HARTZELL PROPELLER INC.
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A.
Telephone: 937.778.4200
Fax: 937.778.4215

MANUAL REVISION TRANSMITTAL
Manual 491 (61-10-91)
Three Blade Raptor Series Reciprocating Propeller Overhaul Manual
REVISION 2 dated April 2023

Remove Pages:	**Insert Pages:**
Entire Manual	**Entire Manual**

NOTE: When the manual revision has been inserted in the manual, record the information required on the Record of Revisions page in this manual.

This page may be discarded after proper filing of the revision.

(Blank Page)

Manual No. 491
61-10-91
Revision 2
April 2023

Three Blade Raptor Series Reciprocating Propeller Overhaul Manual

For Constant Speed and Feathering Propeller Models:
3C2-( )( )( )

Hartzell Propeller Inc.
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A.
Phone: 937.778.4200
Fax: 937.778.4215

REVISION 2 HIGHLIGHTS

Revision 2 dated April 2023, incorporates the following:

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

Updated the Hartzell Propeller Inc. logo on the cover and revised the header on all pages.

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

- DISASSEMBLY
  - Revised the section, "Important Information"
  - Added the section, "Hub Plug Removal" and the applicable Figure
  - Revised the section, "Cylinder Removal/Disassembly" and the applicable Figures
  - Revised the section, "Blade/Fork Removal" and the applicable Figure
  - Added the section, "Mounting Stud Removal"
  - Added the section, "Hub Disassembly"
  - Revised the section, "Blade Disassembly"
- CLEANING
  - Revised the section, "Cleaning Procedures"
- CHECK
  - Revised the check criteria for the following components:
    Pitch Change Rod (Item 200)
    Bolt, 3/8-24, Hex Head (230)
    Fork, Three Blade Assembly (Item 300)
- ASSEMBLY
  - Revised the section, "Hub Assembly Procedures" and added Figure 7-2
  - Revised the section, "Blade Assembly and Installation" and the applicable Figures
  - Incorporated TR-001 that revised the section, "Blade Installation"
  - Revised the section, "Pitch Change Rod Installation and Blade Angle Check"
  - Revised the section, "Cylinder Assembly/Installation" and the applicable Figures
  - Revised the section, "Setting the Blade Angles"
  - Revised the section, "Leak Test"
- FITS AND CLEARANCES
  - Revised the section, "Blade Tolerances"
- ILLUSTRATED PARTS LIST
  - Revised Figure 10-1, "3C2-FP650A1: Propeller Parts"
  - Revised the parts list for propeller model 3C2-FP650A1
  - Illustrations and parts lists for common sub-assemblies (example: hub units) are now located in the "Sub-Assembly Parts Lists and Figures" section in the Illustrated Parts List chapter

REVISION 2 HIGHLIGHTS

1. Introduction

A. General

(1) 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 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 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 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 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	Nov/18	New Issue
Revision 1	Nov/20	Minor Revision
Revision 2	Apr/23	Major Revision

RECORD OF REVISIONS

This is a permanent historical record of revisions inserted into this manual.
Revision 2 includes all prior revisions.

Revision Number	Issue Date	Date Inserted	Inserted By
2	Apr/23	Apr/23	HPI

Revision Number	Issue Date	Date Inserted	Inserted By

(Blank Page)

RECORD OF TEMPORARY REVISIONS

Update this page to show all temporary revisions inserted into this manual.
Revision 2 includes all Temporary Revisions up to and including TR-001.

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

(Blank Page)

SERVICE DOCUMENT LIST

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

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

Service Document Number	Incorporation Rev./Date

Service Document Number	Incorporation Rev./Date

SERVICE DOCUMENT LIST

Service Document Number	Incorporation Rev./Date	Service Document Number	Incorporation Rev./Date

AIRWORTHINESS LIMITATIONS

1. Airworthiness Limitations

   A. Life Limits

      (1) Certain component parts, as well as the entire propeller, may have specific life limits established by the FAA. Such limits require replacement of items after a specific number of hours of use.

      (2) For airworthiness limitations information, refer to Hartzell Propeller Inc. Owner's Manual 480 (61-00-80).

(Blank Page)

LIST OF EFFECTIVE PAGES

Chapter	Page	Rev. Level	Date
Cover	Cover and Inside Cover	Rev. 2	Apr/23
Revision Highlights	1 thru 2	Rev. 2	Apr/23
Record of Revisions	1 thru 2	Rev. 2	Apr/23
Record of Temporary Revisions	1 thru 2	Rev. 2	Apr/23
Service Document List	1 thru 2	Rev. 2	Apr/23
Airworthiness Limitations	1 thru 2	Rev. 2	Apr/23
List of Effective Pages	1 thru 2	Rev. 2	Apr/23
Table of Contents	1 thru 2	Rev. 2	Apr/23
Introduction	1 thru 22	Rev. 2	Apr/23
Description and Operation	1 thru 4	Rev. 2	Apr/23
Testing and Fault Isolation	1-1 thru 1-10	Rev. 2	Apr/23
Automatic Test Requirements	2-1 thru 2-2	Rev. 2	Apr/23
Disassembly	3-1 thru 3-18	Rev. 2	Apr/23
Cleaning	4-1 thru 4-4	Rev. 2	Apr/23
Check	5-1 thru 5-40	Rev. 2	Apr/23
Repair	6-1 thru 6-8	Rev. 2	Apr/23
Assembly	7-1 thru 7-2	Rev. 2	Apr/23
	7-2.1 and 7-2.2	Rev. 2	Apr/23
	7-3 thru 7-46	Rev. 2	Apr/23
Fits and Clearances	8-1 thru 8-8	Rev. 2	Apr/23
Special Tools, Fixtures and Equipment	9-1 thru 9-4	Rev. 2	Apr/23
Illustrated Parts List	10-1 thru 10-12	Rev. 2	Apr/23
	10A-1 thru 10A-10	Rev. 2	Apr/23

(Blank Page)

TABLE OF CONTENTS

(Blank Page)

INTRODUCTION - CONTENTS

(Blank Page)

1. General (Rev. 1)

A. Statement of Purpose

(1) This manual has been reviewed and accepted by the FAA. Additionally, this manual contains data that has been approved in a manner acceptable to the FAA administrator.

(2) This manual provides maintenance and overhaul procedures for use in propeller repair stations by personnel that are trained and experienced with Hartzell Propeller Inc. products.

(a) This manual does not provide complete information for an inexperienced technician to attempt propeller overhaul without supervision.

(3) This manual is intended to be the primary source of maintenance and overhaul information for the applicable Hartzell propeller/component models.

(a) Propeller models addressed in this manual may be Type Certificated by the FAA, or may be experimental. Experimental parts must not be installed on a Type Certificated propeller. Always use the current illustrated parts list for the assembly of any propeller. Always refer to the aircraft Type Certificate (TC) or Supplemental Type Certificate (STC) to determine installation eligibility of any propeller. If installation eligibility is not identifiable, an additional installation approval, such as FAA form 337 field approval or Supplemental Type Certificate may be required. If in doubt, contact Hartzell Propeller Inc. Product Support.

(b) 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.

(4) This manual makes reference to other Hartzell Propeller Inc. manuals that provide important details for procedures such as anodizing, penetrant inspection, and overhaul procedures for hub units.

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

B. Item References

(1) Item references throughout the text in this manual refer to item numbers in the Illustrated Parts List chapter of this manual. The item numbers appear in parentheses directly following the part name. Only the item base number will appear in the text of the manual. Item base numbers and the alpha variants of the base numbers will appear in the illustrated parts list. There are two reasons for the use of alpha variants:

(a) A part may be superseded, replaced, or obsoleted by another part. For example, the pitch change block unit (105733) that is item 320 was superseded by the pitch change block unit (105733-1) that is item 320A.

(b) An Illustrated Parts List may contain multiple configurations. Effectivity codes are used to distinguish different part numbers within the same list. For example, one configuration may use a piston (B-2419) that is item 80, yet another configuration uses a piston (104256) that is item 80A. Effectivity codes are very important in the determination of parts in a given configuration.

2. Reference Publications

A. Hartzell Propeller Inc. 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) 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.)	Available at www.hartzellprop.com	Hartzell Propeller Inc. Manual Title
n/a	Yes	Active Hartzell Propeller Inc. Service Bulletins, Service Letters, Service Instructions, and Service Advisories
Manual 127 (61-16-27)	Yes	Metal Spinner Maintenance Manual
Manual 135F (61-13-35)	-	Composite Blade Overhaul Manual
Manual 159 (61-02-59)	Yes	Application Guide

Manual No. (ATA No.)	Available at www.hartzellprop.com	Hartzell Propeller Inc. Manual Title
Manual 165A (61-00-65)	Yes	Illustrated Tool and Equipment Manual
Manual 170 (61-13-70)	Yes	Composite Propeller Blade Field Maintenance and Minor Repair Manual
Manual 180 (30-61-80)	Yes	Propeller Ice Protection System Manual
Manual 202A (61-01-02)	Vol. 7, Yes Vol. 11, Yes	Standard Practices Manual, Volumes 1 through 11
Manual 480 (61-00-80)	Yes	Propeller Owner's Manual and Logbook for Raptor Reciprocating Propeller Series with Composite Blades Constant Speed, Non-counterweighted

B. Vendor Publications

None.

3. Personnel Requirements (Rev. 1)

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 Inc. 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 Federal Aviation Regulation (FAR) Part 43 for additional information about general aviation maintenance requirements.

4. Special Tooling and Consumable Materials (Rev. 1)

A. Special Tooling

(1) Special tooling may be required for procedures in this manual. For further tooling information, refer to Hartzell Propeller Inc. 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 Inc. 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.

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

A. Instructions for Use

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

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

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

6. Calendar Limits and Long Term Storage (Rev. 2)

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

7. Component Life and Overhaul (Rev. 2)

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

A. Component Life

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

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

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

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

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

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

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

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

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

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

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

(b) Hub replacement

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

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

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

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

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

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

B. Overhaul

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

(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 Inc. 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 Inc. 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 Inc. component maintenance manual.

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

8. Damage/Repair Types (Rev. 1)

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 Inc. 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 Inc. 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 Inc. 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 Inc.

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

9. Propeller Critical Parts (Rev. 1)

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 Inc. 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.

10. Warranty Service (Rev. 1)

A. Warranty Claims

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

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

11. Hartzell Propeller Inc. Contact Information (Rev. 2)

A. Product Support Department

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

(b) Hartzell Propeller Inc. Product Support 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 Inc. website at www.hartzellprop.com.

