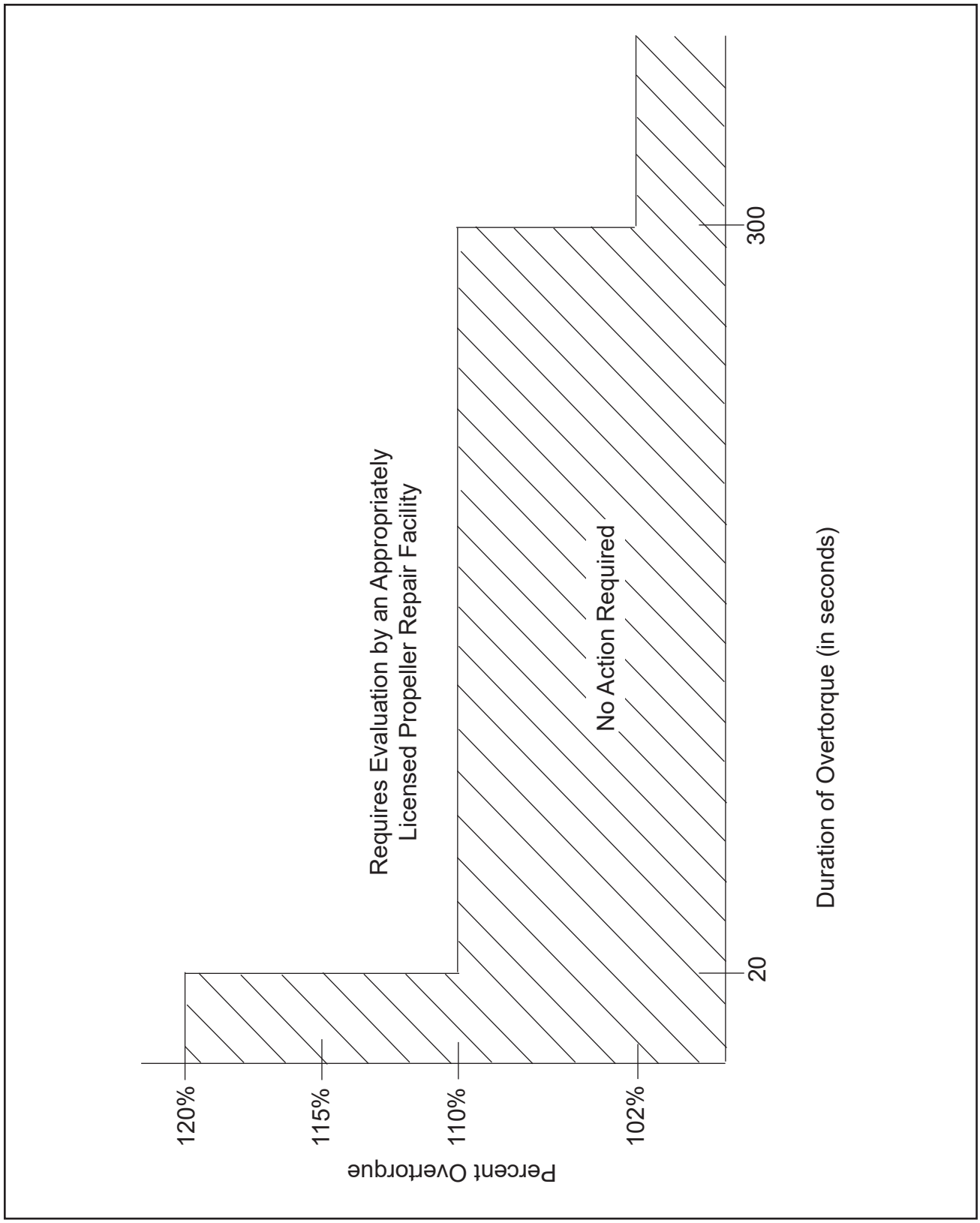
2 Contact the local airworthiness authority for repair approval.

G. Propeller Ice Protection Systems (BP-1)

(1) Refer to the Anti-ice and De-ice Systems chapter of this manual for operational checks and troubleshooting information.



Overspeed Limits
Figure 5-2



Overtorque Limits
Figure 5-3

5. Special Inspections

A. Overspeed/Overtorque (BP-2)

(1) An overspeed has occurred when the propeller RPM has exceeded the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. An overtorque condition occurs when the engine load exceeds the limits established by the engine, propeller, or airframe manufacturer. The duration of time at overspeed/overtorque for a single event determines the corrective action that must be taken to make sure no damage to the propeller has occurred.

(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 the propeller has an overspeed event, refer to the Engine Overspeed Limits (Figure 5-2) to determine the corrective action to be taken.

(b) When the propeller has an overtorque event, refer to the Engine Overtorque Limits (Figure 5-3) to determine the corrective action to be taken.

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

B. Lightning Strike - Propeller Assembly (BP-2)

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) Perform an operational check of the propeller ice protection system (if installed) in accordance with the Anti-ice and De-ice Systems chapter of this manual.

(d) 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 (BP-3)

(1) General

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

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

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

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

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

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

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

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

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

(2) Inspection Procedure

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

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

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

2 Blade(s) loose or rotate in the hub - loose blades are not permitted

3 Any blade diameter reduction

4 Bent, cracked, or failed engine shaft

5 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.

NOTE: It is not necessary to remove the de-ice/anti-icing boot for this inspection.

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

D. Fire/Heat Damage (BP-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 (BP-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.

6. Long Term Storage (BP-1)

   A. Important Information

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

      (2) Long term storage procedures are detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).

      (3) Information regarding the return of a propeller assembly to service after long term storage is detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).

   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

CAUTION 1: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER 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.

1. Cleaning (BP-2)

   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, then repeat steps 5 thru 7.

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

(9) Let the propeller dry.

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

B. Spinner Cleaning and Polishing

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

(2) If an aluminum spinner dome is installed, polish the dome (if required) with an automotive-type aluminum polish.

2. Composite Blades (BP-2)

   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).

3. Propeller Blade Angle

   A. Blade Angle Setting

      WARNING 1: RPM ADJUSTMENTS MUST BE MADE WITH REFERENCE TO A CALIBRATED TACHOMETER.

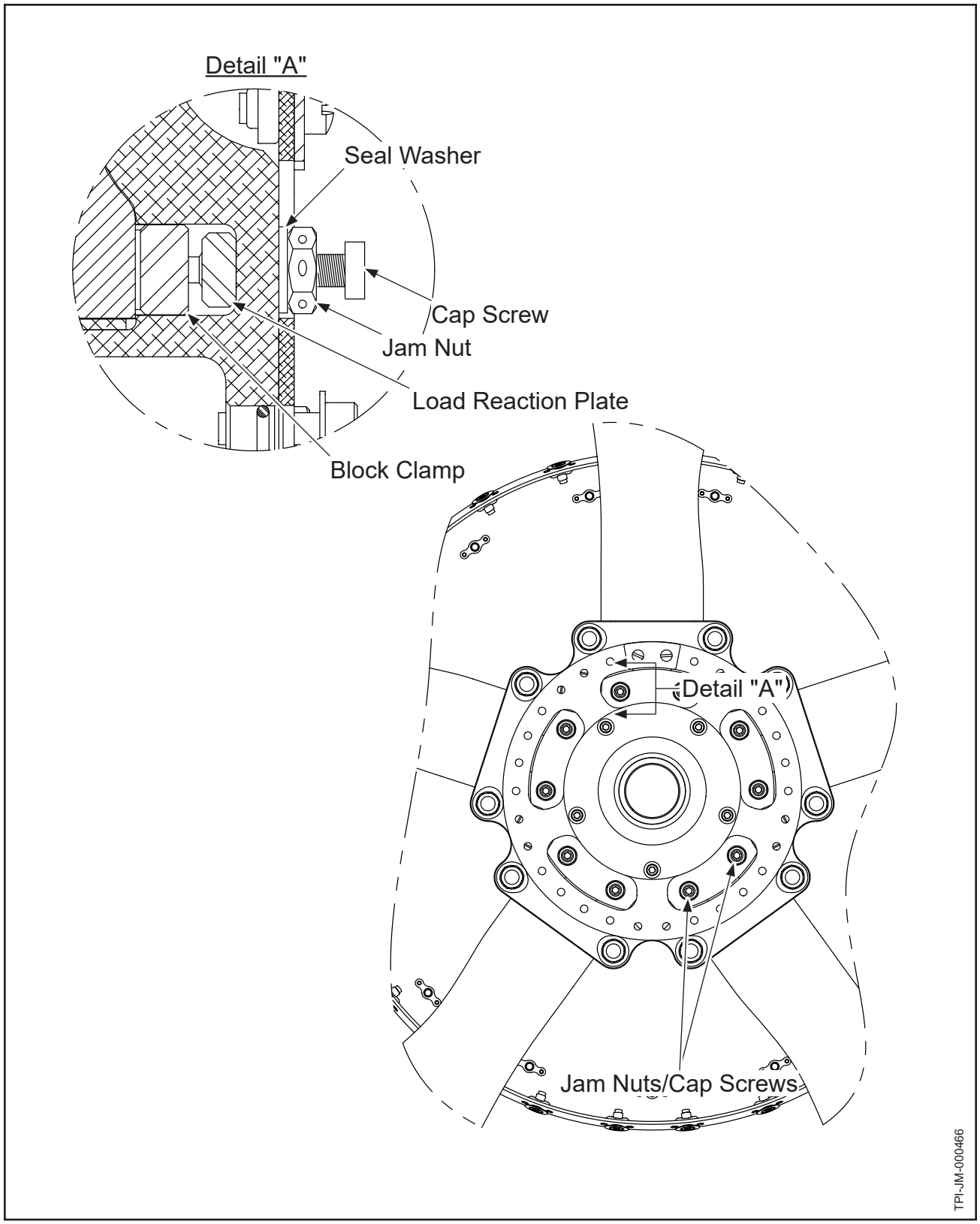
      WARNING 2: BLADE ANGLE ADJUSTMENTS MUSTBE MADE WITHIN THE BLADE ANGLE LIMITS ESTABLISHED BY THE APPLICABLE TYPE CERTIFICATE OR SUPPLEMENTAL TYPE CERTIFICATE.

      (1) The propeller blade angle is set at Hartzell Propeller in accordance with the aircraft TC or STC Holder's requirements.