B. Technical Publications Department

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

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

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

C. Recommended Facilities

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

12. Definitions (Rev. 4)

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

Term	Definition
Annealed	Softening of material due to overexposure to heat
Aviation Certified	Intended for FAA or international equivalent type certificated aircraft applications. A TC and PC number must be stamped on the hub, and 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

Term	Definition
Bulge	An outward curve or bend
Camber	The surface of the blade that is directed toward the front of the aircraft. It is the low pressure, or suction, side of the blade. The camber side is convex in shape over the entire length of the blade.
Chord	A straight line distance between the leading and trailing edges of an airfoil
Chordwise	A direction that is generally from the leading edge to the trailing edge of an airfoil
Co-bonded	The act of bonding a composite laminate and simultaneously curing it to some other prepared surface
Composite Material	Kevlar®, carbon, or fiberglass fibers bound together with, or encapsulated within an epoxy resin
Compression Rolling	A process that provides improved strength and resistance to fatigue
Constant Force	A force that is always present in some degree when the propeller is operating
Constant Speed	A propeller system that employs a governing device to maintain a selected engine RPM
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

Term	Definition
Face	The surface of the blade that is directed toward the rear of the aircraft. The face side is the high pressure, or thrusting, side of the blade. The blade airfoil sections are normally cambered or curved such that the face side of the blade may be flat or even concave in the midblade and tip region.
Face Alignment	Distance from the blade centerline to the highest point on the face side perpendicular to the chord line
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag
Fraying	A raveling or shredding of material
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

Term	Definition
Major Propeller Effect	The major propeller effects are defined in Title 14 CFR section 35.15(g)(2)
Minor Deformation	Deformed material not associated with a crack or missing material
Monocoque	A type of construction in which the outer skin carries all or a major part of the load
Nick	Removal of paint and possibly a small amount of material
Non-Aviation Certified	Intended for non-aircraft application, such as Hovercraft or Wing-in-Ground effect (WIG) applications. These products are certificated by an authority other than FAA. The hub and blades will be stamped with an identification that is different from, but comparable to TC and PC.
Non-Aviation Experimental	Intended for non-aircraft application, such as Hovercraft or Wing-In-Ground effect (WIG) applications. Products marked with an “X” at or near the end of the model number or part number are not certified by any authority and are not intended for use on certificated craft.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control/condition lever and the actual engine (propeller) RPM are equal
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

Term	Definition
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
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

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

13. Abbreviations (Rev. 2)

Abbreviation	Term
AD	Airworthiness Directives
AMM	Aircraft Maintenance Manual
AOG	Aircraft on Ground
AR	As Required
ATA	Air Transport Association
CSU	Constant Speed Unit
FAA	Federal Aviation Administration
FH	Flight Hour
FM	Flight Manual
FMS	Flight Manual Supplement
Ft-Lb	Foot-Pound
HMI	Human Machine Interface
ICA	Instructions for Continued Airworthiness
ID	Inside Diameter
In-Lb	Inch-Pound
IPL	Illustrated Parts List
IPS	Inches Per Second
kPa	Kilopascals
Lb(s)	Pound(s)
Max.	Maximum
Min.	Minimum
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection (Overhaul)
MS	Military Standard
MSDS	Material Safety Data Sheet

Abbreviation	Term
N	Newtons
N/A	Not Applicable
NAS	National Aerospace Standards
NASM	National Aerospace Standards, Military
NDT	Nondestructive Testing
NIST	National Institute of Standards and Technology
N•m	Newton-Meters
OD	Outside Diameter
OPT	Optional
PC	Production Certificate
PCP	Propeller Critical Part
PLC	Programmable Logic Controller
PMB	Plastic Media Blasting (Cleaning)
POH	Pilot’s Operating Handbook
PSI	Pounds per Square Inch
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

(Blank Page)

DESCRIPTION AND OPERATION - CONTENTS

(Blank Page)

1. General (Rev. 1)

   A. Propeller/Blade Model Designation

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

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

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

         (a) For additional information about the propeller model number designation system, refer to the applicable Hartzell Propeller Inc. owner's manual.

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

         (a) For additional information about the model number designation system for composite blades, refer to Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35).

         (b) For additional information about the model number designation system for aluminum blades, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

2. Operation

   A. Raptor Series Constant Speed and Feathering Propellers

      (1) The 3C2 models are constant speed propellers that use an air charge, spring, and counterweights (if installed) to move the blades to high pitch/ feather position. Blade centrifugal twisting moment acts to move the blades to low pitch, but the air charge, spring, and counterweights overcome this force. Oil pressure against a propeller mounted hydraulic piston opposes the counterweight, spring, and air charge forces to move the blades to low blade angle (low pitch).

      (2) The action of the air charge, spring, and counterweights tends to move the blades to a higher blade angle (high pitch), reducing engine RPM. Oil pressure toward low pitch increases engine RPM.

      (3) If oil pressure is lost during operation, the propeller will feather. Feathering occurs because the air charge, spring, and blade counterweights are no longer opposed by hydraulic oil pressure. The air charge, spring, and blade counterweights are then free to increase blade pitch to the feathering (high pitch) stop.

      (4) Normal in-flight feathering of these propellers is accomplished when the pilot retards the propeller pitch control past the feather detent. This allows control oil to drain from the cylinder and return to the engine sump. The engine can then be shut down.

(5) Normal in-flight unfeathering is accomplished when the pilot positions the propeller pitch control into the normal flight (governing) range and an engine restart is attempted.

(6) Some aircraft are equipped with a hydraulic accumulator that stores a supply of oil under pressure. This oil supply is released to unfeather the propeller during an in-flight engine restart. Pressurized oil is directed to the propeller, resulting in blade angle decrease. The propeller begins to windmill, and engine restart is possible.

(7) When the engine is stopped on the ground, it is undesirable to feather the propeller, as the high blade angle prevents the engine from starting. To prevent feathering during normal engine shutdown on the ground, the propeller incorporates spring energized latches. If propeller rotation is approximately 800 RPM or above, the latches are disengaged by centrifugal force acting on the latches to compress the springs. When RPM drops below 800 RPM (and blade angle is typically within 7 degrees of the low pitch stop), the springs overcome the latch weight centrifugal force and move the latches to engage the high pitch stops, preventing blade angle movement to feather during normal engine shutdown.

TESTING AND FAULT ISOLATION - CONTENTS

LIST OF FIGURES

(Blank Page)

1. Troubleshooting Guide

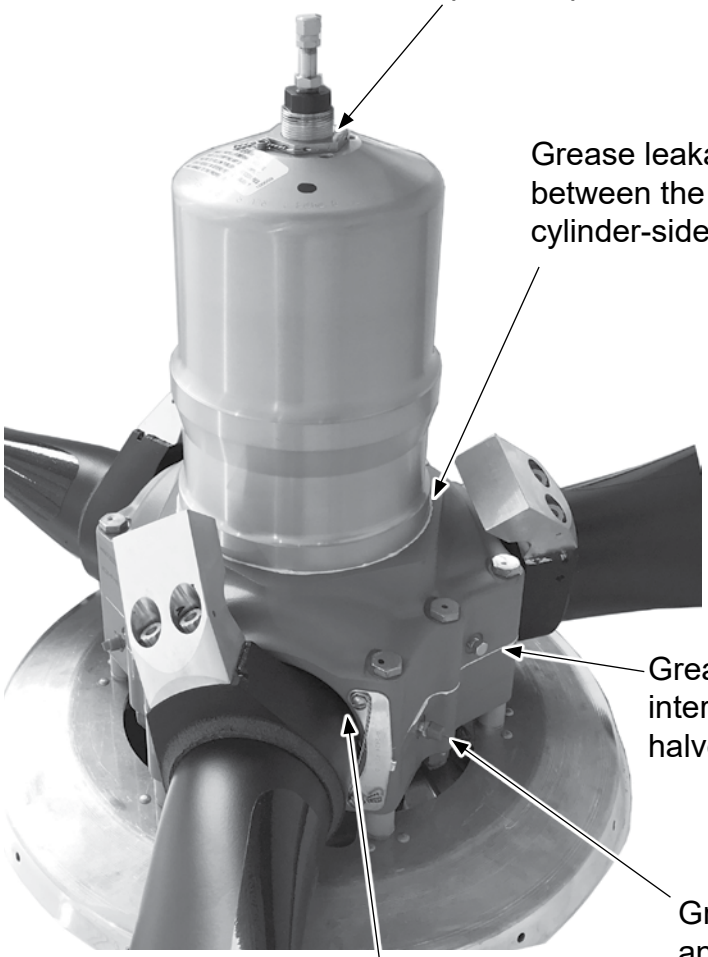
CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS CHAPTER MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST IN THIS MANUAL FOR IDENTIFICATION OF PROPELLER CRITICAL PARTS.

The purpose of this guide is to help isolate probable causes and suggest possible remedies for some of the more common propeller service problems. In all cases, the remedy for a problem should follow the procedures detailed in the applicable section of this manual.

Problem		Probable Cause	Remedy
A. Pitch Control Difficulty		Too much friction in moving parts.	Refer to problem, "Friction" in this chapter.
	or	Oil leaking around the piston causing underspeed.	Disassemble the propeller and examine the O-ring and piston-to-cylinder sealing surfaces. Replace the defective O-ring.
B. Friction		Lack of lubrication.	Add approved lubricant.
	or	Blade is shimmed too tight.	Disassemble the propeller and readjust the blade shim.
	or	Balls in the blade retention split bearing are unusually rough, corroded, or chipped.	Replace the blade retention split bearing assembly.
	or	Not enough clearance between the various moving parts in the pitch change mechanism.	Examine the moving parts individually. Increase the clearances between the individual parts as necessary to decrease friction in the mechanism. Refer to the section, "Pitch Change Block Button Modification" in the Repair chapter of this manual.
	or	Wear strip is damaged causing too much friction on the blade butt seal O-ring.	Replace the damaged wear strip and the seal O-ring.

Problem	Probable Cause	Remedy
C. Abnormal Propeller Vibration	Bent, cracked, or damaged blade or pitch change knob.	Refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).
	or Cracked or damaged hub.	Refer to the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	or Broken blade retention split bearings.	Replace the bearings and inspect the other blade retention components.
	or Grease leakage.	Refer to the problem, "Grease Leakage" in this chapter.
D. Slight Vibration	Blades not tracking.	Refer to the problem, "Blades Not Tracking" in this chapter.
	or Static balance incorrect.	Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	or Dynamic balance incorrect.	Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02.
	or Blade wear.	Refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).
	or Grease leakage.	Refer to the problem, "Grease Leakage" in this chapter.
	or Blade-to-blade pitch variance is too great.	Disassemble the propeller and correct the blade-to-blade pitch variance.

Problem		Probable Cause	Remedy
E. Surging RPM or Torque		Too much friction in the pitch change mechanism.	Refer to the problem, "Friction" in this chapter.
	or	Air is trapped in the propeller actuating piston or in the engine shaft.	After propeller installation and before each flight, exercise the propeller by changing pitch or feathering. The engine should have a provision for trapped air to escape from the system during one-half of the pitch cycle.
	or	Governor problem.	Refer to the airframe or the engine manufacturer's maintenance manual for installation instructions.