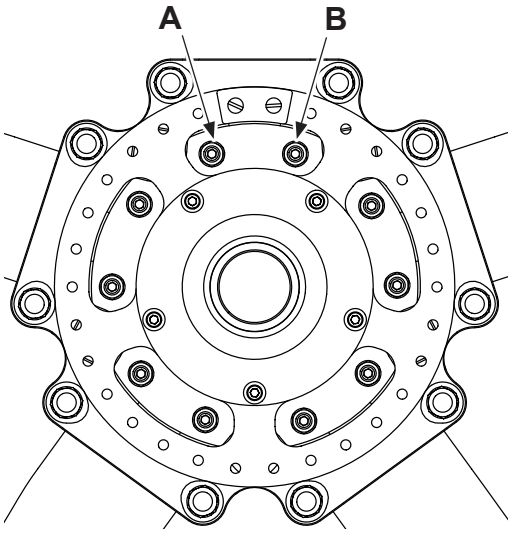
      (2) The TC or STC Holder provides the required blade angle setting and may also provide an approved range of blade angle settings, or an approved RPM range for a maximum power static condition.

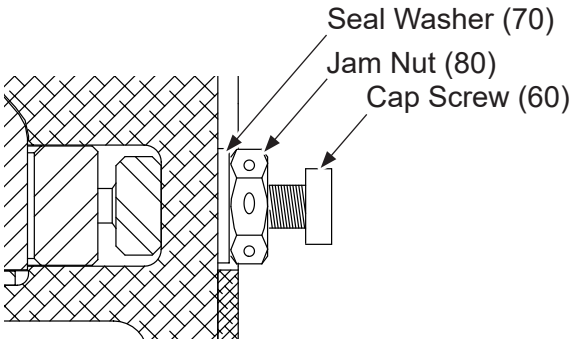
         (a) Be aware that the aircraft TC or STC Holder may specify the static RPM to be less than the RPM to which the engine is rated.

      (3) An overspeed at the maximum power static condition may indicate that the propeller blade angle setting is set too low.



5FB-F375A1( ) Propeller Blade Angle Adjustment
Figure 6-1





TPI-JM-000466

Cap Screw (60) Torque Sequence

NOTE: Alternate torque between paired cap screws.

Step 1 - Rotate cap screw "A" until snug

Step 2 - Rotate cap screw "B" until snug

Step 3 - Torque cap screw "A" to 33% of torque value in Table 3-2

Step 4 - Torque cap screw "B" to 33% of torque value in Table 3-2

Step 5 - Torque cap screw "A" to 66% of torque value in Table 3-2

Step 6 - Torque cap screw "B" to 66% of torque value in Table 3-2

Step 7 - Torque cap screw "A" to 100% of torque value in Table 3-2

Step 8 - Torque cap screw "B" to 100% of torque value in Table 3-2

Jam Nut (80) Torque Sequence

NOTE: Alternate torque between paired nuts.

Step 1 - Rotate jam nut "A" until snug.

Step 2 - Rotate jam nut "B" until snug.

Step 3 - Torque jam nut "A" to 33% of torque value in Table 3-2

Step 4 - Torque jam nut "B" to 33% of torque value in Table 3-2

Step 5 - Torque jam nut "A" to 66% of torque value in Table 3-2

Step 6 - Torque jam nut "B" to 66% of torque value in Table 3-2

Step 7 - Torque jam nut "A" to 100% of torque value in Table 3-2

Step 8 - Torque jam nut "B" to 100% of torque value in Table 3-2

Torquing Sequence for Cap Screws/Jam Nuts
Figure 6-2

B. Blade Angle Setting Adjustment - Refer to Figures 6-1 and 6-2.

(1) Remove the safety wire from the five screws attaching the floward bulkhead adapter to the hub.

(2) Remove the five screws and the balance ring/forward bulkhead adapter assembly.

(3) Remove safety wire from two jam nuts.

(4) Loosen the two jam nuts three full rotations.

(5) Loosen the two cap screws two to three full rotations.

(6) Using a calibrated protractor, zero the protractor to the face of the hub.

(7) Using the protractor, rotate and set the blade to the desired blade angle at the location specified by the STC or TC Holder.

(8) Tighten and torque the two cap screws in accordance with Table 3-2 and Figure 6-2.

(9) Tighten and torque the two jam nuts in accordance with Table 3-2 and Figure 6-2.

(10) Complete steps (3) through (9) for each blade.

(11) Using the protractor, measure each blade angle and verify that the difference between the maximum and minimum blade angle of all blades is within 0.2 degree.

(a) If all blades are within tolerance, complete the following check:

1 Start the engine and run the propeller for approximately 5 minutes at no less than 50% of maximum rated RPM.

2 Shut the engine down and wait for the propeller to come to a full complete stop.

3 Check the torque on the jam nuts to verify there is no loss of torque due to the seating of the blades in the hub.

a If loss of torque occurs:

(1) Tighten both the cap screw and jam nut to the final torque in accordance with Table 3-2 and Figure 6-2.

(2) Safety the 10 jam nuts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable.

b If no loss of torque occurs,

(1) Safety the 10 jam nuts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable.

(b) Blades that are not within the tolerance, repeat steps (4) through (9) of this procedure.

(12) Make entry in the propeller log book detaling the blade angle adjustment.

4. Blade Paint Touch-Up (BP-3)

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 square inches (6451.6 square mm), blade paint touch-up is permitted.

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

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

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

Touch-up Paints
Table 6-1

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) Let the solvent 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) Let the solvent evaporate.

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

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

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

(7) 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 dry time is longer than four hours, it must be lightly sanded before another coat is applied.

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

(9) 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 dry time is longer than four hours, it must be lightly sanded before another coat is applied.

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

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

5. Dynamic Balance

A. Overview

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

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

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

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

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

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

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

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 dirt/grime on the blades and inner surface of the spinner dome.

(a) Use Stoddard solvent (or equivalent) to completely remove any dirt/grime on the blades or inner surface of the spinner dome.

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

(3) Static balance is accomplished at an appropriately rated propeller repair station that is certified by the Federal Aviation Administration (FAA) or international equivalent when an overhaul or major repair is performed.

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

C. Placement of Balance Weights

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

(2) Removal of the dynamic balance weights will return the propeller to its original static balance condition.

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

(a) A maximum of six B-6722-3 washers, or equivalent, weighing up to approximately 1.0 oz (28.0 g) may be installed at any one location.

NOTE: B-6722-3 washer dimensions: ID 0.203 inch (5.16 mm), OD 0.875 inch (22.23 mm), and thickness 0.063 inch (1.59 mm) ±0.01 inch (±0.25 mm).

(4) Install dynamic weights using B-3873-( ) bolts and self-locking nuts in through drilled holes.

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

(5) Screws that attach the balance weights to the spinner bulkhead must protrude through the self-locking nuts/nut plates a minimum of one thread. The maximum number of threads protruding through the self-locking nuts/nut plates is four.

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

(6) 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.

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

(8) 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.

6. Erosion Tape on Composite Blades (BP-2)

   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 require erosion tape if no de-ice/anti-ice boot is installed

         (b) Installation instructions of erosion tape

7. Propeller Ice Protection Systems (BP-1)

   A. Maintenance Information

      (1) Refer to the Anti-ice and De-ice Systems chapter of this manual for ice protection system maintenance information.

8. Tachometer Calibration (BP-2)

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

   A. Important Information

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

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

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

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

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

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

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

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

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

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

B. Tachometer Calibration

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

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

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ANTI-ICE AND DE-ICE SYSTEMS - CONTENTS

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1. Anti-ice System Description (BP-1)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

NOTE: There are many configurations of anti-ice systems. This section provides a general overview of system operation. Consult the airframe manufacturer's manual for a description of your specific anti-ice system and controls.

A. Overview of an Anti-ice System

(1) A propeller anti-ice system prevents formation of ice on the propeller blades. The system dispenses a liquid (usually isopropyl alcohol) onto the propeller blades. This liquid mixes with moisture on the blades and lowers the freezing point of the water, allowing the water/alcohol mixture to flow off of the blades before ice forms.

(a) Anti-ice systems must be in use before ice forms. This system is not effective for removing ice after it has formed.

B. Components of an Anti-ice System

(1) A typical anti-ice system includes the following components:

(a) Fluid tank, pump, slinger ring, blade mounted anti-icing boots, and fluid dispensing tubes located at each blade mounted anti-icing boot.

C. Anti-ice System Operation

(1) The anti-ice system is typically controlled by the pilot using a cockpit mounted rheostat. The rheostat controls the pump and the flow of anti-ice fluid from the fluid tank.

(2) The anti-ice fluid is pumped through airframe mounted distribution tubing and into a rotating slinger ring that is mounted on the rear of the propeller hub.

(3) From the slinger ring, centrifugal force pushes the anti-icing fluid through the fluid dispensing tubes onto the blade mounted anti-icing boots.

(4) The anti-icing boots evenly distribute the fluid along the leading edge of the propeller blade to prevent ice from forming.

2. De-ice System Description (BP-1)

WARNING: CONSULT THE PILOT OPERATING HANDBOOK (INCLUDING ALL SUPPLEMENTS) REGARDING FLIGHT INTO CONDITIONS OF KNOWN ICING. THE AIRCRAFT MAY NOT BE CERTIFICATED FOR FLIGHT INTO KNOWN ICING CONDITIONS, EVEN THOUGH AN ICE PROTECTION SYSTEM IS INSTALLED.

NOTE: There are many configurations of de-ice systems. This section provides a general overview of system operation. Consult the airframe manufacturer's manual for a description of your specific de-ice system and controls.

A. Overview of a De-ice System

(1) A propeller de-ice system removes ice after it forms on the propeller blades. The system uses electrical heating elements to melt the ice layer next to the blade permitting the ice to be thrown from the blade by centrifugal force.

B. Components of a De-ice System

(1) A typical de-ice system includes the following components:

(a) ON/OFF switch(es), ammeter, timer or cycling unit, slip ring, brush blocks, and blade mounted de-ice boots.

C. De-ice System Operation

(1) The de-ice system is controlled by the pilot using a cockpit control switch. When this switch is ON, electrical power is supplied to the de-ice system.

(a) Some systems may have additional controls to adjust for different icing conditions.

1 A mode selector switch lets the pilot set the cycling speed for heavy or light icing conditions.

2 For twin engine aircraft, a full de-ice mode switch lets the pilot de-ice both propellers simultaneously. This switch is used when ice builds up on the propeller before the system is turned on and may only be used for short periods.

(2) The ammeter indicates current draw by the system. It is typically located near the de-ice system switches. The ammeter may indicate total system load, or in twin engine aircraft, a separate ammeter may be supplied for each propeller.