Areas of Leaking Oil or Grease
Figure 1-1

Problem	Probable Cause	Remedy
F. Oil Leakage (Refer to Figure 1-1)	Defective O-ring seal between the engine flange and the propeller mounting flange.	Remove the propeller from the engine and visually examine the O-ring and the sealing surface. Replace the defective O-ring.
	or Defective O-ring seal between the cylinder and the hub.	Remove the cylinder and visually examine the O-ring and the sealing surface. Replace the defective O-ring.
	or Defective O-ring seal between the piston and the cylinder, resulting in leakage between the pitch change rod plug and the cylinder.	Remove the cylinder and visually examine the piston O-ring and cylinder sealing surface. Replace the defective O-ring.
	or Defective O-ring seal between the pitch change rod and either hub half, resulting in leakage from the hub and from around the blade shanks.	Remove the lubrication fitting at the bottom of the hub and insert a wire. If oil runs out, then one or both O-rings are defective. Remove the propeller from the engine and disassemble. Visually examine both O-rings and sealing surfaces. Replace the defective O-ring(s).
G. Grease Leakage (Refer to Figure 1-1) A new or newly overhauled propeller can leak slightly during the first several hours of operation. The leakage can be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. This leakage should stop within the first ten hours of operation.	Defective lubrication fitting.	Replace defective lubrication fittings.
	or Defective seal at blade socket in the hub.	Disassemble the propeller and visually examine the seal and the sealing surface. Replace defective seal.

Problem	Probable Cause	Remedy
H. End-Play Movement of the Blade NOTE: Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter in this manual.	Blade retention bearing is worn.	Follow the Blade Retention Split Bearing Inspection and Replacement Procedures.
	or Internal blade shim is worn.	Disassemble the propeller, remove the blade shim, and inspect the blade shim. Replace the worn blade shim.
I. Fore-and-Aft Movement of the Blade NOTE: Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter in this manual.	Blade retention bearing is worn.	Follow the Blade Retention Split Bearing Inspection and Replacement Procedures.
	or Internal blade shim is worn.	Disassemble the propeller, remove the blade, and inspect the blade shim. Replace the worn blade shim.
J. In-and-Out Movement of the Blade NOTE: Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter in this manual.	Blade retention bearing is worn.	Follow the Blade Retention Split Bearing Inspection and Replacement Procedures.
K. Excessive Radial Play of the Blade (backlash) NOTE: Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter in this manual.	Pitch change fork is worn.	Disassemble the propeller. Inspect and replace the fork, as required.
L. Blades Not Tracking	Ground strike damage.	For a composite blade, refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

2. Lightning Strike on Hub or Blade (Rev. 1)

A. Before Further Flight

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

(a) A lightning strike on the propeller usually leaves arcing damage on the blade, as evidence of where it entered or left the tip of the blade.

(b) Refer to the Special Inspections chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) for lightning strike inspection criteria.

(Blank Page)

AUTOMATIC TEST REQUIREMENTS (NOT APPLICABLE)

NOTE: In accordance with ATA iSpec 2200 specification this space is reserved for automatic test requirements. Such requirements are not applicable to the Hartzell Propeller Inc. propellers included in this manual.

(Blank Page)

DISASSEMBLY - CONTENTS

LIST OF FIGURES

1. Important Information (Rev. 3)

WARNING 1: THE USE OF BLADE PADDLES TO MOVE BLADES CAN RESULT IN THE OVERLOAD AND DAMAGE OF BLADE PITCH CHANGE KNOBS. THIS DAMAGE IS NOT REPAIRABLE AND CAN RESULT IN SEPARATION BETWEEN THE BLADE AND THE PITCH CHANGE KNOB, CAUSING LOSS OF PITCH CONTROL DURING FLIGHT.

WARNING 2: ADHESIVES AND SOLVENTS ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES, AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT AND BREATHING OF VAPORS. USE SOLVENT RESISTANT GLOVES TO MINIMIZE SKIN CONTACT AND WEAR SAFETY GLASSES FOR EYE PROTECTION. USE IN A WELL VENTILATED AREA AWAY FROM SPARKS AND FLAME. READ AND OBSERVE ALL WARNING LABELS.

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 IN THIS MANUAL FOR IDENTIFICATION OF PROPELLER CRITICAL PARTS.

CAUTION 2: USE COMPRESSED AIR THAT HAS BEEN FILTERED FOR MOISTURE, OR NITROGEN TO ACTUATE THE PROPELLERS.

CAUTION 3: DO NOT USE MORE THAN 175 PSI (12.06 BARS) OF PRESSURE WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

CAUTION 4: USE ENOUGH PRESSURE TO MAKE SURE THAT THE PROPELLER ACTUATES AGAINST EACH POSITIVE STOP.

A. Removing the Propeller

(1) Remove the propeller from the aircraft in accordance with the applicable Hartzell Propeller Inc. owner's manual.

B. Record Serial Numbers/Blade Location Before Disassembly

(1) Make a record of the serial number and model number of the hub, blades, and any other serial-numbered parts and compare with the data in the propeller logbook.

(a) For the location of the serial number on the hub, refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

CAUTION 1: DO NOT ETCH, SCRIBE, PUNCH MARK, OR SIMILARLY IDENTIFY PARTS IN ANY MANNER THAT MAY BE HARMFUL TO THE STRENGTH OR FUNCTION OF THE PROPELLER.

CAUTION 2: GRAPHITE ("LEAD") PENCIL MARKS WILL CAUSE CORROSION. ALL MARKS MADE ON PARTS MUST BE MADE WITH a crayon or soft, non-graphite pencil such as CM162.

(2) Before disassembly, use a crayon or soft, non-graphite pencil such as CM162 to number the blades counterclockwise from the propeller serial number impression stamped on the propeller hub unit.

(a) Make a record of each blade serial number and the hub socket/arm from which it was removed.

C. Ice Protection System (if applicable)

(1) If the propeller is equipped with an ice protection system supplied by Hartzell, refer to Hartzell Propeller Inc. Ice Protection System Manual 180 (30-61-80) for technical information about the applicable ice protection system.

(2) If the propeller is equipped with an ice protection system not supplied by Hartzell Propeller Inc., refer to the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA) for technical information about the applicable ice protection system.

D. Hub Balance Weight Removal

(1) Remove the safety wire from the balance weight screws (800).

(2) Remove and discard the balance weight screws (800).

(3) Remove the balance weights (810).

E. Counterweight Removal

(1) For removal instructions, refer to the Overhaul chapter of Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

2. Hub Plug Removal

A. 3C2-FP650A1 Propellers - Refer to Figure 3-1

(1) Turn the propeller over and put it on a support to get access to the propeller mounting flange.

NOTE: A sturdy barrel or drum with the rim well padded may be used as a support.

(2) Remove and discard the O-ring (540).

(3) Using puller TE98, or equivalent, remove the hub plug (370).

(a) Put the puller TE98 on the end of the pitch change rod (200).

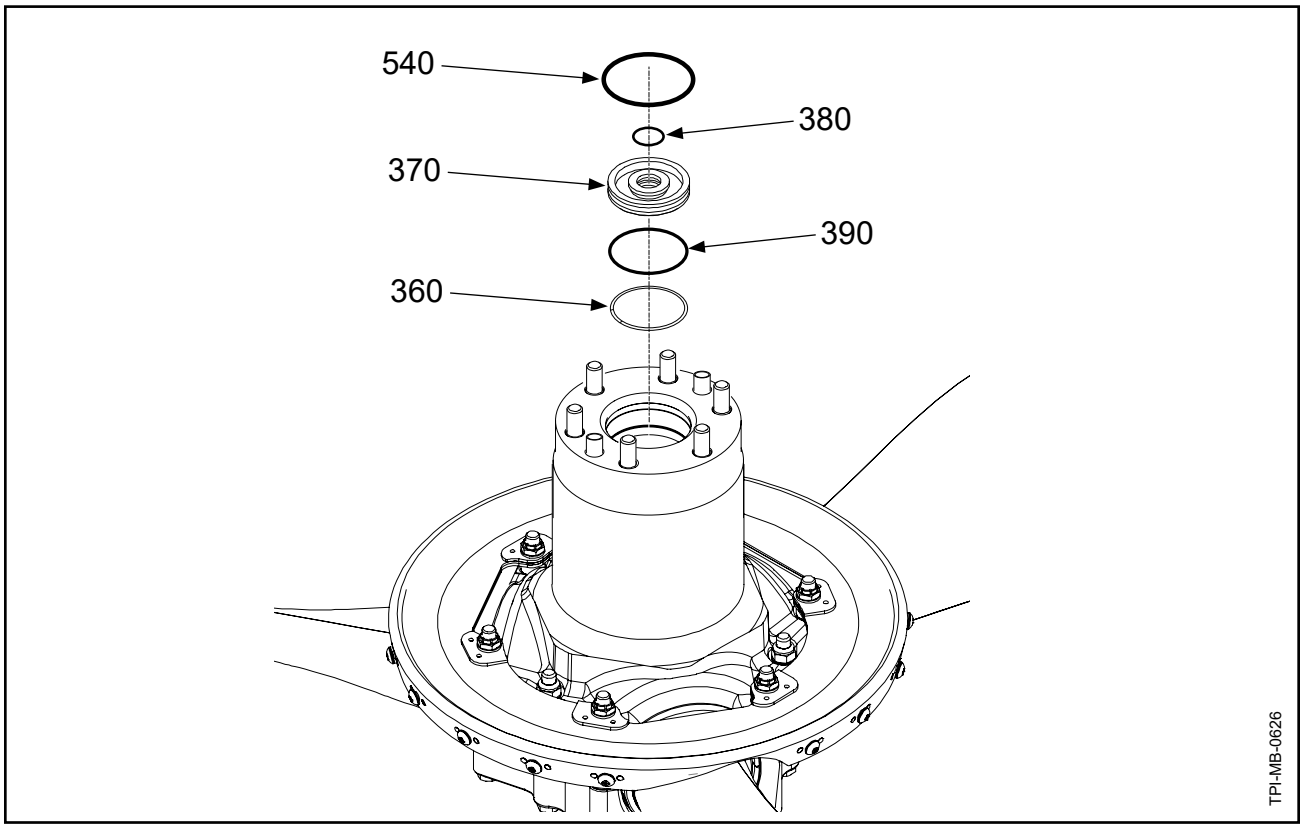
(b) Put the pulling ends of the puller TE98 firmly in the recesses of the hub plug (370).

(c) Tighten the puller TE98 until the hub plug (370) is removed from the bore of the hub (240).

(4) Remove and discard the O-ring (390) from the OD of the hub plug (370).

(5) Remove and discard the O-ring (380) from the ID of the hub plug (370).

(6) Remove and discard the internal spiral retaining ring (360).