(3) The timer or cycling unit is controlled by the pilot using a cockpit control switch. When the timer/cycling unit is ON, power is applied to each de-ice boot (or boot segment) in a sequential order for a preset amount of time. This heating interval evenly de-ices the propeller.

(4) The brush block supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The brush block is typically mounted on the engine just aft of the propeller. The slip ring rotates with the propeller and is typically mounted on the spinner bulkhead.

(5) The de-ice boots contain internal heating elements that melt the ice layer from the blades when electrical current is applied. De-ice boots are attached to the leading edge of each blade using adhesive.

3. Operational Checks (BP-2)

A. De-ice and Anti-ice Systems

(1) Perform the applicable Operational Check procedure(s) in accordance with the Check chapter in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) and/or the Aircraft Maintenance Manual.

4. Troubleshooting (BP-2)

A. De-ice and Anti-ice Systems

(1) Refer to the applicable chapter(s) in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) to troubleshoot malfunctions in Hartzell de-ice and anti-ice systems.

(a) Part numbers for components used in Hartzell de-ice and anti-ice systems are found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

5. Periodic Inspections (BP-2)

A. De-ice and Anti-ice Systems

(1) Refer to the Check chapter in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) for detailed information about inspection intervals and procedures.

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RECORDS - CONTENTS

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1. Record Keeping (BP-2)

   A. General

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

   B. Information to be Recorded

      (1) Refer to Title 14 Code of Federal Regulations (CFR) Part 43 for a list of information that must be recorded.

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

         (a) Propeller position (on aircraft)

         (b) Propeller model

         (c) Propeller serial number

         (d) Blade design number

         (e) Blade serial numbers

         (f) Spinner assembly part number

         (g) Propeller pitch range

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

   C. Blade Damage Repair Sheets

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

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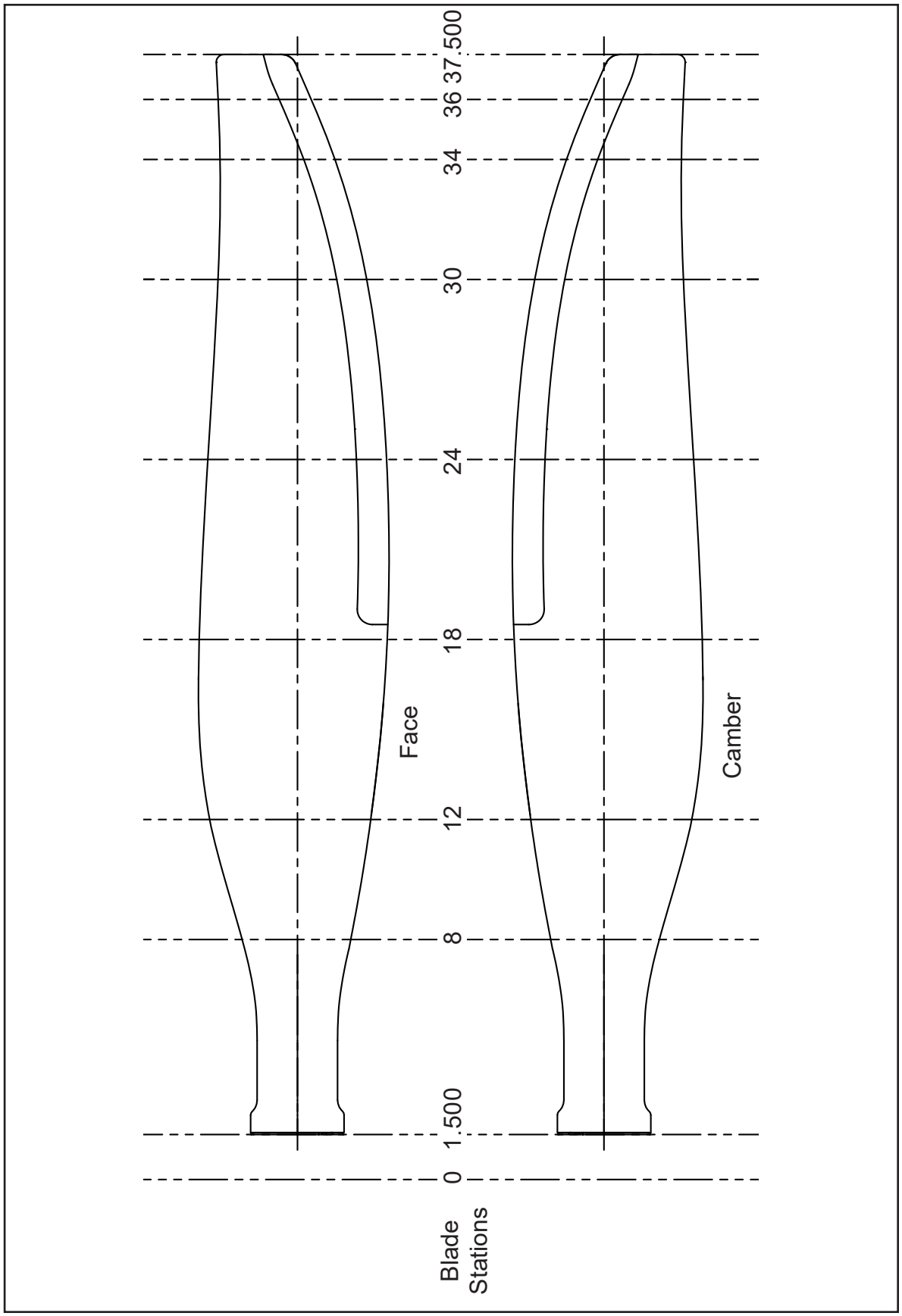
Record of 73( )01( ) Composite Blade Damage Repair

Blade Serial No. _____



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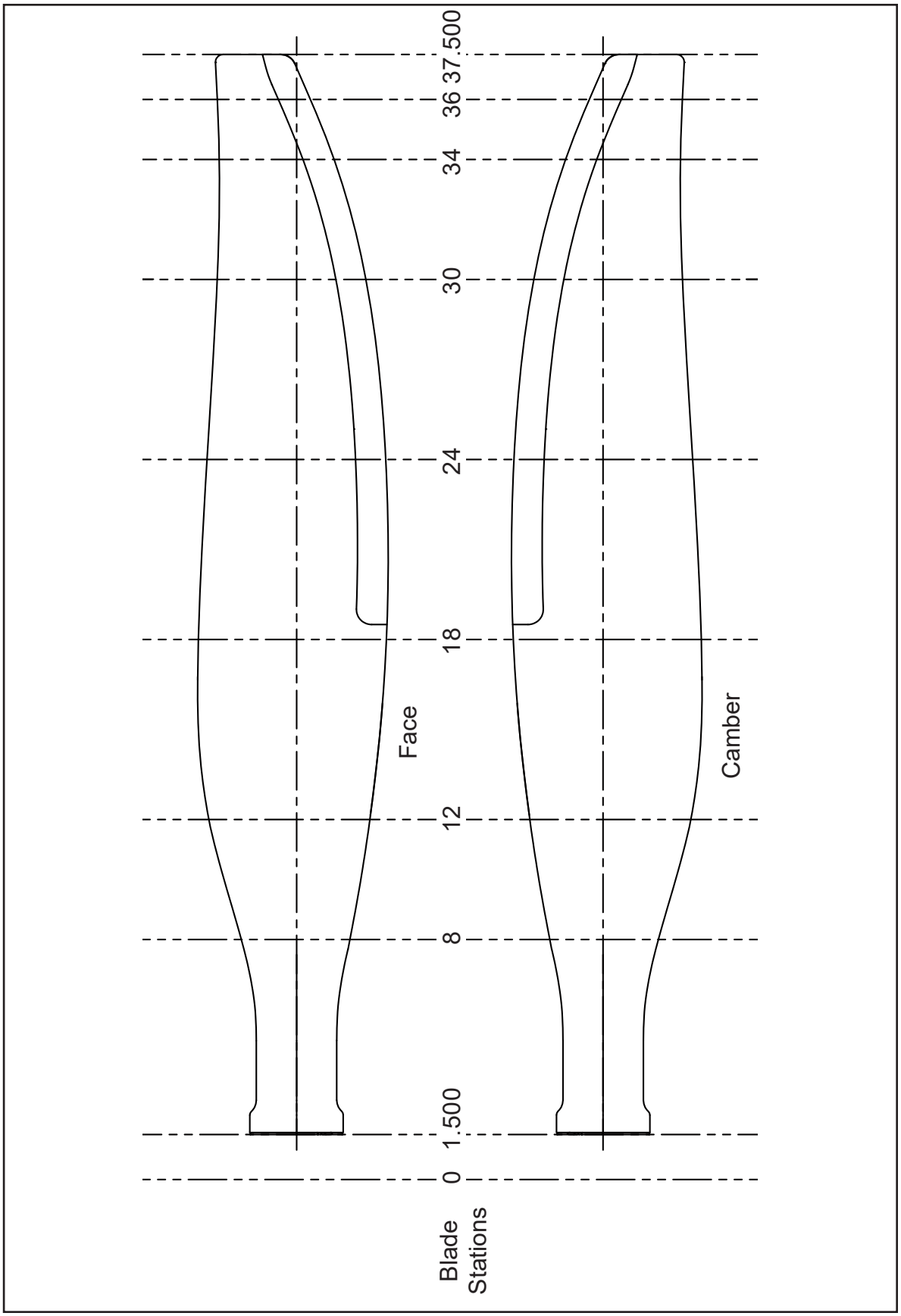