Hub Plug Removal
Figure 3-1

3. Cylinder Removal/Disassembly

A. Cylinder Removal

(1) To simplify the assembly process and make it easier to set the necessary blade angles, make a record of the location and orientation (where applicable) of each part in the propeller hub assembly.

(2) Attach the propeller assembly to the rotatable fixture TE125 or equivalent on the assembly table TE129 or equivalent.

(3) Remove the air valve cap if present.

(4) Using an air gauge or other appropriate instrument, depress the needle in the air valve (10) to release the air charge in the cylinder (50).

WARNING: INTERNAL CYLINDER AIR PRESSURE MUST BE REDUCED TO ZERO BEFORE REMOVING THE AIR VALVE (10).

(5) Remove and discard the air valve (10). Refer to Figure 3-2.

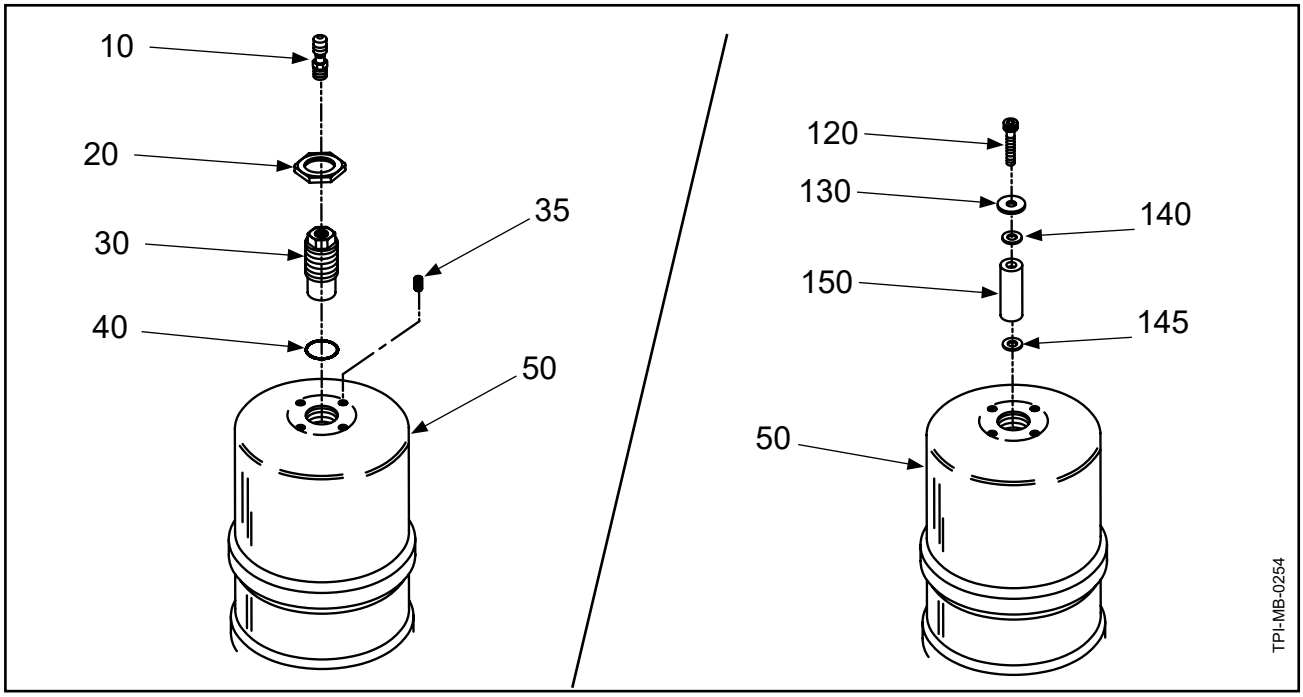
(6) Remove the blade counterweights if applicable. Refer to Hartzell Propeller Inc. Composite Propeller Blade Maintenance Manual 135F (61-13-35).

(7) Remove and discard the set screw (35) from the cylinder wrench attachment hole.

(8) Remove the self-locking nut (20).

(9) Remove the low pitch stop (30) from the cylinder (50). Refer to Figure 3-2.

(a) Remove and discard the O-ring (40) from the low pitch stop (30).



Air Valve/Low Pitch Stop Removal
Figure 3-2

(10) Using air pressure in the rotatable fixture TE125 or equivalent, move the propeller to low pitch position.

WARNING: HOLD THE PROPELLER BLADES AT LOW PITCH WITH AIR PRESSURE IN THE ROTATABLE FIXTURE TE125. REMOVAL OF THE STOP SCREW (120) WITHOUT AIR PRESSURE COULD CAUSE SUDDEN AND EXPLOSIVE ROTATION OF THE BLADES TO FEATHER PITCH, RESULTING IN PERSONAL INJURY AND DAMAGE TO THE INTERNAL COMPONENTS OF THE PROPELLER.

(11) Using the T-handle wrench TE381 or equivalent, remove the stop screw (120), washer (130), feather adjust washer(s) (140), high pitch stop sleeve (150), and high pitch adjust washer(s) (145). Refer to Figure 3-2.

(a) Make a record of the number of washers both under the feathering stop and on top of the feathering stop to reference during reassembly.

(b) Discard the stop screw (120), washer (130), feather adjust washer(s) (140), and high pitch adjust washer(s) (145).

(c) Retain the high pitch stop sleeve (150).

(12) Release the air pressure in the rotatable fixture to permit the propeller to move to feather position.

WARNING: USE EXTREME CAUTION WHEN REMOVING THE CYLINDER (50) AND FEATHERING SPRING ASSEMBLY (110). WHEN COMPRESSED, THE FEATHERING SPRING ASSEMBLY IS LOADED TO APPROXIMATELY 750 POUNDS (341 KG) FORCE. ENSURE THE SAFETY OF PERSONNEL IN THE VICINITY DURING THE DISASSEMBLY PROCEDURES.

CAUTION: CYCLE THE PROPELLER BEFORE BEGINNING THE CYLINDER (50) REMOVAL PROCESS. FAILURE TO CYCLE THE PROPELLER MAY CAUSE THE PITCH CHANGE ROD (200) TO PREMATURELY DISENGAGE FROM THE FORK (300).

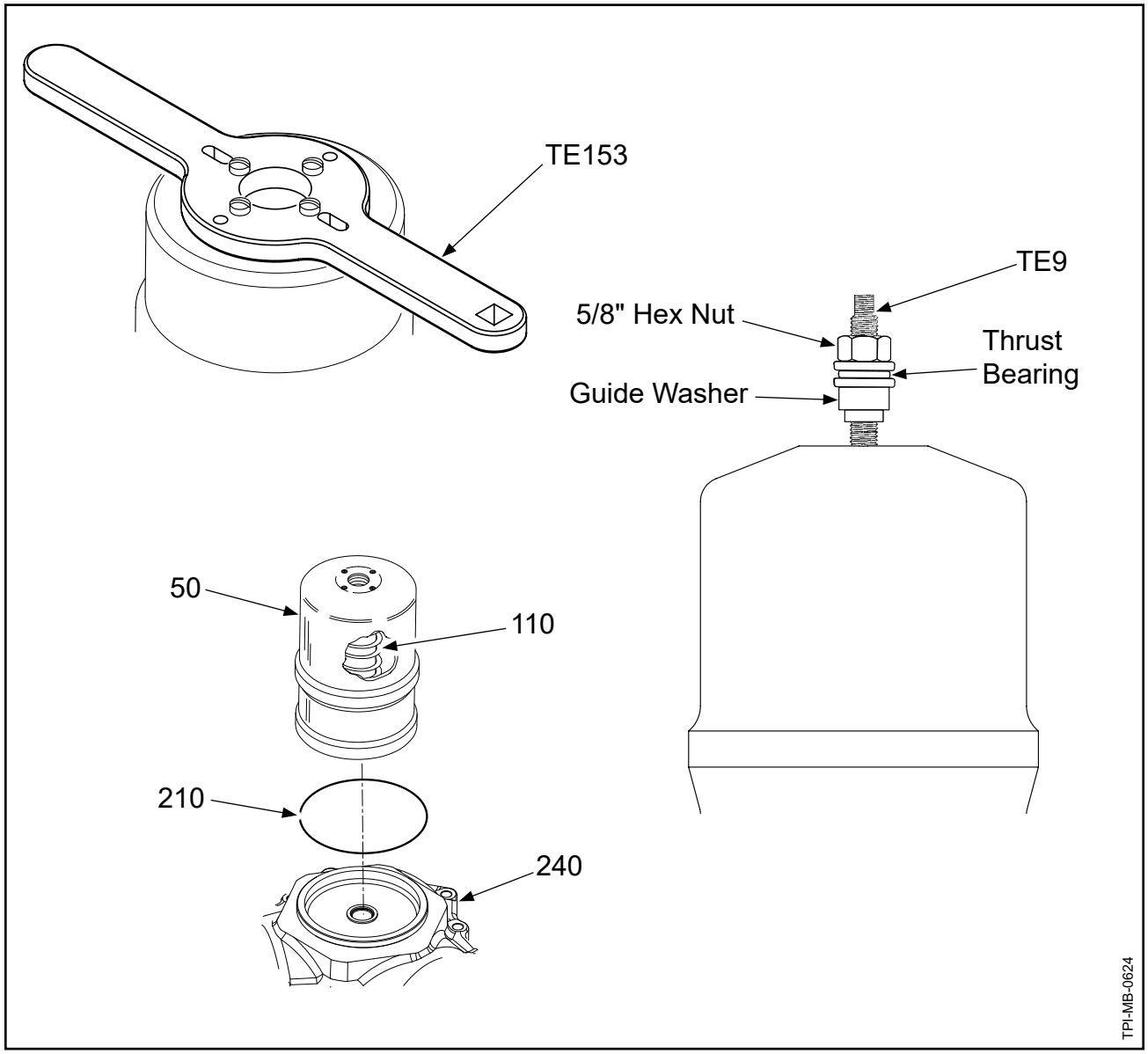
(13) Cycle the propeller through the entire range of movement and cycle back to no pressure or low pitch before beginning disassembly.

(14) Attach a cylinder wrench TE153 to the top of the cylinder (50). Refer to Figure 3-3.

(15) Insert the small threaded end of the feather assist spring assembling tool TE9 into the cylinder and turn the tool into the end of the pitch change rod (200) until tight. Refer to Figure 3-3.

NOTE: Using the spring assembling tool TE9 prevents the spring from forcefully releasing if the spring retainer is broken or the screws are damaged.

(16) Tighten the 5/8" hex nut on the spring assembling tool TE9 until the guide washer and the thrust bearing are snug against the cylinder (50).



Cylinder Removal
Figure 3-3

(17) Loosen the 5/8" hex nut on the spring assembling tool TE9 approximately two full turns. Refer to Figure 3-3.

CAUTION: DO NOT DAMAGE THE CYLINDER THREADS WHEN REMOVING THE CYLINDER (50) FROM THE HUB (240).