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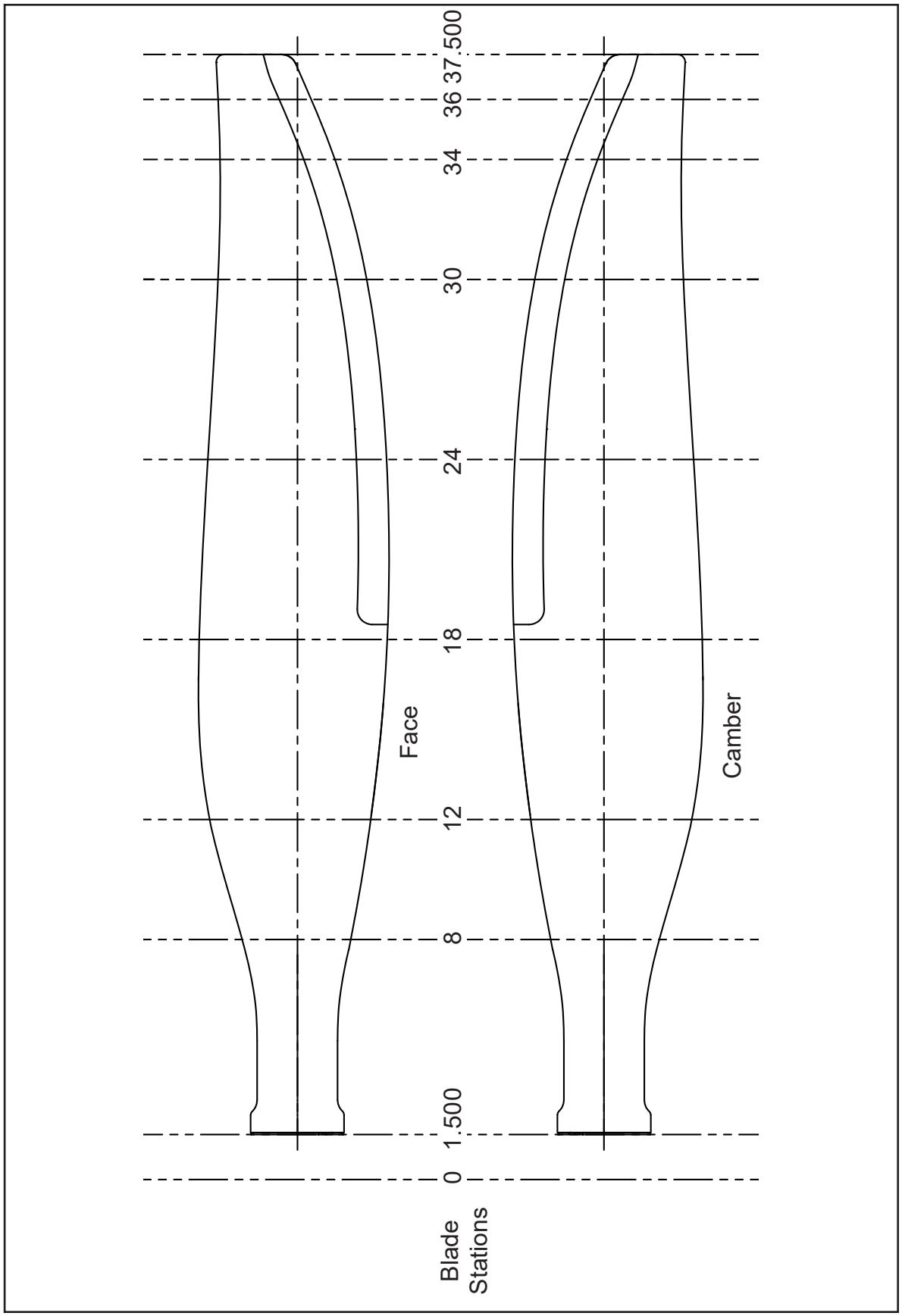

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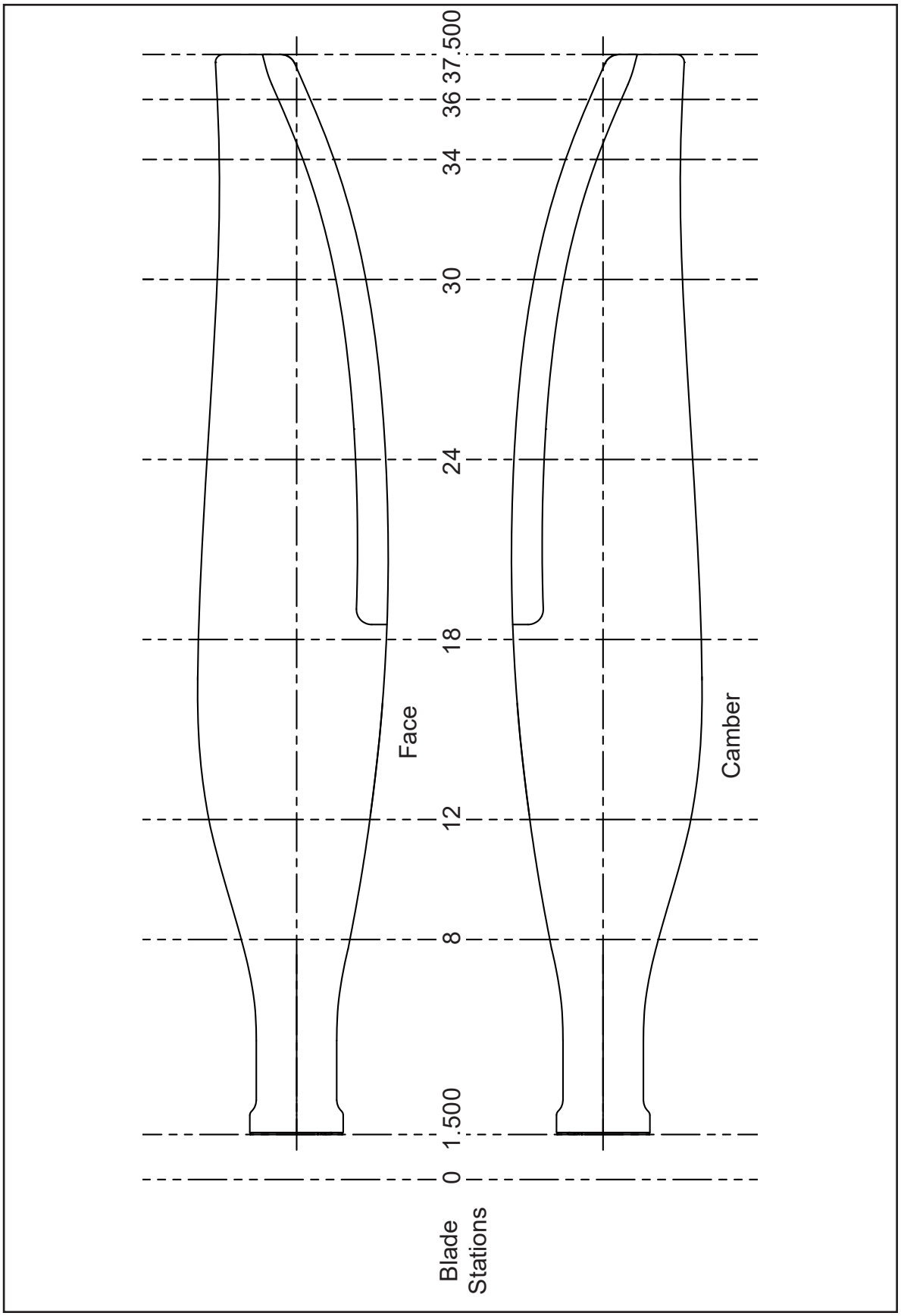