(18) Turn the cylinder wrench TE153 counterclockwise until the cylinder (50) threads are free from the hub (240).

NOTE: The feathering spring assembly (110) attached to the cylinder (50) is removed with the cylinder.

(19) Unthread the 5/8" hex nut on the spring assembly tool TE9, allowing the feather assist spring to gradually extend.

NOTE: The feather assist spring is completely extended when the 5/8" hex nut, guide washer, and thrust bearing become loose.

(20) Remove the feather assist spring assembly tool TE9 and the cylinder wrench TE153 from the cylinder (50).

(21) Remove the cylinder (50), with the feather assist spring assembly (110), from the propeller.

(a) Remove and discard the cylinder O-ring (210) from the hub (240).

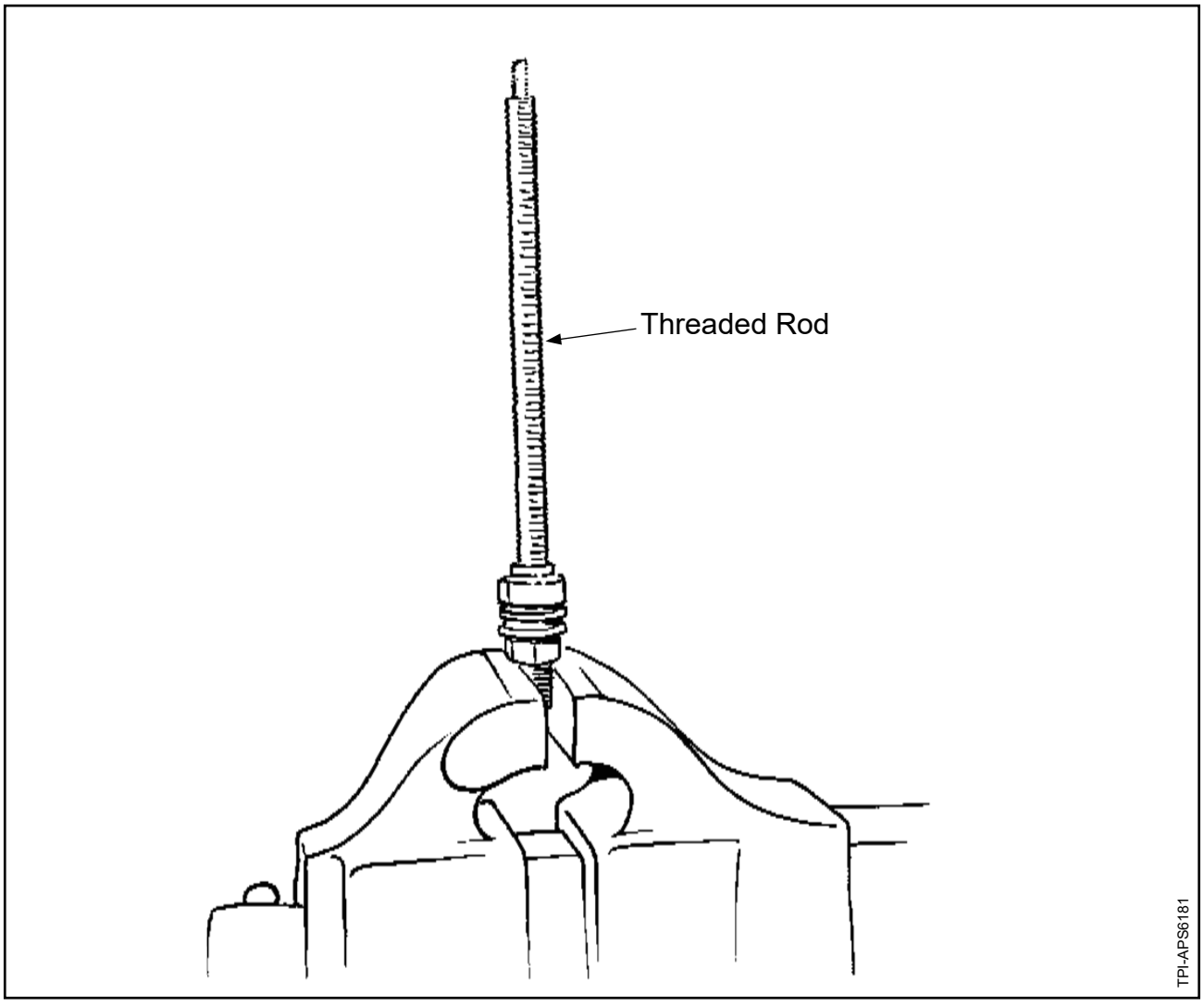
(22) Set aside the cylinder (50) with the feather assist spring assembly (110) for further disassembly.

B. Cylinder/Feathering Spring Disassembly

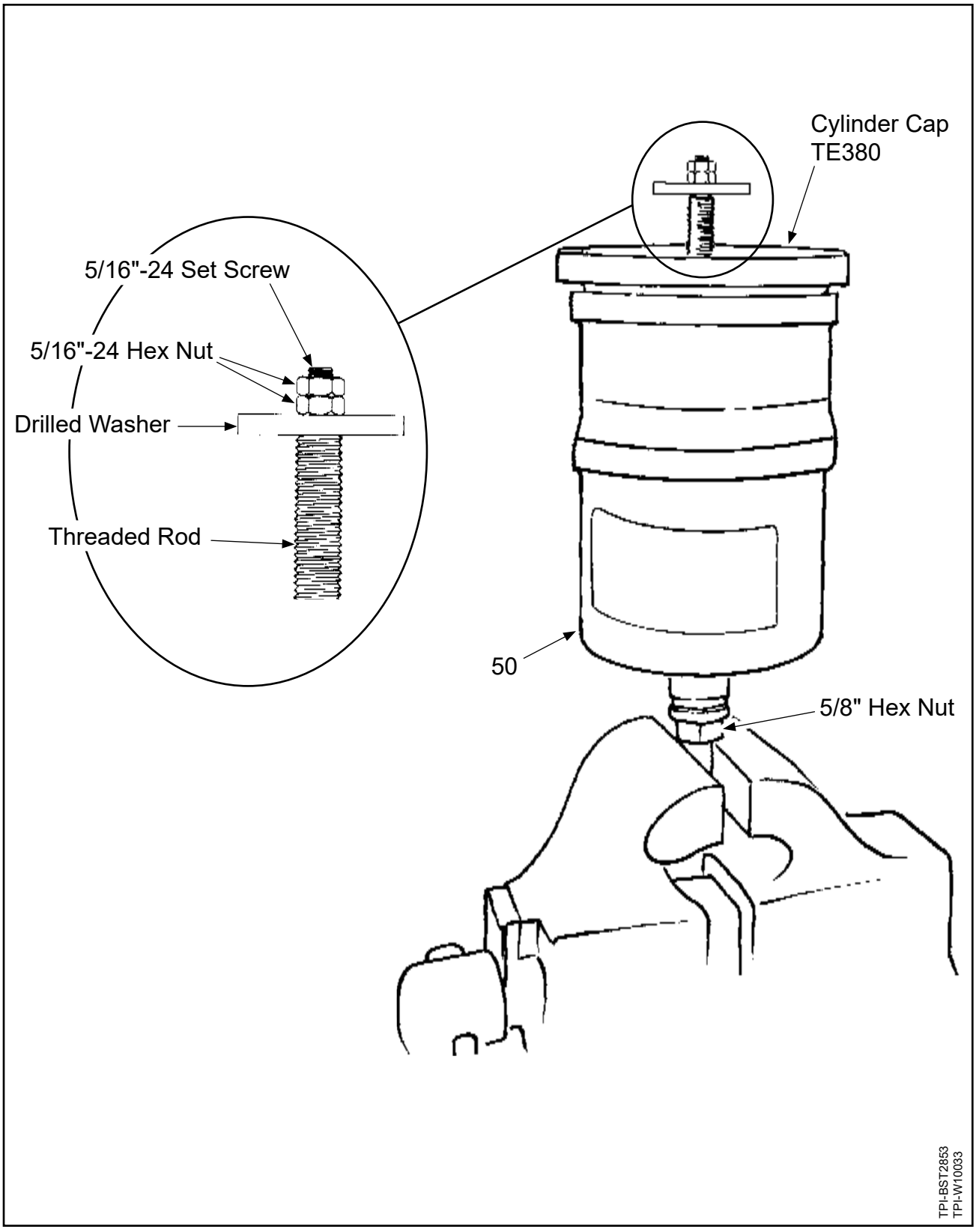
WARNING: WHEN COMPRESSED, THE FEATHERING SPRING ASSEMBLY (110) IS LOADED TO APPROXIMATELY 750 POUNDS (341 KG) FORCE. ENSURE THE SAFETY OF PERSONNEL IN THE VICINITY DURING DISASSEMBLY PROCEDURES.

CAUTION: DO NOT ATTEMPT TO DISASSEMBLE THE FEATHERING SPRING ASSEMBLY (110) WITH THE CYLINDER TORQUE WRENCH ADAPTER TE153 ATTACHED TO THE CYLINDER.

(1) Put the assembling tool TE9 in a vise with the flattened portion of the threaded rod between the jaws of the vise, and tighten the vise. Refer to Figure 3-4.



Assembling Tool TE9
Figure 3-4



Positioning the Cylinder on the Assembly Tool TE9
Figure 3-5

CAUTION: DO NOT DAMAGE THE CYLINDER THREADS WHEN INSTALLING THE CYLINDER CAP TE380.

(2) Install the cylinder (50) onto the assembling tool TE9 in accordance with Figure 3-5 and the following steps:

(a) Install the cylinder cap TE380 on the cylinder (50).

(b) Slide the cylinder (50) onto the assembling tool TE9 with the small opening of the cylinder toward the vise.

(c) Put the drilled washer over the end of the 5/16"-24 set screw in the end of the assembling tool TE9.

(d) Install two 5/16"-24 hex nuts on the 5/16"-24 set screw.