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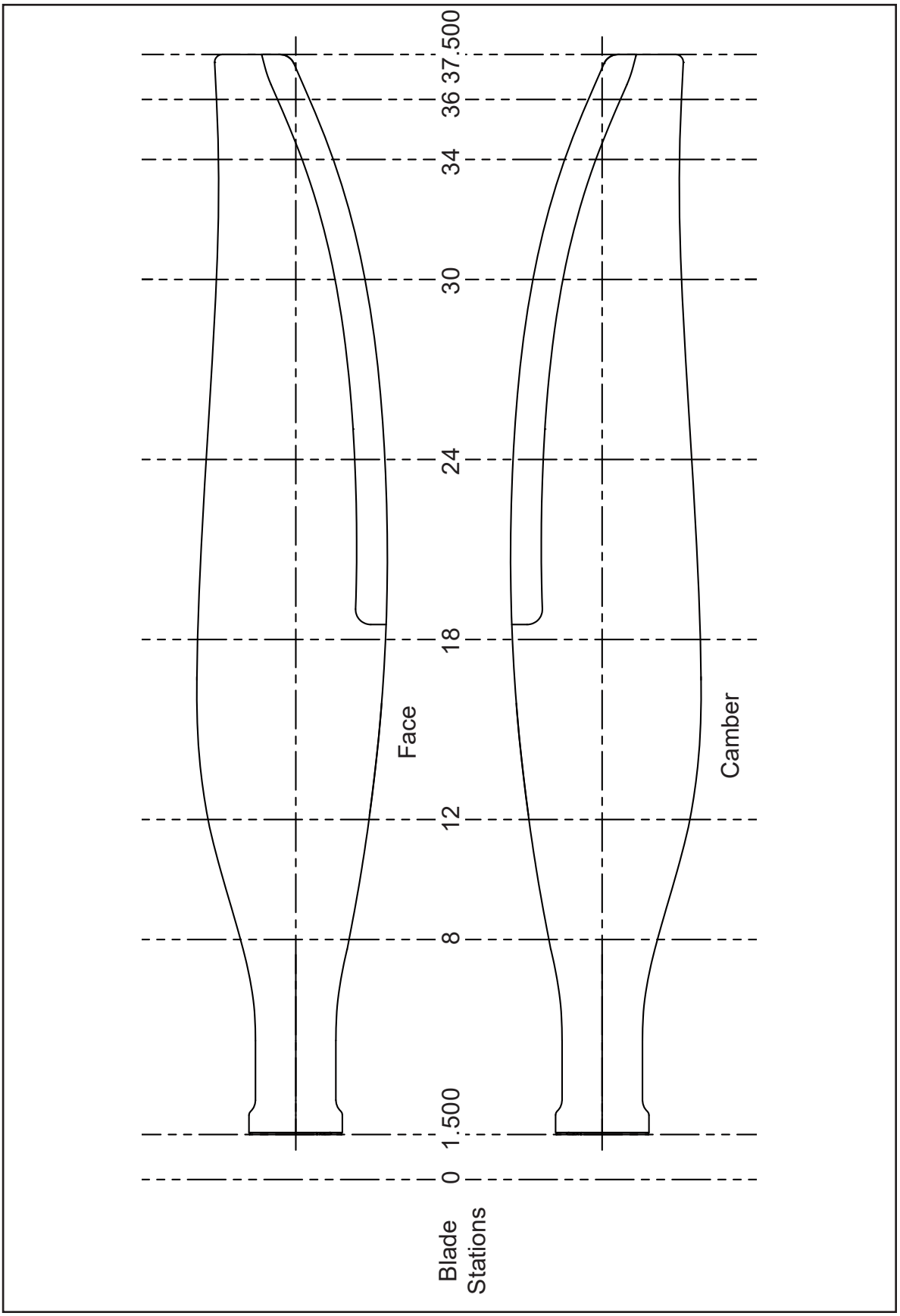

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