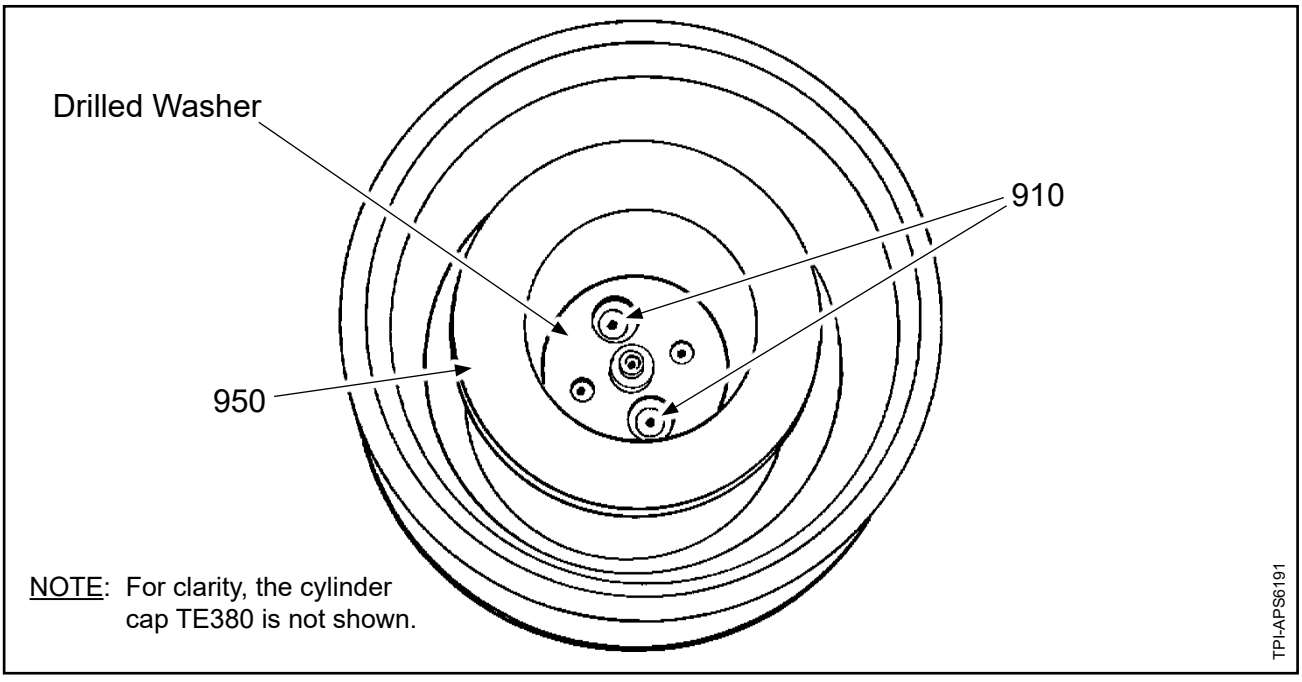
(3) Turn the 5/8" hex nut until the drilled washer is snug against the weight (920) with two screws (910) visible through the large holes in the drilled washer. Refer to Figure 3-6.

(4) Remove and discard the two screws (910).

(5) Loosen the 5/8" hex nut until the drilled washer can be rotated over the weight (920) and two screws (910) inside the spring guide (950).

(6) Turn the drilled washer until the heads of the remaining two screws (910) can be seen through the large holes in the drilled washer. Refer to Figure 3-6.

(7) Tighten the 5/8" hex nut until the drilled washer is tight against the weight (920).



Feathering Spring Assembly Screws
Figure 3-6

(8) Remove the remaining two screws (910).

(9) Remove the cylinder cap TE380. Refer to Figure 3-5.

(10) Loosen the 5/8" hex nut until the feather assist spring (960) is fully released.

(11) Remove the two 5/16"-24 hex nuts and the drilled washer.

(12) Disassemble the feathering spring assembly in accordance with Figure 3-7 and the following steps:

(a) Remove the weight (920) and the flyweight plate (940).

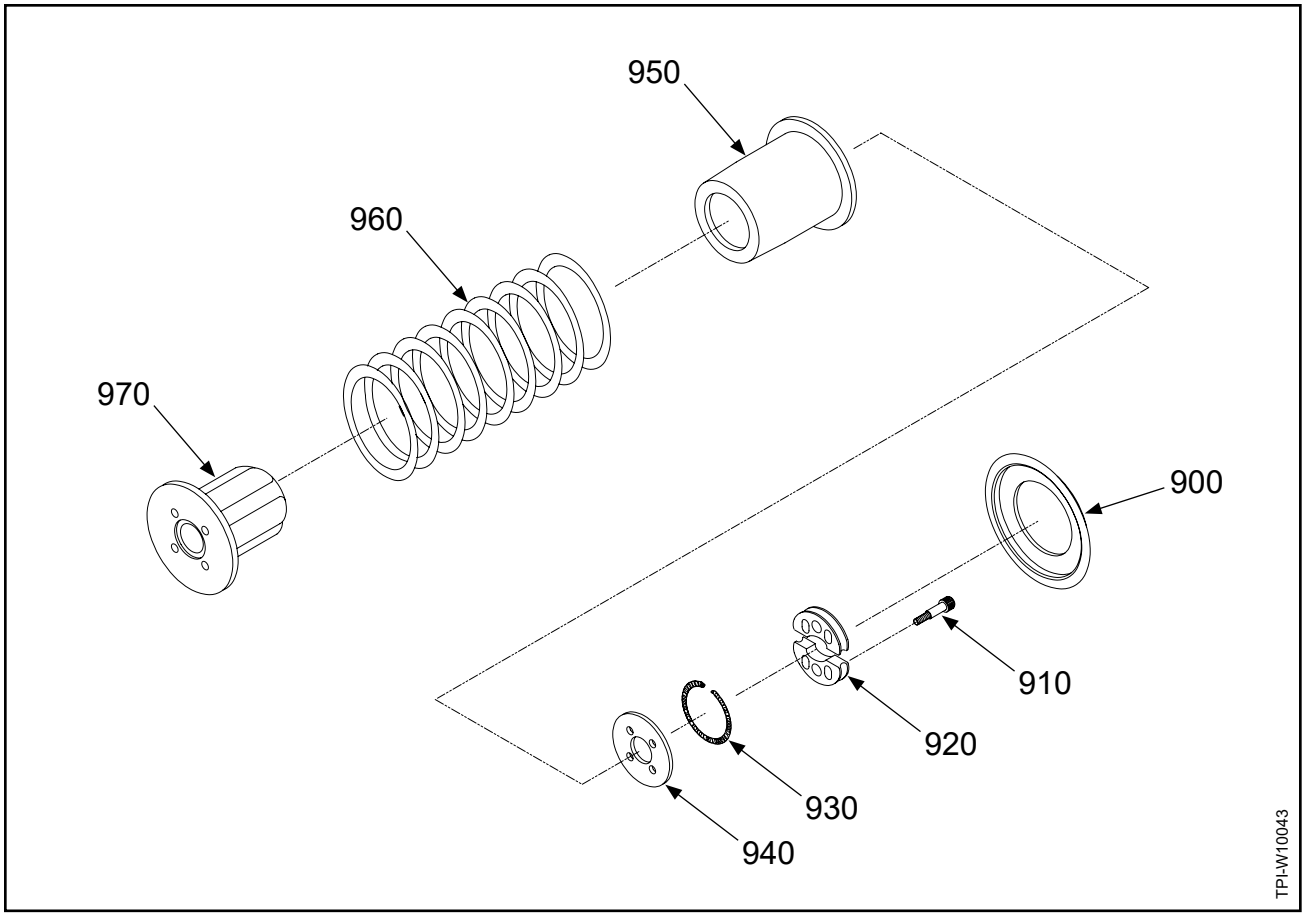
(b) Remove and discard the spring guide (950).

(c) Remove the feathering spring (960).

(d) Remove and discard the screws (100) holding the start lock housing (970) in place.

(e) Remove the start lock housing (970).

(13) Remove and discard the cylinder ID O-ring (190).



Feathering Spring Assembly Components
Figure 3-7

4. Blade/Fork Removal

A. 3C2-FP650A1 Propellers

(1) Remove and discard the piston nut (170).

(2) Remove the piston (180).

(3) Remove and discard the piston O-ring (160).

(4) Using the wrench adapter TE6, remove the pitch change rod (200).

(5) Remove and discard the hub nuts (350) and washers (340).

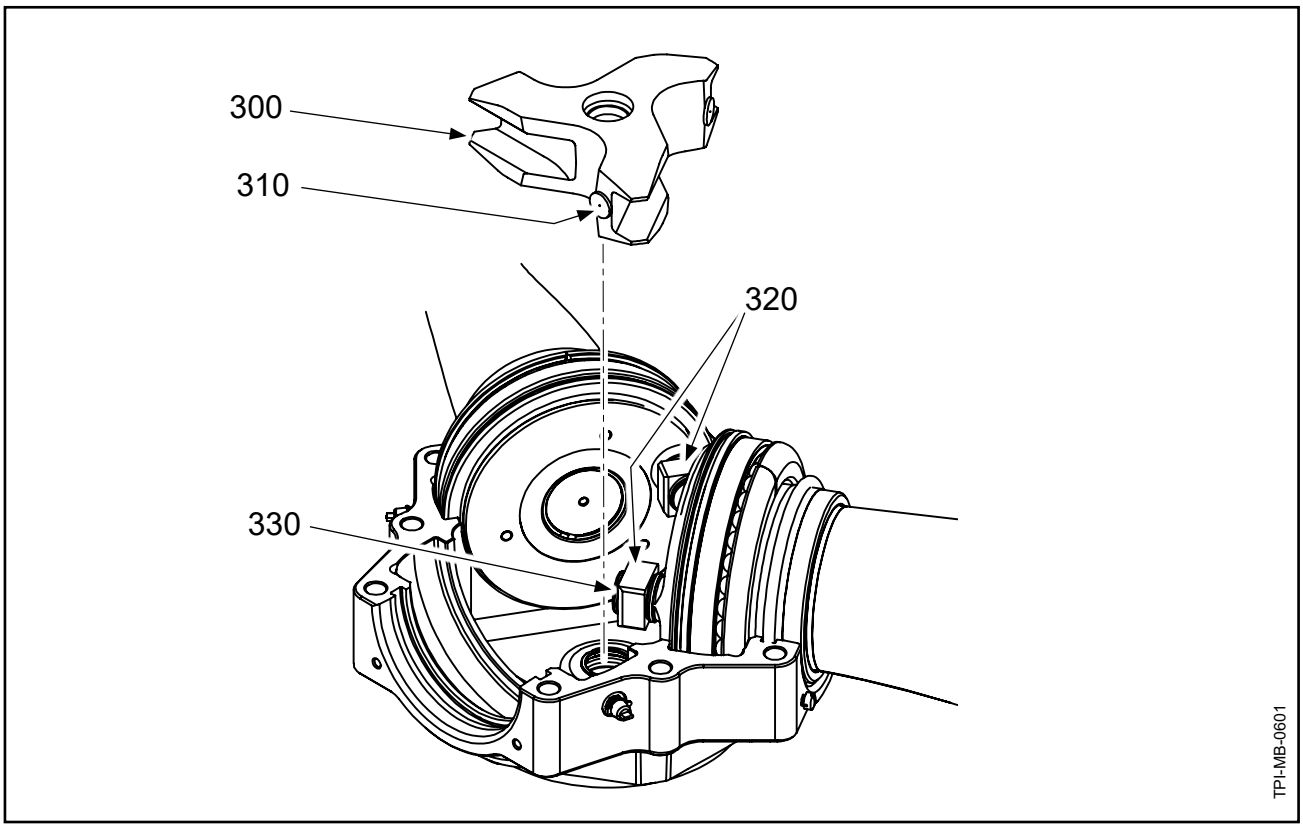
(6) Remove the hub clamping bolts (230).

(a) If the spinner bulkhead is mounted to the propeller with the hub bolts, remove the spinner bulkhead.

(7) Remove the cylinder-side half of the hub unit (240).

(a) A plastic wedge and rubber mallet may be used to separate the hub halves.

(8) Remove and discard the pitch change rod O-ring (220) from the cylinder-side hub half.



Blade/Fork Removal
Figure 3-8

(9) Using blade retention clamp TE24 if desired, remove blade number one from the hub (220).

(10) Remove the fork (300). Refer to Figure 3-8.

(a) Remove and discard the fork bumpers (310).

(11) Using blade retention clamp TE24 if desired, remove the remaining blades from the hub (240).

(12) Remove the pitch change block (320) from each pitch change knob.

(a) Make a mark to indicate the direction of the thin wall of each pitch change block (320) to the fork (300).

(13) Remove and discard the pitch change block button (330) from each pitch change block (320).

5. Mounting Stud Removal

A. F-flange

(1) Remove F-flange mounting studs (500) and dowel pins (530) in accordance with Appendix B in the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

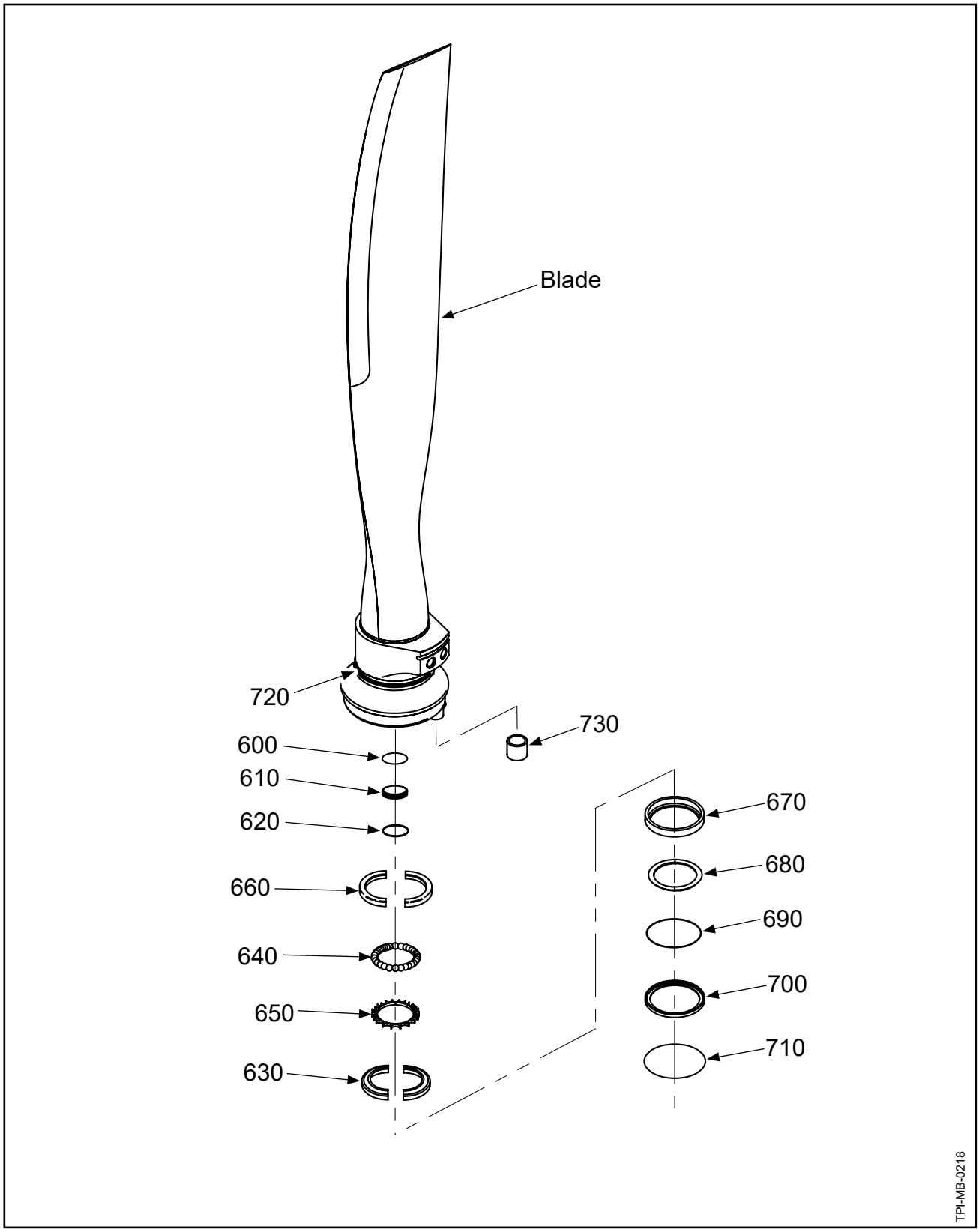
6. Hub Disassembly

A. All Propeller Models

(1) Remove the lubrication fitting caps (290), lubrication fittings (280), and lubrication plugs (270) from both halves of the hub unit (240).

(2) Remove components of the hub unit (240) in accordance with Appendix B in the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(a) The inspection criteria for hub assembly components is located in Appendix B in the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Blade Retention Components
Figure 3-9

7. Blade Disassembly

A. All Propeller Models - Refer to Figure 3-9

(1) Remove and discard the blade O-ring (720).

(2) Remove the hub-side blade bearing race (660).

(3) Remove and discard the bearing balls (640).

(4) Remove and discard the ball spacer (650).

(5) Remove and discard the pitch change knob bushing (730).

(6) Remove the blade seal (700) and the blade shim (680) from the blade.

(a) To make reassembly of the propeller easier, measure the thickness of the blade shim (680) and make a record of the measurement.

(7) Remove and discard the O-ring (690) from the ID of the blade seal (700).

(8) Remove and discard the O-ring (710) from the OD of the blade seal (700).

(9) Remove and discard the internal spiral retaining ring (620) from the bore of the blade.

(10) Remove the blade plug (610).

(a) Turn a screw with 8-32 UNC-3B threads into the threaded hole in the blade plug (610).

(b) Pull the blade plug (610) from the bore of the blade.

(11) Remove and discard the O-ring (600) from the OD of the blade plug (610).

(12) Using a suitable gear puller or brass drift, remove the bearing retaining ring (670).

(13) Remove the blade-side blade bearing race (630) of the blade retention bearing.

(14) For additional blade disassembly instructions, refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

(Blank Page)

CLEANING - CONTENTS

(Blank Page)

1. Cleaning Procedures (Rev. 3)

A. General Cleaning

(1) Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

B. Cleaning Steel Parts for Magnetic Particle Inspection

(1) Refer to the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

C. Cleaning Steel Parts for Cadmium Replating Procedures

(1) Refer to the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

D. Cleaning Aluminum Parts for Penetrant Inspection

(1) Refer to the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

E. Cleaning Titanium Parts for Penetrant Inspection

(1) Refer to the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

F. Cleaning Aluminum Parts for Chromic Acid Anodizing Procedures

(1) Refer to the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

G. Cleaning Cylinder Threads

CAUTION: DO NOT USE GLASS BEAD OR OTHER ABRASIVE CLEANING METHODS, AS THEY MAY CAUSE EXCESSIVE DAMAGE TO THE CYLINDER THREADS.

(1) It is preferable that the cylinder threads be cleaned only with solvent CM23; however, removal of sealant in the threaded area can be difficult.

(2) Plastic media may be used to remove the sealant from the cylinder threads, if minimal pressure and duration is used to minimize possible abrasion of the aluminum threads.

(Blank Page)

CHECK - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. Inspection Interval Requirements (Rev. 1)

   A. General

      (1) For information about life limited components and mandatory inspections, refer to the Airworthiness Limitations chapter of the applicable Hartzell Propeller Inc. owner's manual.

      (2) For overhaul periods of Hartzell Propeller Inc. propellers, refer to Hartzell Propeller Inc. Service Letter HC-SL-61-61Y.

2. Dimensional Inspection (Rev. 1)

   A. Diameter Measurements

      (1) When measuring the diameter of a part with a two point measuring instrument, take at least two measurements unless specified differently.

         (a) Obtaining a measurement outside the specified tolerance at any point of measurement is cause for retirement of the part when a minimum of two measurements are taken.

         (b) Alternately, take eight evenly spaced measurements, unless specified differently.

            1 Obtaining a measurement outside the specified tolerance on three or more measurements is cause for retirement of the part when eight measurements are taken (two of eight measurements may be out of specified tolerance).

            2 This alternate method may not be used to accept a diameter that has obvious damage beyond repairable (serviceable) limits.

      (2) When measuring the diameter of a part with a three point measuring instrument, take one measurement. A measurement outside the specified tolerance is cause for retirement of the part.

   B. Decimal Places

      (1) Inspect the part features to the number of decimal places specified. If three decimal places are specified, inspect the part to three decimal places only.

3. Inspection Criteria/Procedures (Rev. 2)

A. Propeller Components (Except for those listed separately in this section)

(1) Refer to Table 5-1, "Component Inspection Criteria" in this chapter.

B. Hubs

(1) Aluminum Hubs: Refer to the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

C. Blades

(1) Aluminum Blades: Refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(2) Composite Blades: Refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

D. Ice Protection Systems

(1) For ice protection systems supplied by Hartzell, refer to Hartzell Propeller Inc. Ice Protection System Manual 180 (30-61-80).

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

E. Spinner Assemblies

(1) Metal Spinners: Refer to Hartzell Propeller Inc. Metal Spinner Maintenance Manual 127 (61-16-27).

(2) Composite Spinners: Refer to Hartzell Propeller Inc. Composite Spinner Maintenance Manual 148 (61-16-48)

F. Special Inspections (Lightning Strike, Foreign Object Strike, etc.)

(1) Refer to the Special Inspections chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

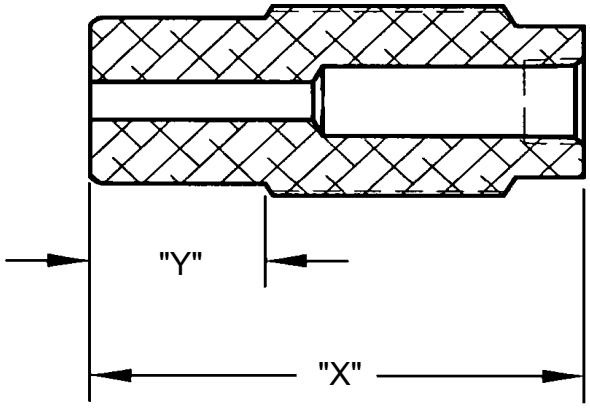
4. Propeller Component Checks

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 IN THIS MANUAL FOR IDENTIFICATION OF PROPELLER CRITICAL PARTS.

Refer to Table 5-1, "Component Inspection Criteria" in this chapter.

Component Inspection Criteria
Table 5-1

	Inspect	Serviceable Limits	Corrective Action
A.	NUT, 15/16-20, HEX (Item 20)		
	(1) Visually examine each nut for wrenching damage.	The corners between the wrenching flats may be rounded. Two (2) wrenching flats must be sufficiently undamaged to withstand installation torque. Material may not be displaced above or below the nut that could result in interference with the mating parts.	File away unwanted material displacement. Replace the nut if a minimum of two flats will not withstand installation torque.
	(2) Visually examine each nut for corrosion product on all surfaces and wear on surfaces other than wrenching flats.	The maximum permitted depth of material loss is 0.005 inch (0.12 mm).	If there is material loss deeper than the permitted serviceable limits, replace the nut.
	(3) Visually examine the nut for cadmium plating coverage.	Cadmium plating must be present on all surfaces.	Cadmium replate the nut in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc.Standard Practices Manual 202A (61-01-02).



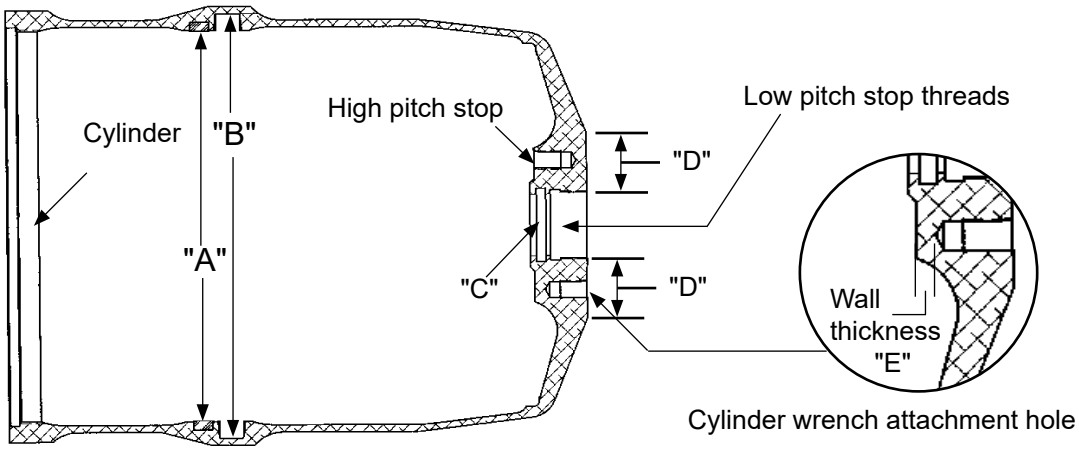
Part No.	"X" Dimension	"Y" Dimension
A-2404-4	2.00 ± 0.03 inch (50.8 ± 0.8 mm)	0.500 ± 0.010 inch (12.70 ± 0.05 mm)
A-2404-3	2.35 ± 0.03 inch (59.7 ± 0.8 mm)	0.700 ± 0.010 inch (17.78 ± 0.05 mm)
A-2404-2	2.00 ± 0.03 inch (50.8 ± 0.8 mm)	0.600 ± 0.010 inch (15.24 ± 0.05 mm)
A-2404-1	2.10 ± 0.03 inch (53.3 ± 0.8 mm)	0.700 ± 0.010 inch (17.78 ± 0.05 mm)
A-2404	2.25 ± 0.03 inch (57.2 ± 0.8 mm)	0.800 ± 0.010 inch (20.32 ± 0.05 mm)

APS6256
LOWSTOP.XLS

Pitch Stop Dimensions
Figure 5-1

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
B. PITCH STOP (Item 30) Refer to Figure 5-1		
(1) Visually examine the pitch change rod/pitch stop contact surface for damage.	Slight damage is permitted. Damage must not affect the performance of the pitch stop.	If the damage is more than the permitted serviceable limits, replace the pitch stop.
(2) Visually examine the external threads of the pitch stop for damage.	One damaged thread is permitted.	If more than one thread is damaged, replace the pitch stop.
(3) Visually examine the internal threads of the pitch stop for damage.	One damaged thread is permitted.	If more than one thread is damaged, replace the pitch stop.
(4) Visually examine the air hole in the center of the pitch stop.	The air passage must be clean and unobstructed.	If the air passage cannot be cleared, replace the pitch stop.
(5) Visually examine the Hard Anodize on the "Y" dimension surface of the pitch stop.	Loss of Hard Anodize on the "Y" dimension is not permitted. The OD threads may be bare aluminum or be coated with anodize.	If there is loss of Hard Anodize on the "Y" dimension, replace the pitch stop.



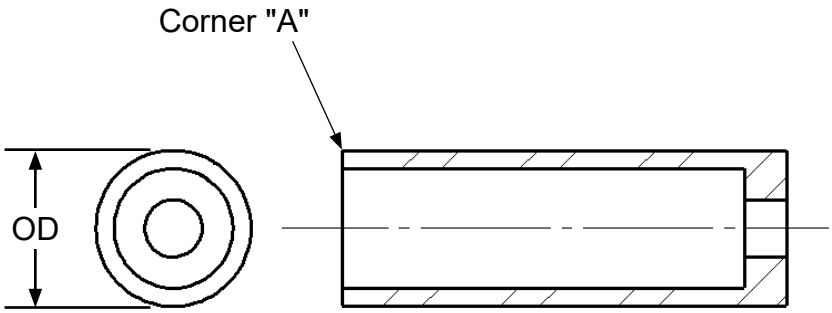
Part Number	"A" Bushing Maximum Diameter	"B" O-ring Groove Maximum Diameter	"C" Low Pitch Stop O-ring Groove Maximum Diameter
B-2423-1	4.759 inch (120.88 mm)	5.235 inch (132.97 mm)	0.989 inch (25.12 mm)

APS6230
CYL.XLS

Cylinder Dimensional Inspection Criteria
Figure 5-2

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
C. CYLINDER - 3 BLADE PROPELLER (Item 50) Refer to Figure 5-2.		
(1) Visually examine the external surfaces of the cylinder for wear, nicks, scratches or other damage.	All external surfaces: maintain a wall thickness of 0.079 inch (2.00 mm), repaired area must be less than 0.5 inch (12.7 mm) in diameter, repairs must be separated by a minimum of 0.5 inch (12.7 mm).	Using an abrasive pad CM47 or equivalent, polish to blend out damage. High spots are not permitted. If base aluminum is exposed, chromate conversion coat. If damage is greater than the permitted serviceable limits, replace cylinder.
	Damage in circular area "D" limited to 0.020 inch (0.50 mm) depth. Sufficient flat surface must remain to support the nut.	If damage is greater than the permitted serviceable limits, replace the cylinder.
(2) Visually examine the cylinder wrench attachment threads for damage.	A maximum of 1/4 of one thread accumulated damage per wrench attachment hole is permitted.	Refer to the Repair chapter in this manual for repair of cylinder wrench attachment threads.
(3) If cylinder wrench attachment holes are repaired with a slimsert, measure the wall thickness, "E".	The minimum permitted wall thickness under the center point of the hole is 0.080 inch (2.03 mm).	If the wall thickness under the center point of the hole is less than the seviceable limits, replace the cylinder.
(4) Visually examine the low pitch stop threads for damage.	Damage is not permitted	If there is damage, replace the cylinder.
(5) Visually examine the ID of the cylinder bushing and the immediate surrounding cylinder wall area for signs of bushing wear.	If the cylinder bushing or surrounding area shows signs of wear, dimensionally inspect the cylinder ID in accordance with Figure 5-2.	If the ID is greater than the permitted serviceable limits, replace the cylinder bushing. For cylinder bushing replacement procedures, refer to the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(6) Visually examine the adhesive bond of the cylinder bushing.	An unbonded area is not permitted.	If there is an unbonded area, replace the bushing. For cylinder bushing replacement procedures, refer to the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

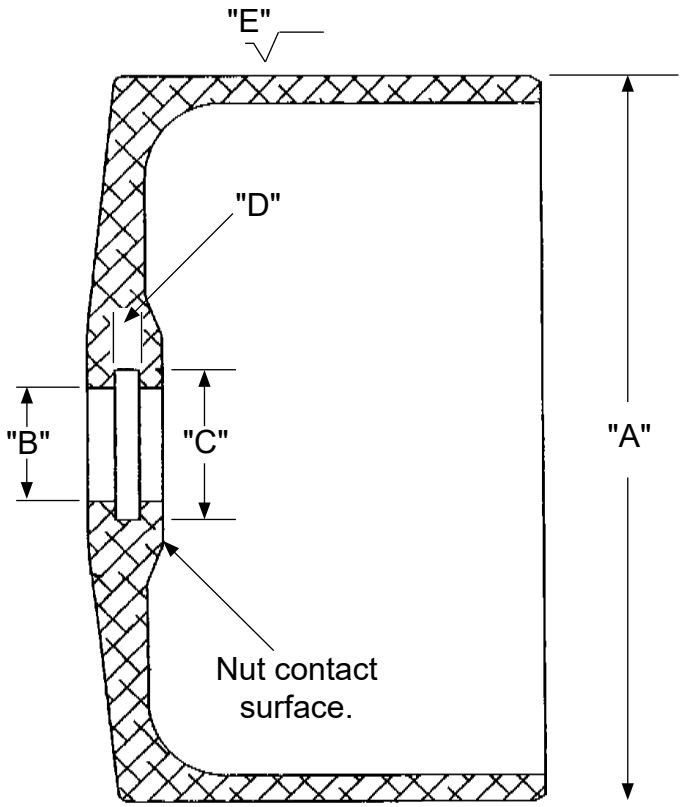


103339, A-2499

Stop Sleeve
Figure 5-3

Component Inspection Criteria
Table 5-1

	Inspect	Serviceable Limits	Corrective Action
D.	STOP SLEEVE (Item 150) Refer to Figure 5-3		
(1)	Visually examine the OD of the stop sleeve for wear, nicks, scratches, or other damage that would affect fit or performance.	The maximum permitted depth of damage is 0.005 inch (0.12 mm).	Smooth out the damaged area. If the depth of damage is greater than the permitted serviceable limits, replace the stop sleeve.
(2)	Visually examine the cadmium plating on the surface of the stop sleeve.	Except for a few scratches and corners with cadmium plating missing, complete coverage is required.	If the damage is greater than the serviceable limits, cadmium replate and bake the stop sleeve in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(3)	Visually examine corner "A" for rounding and damage.	Minor rounding of the corner that does not affect the engagement by the high pitch stop pins is permitted.	If the rounding or damage of the corner affects the engagement of the high pitch stop pins, replace the stop sleeve.



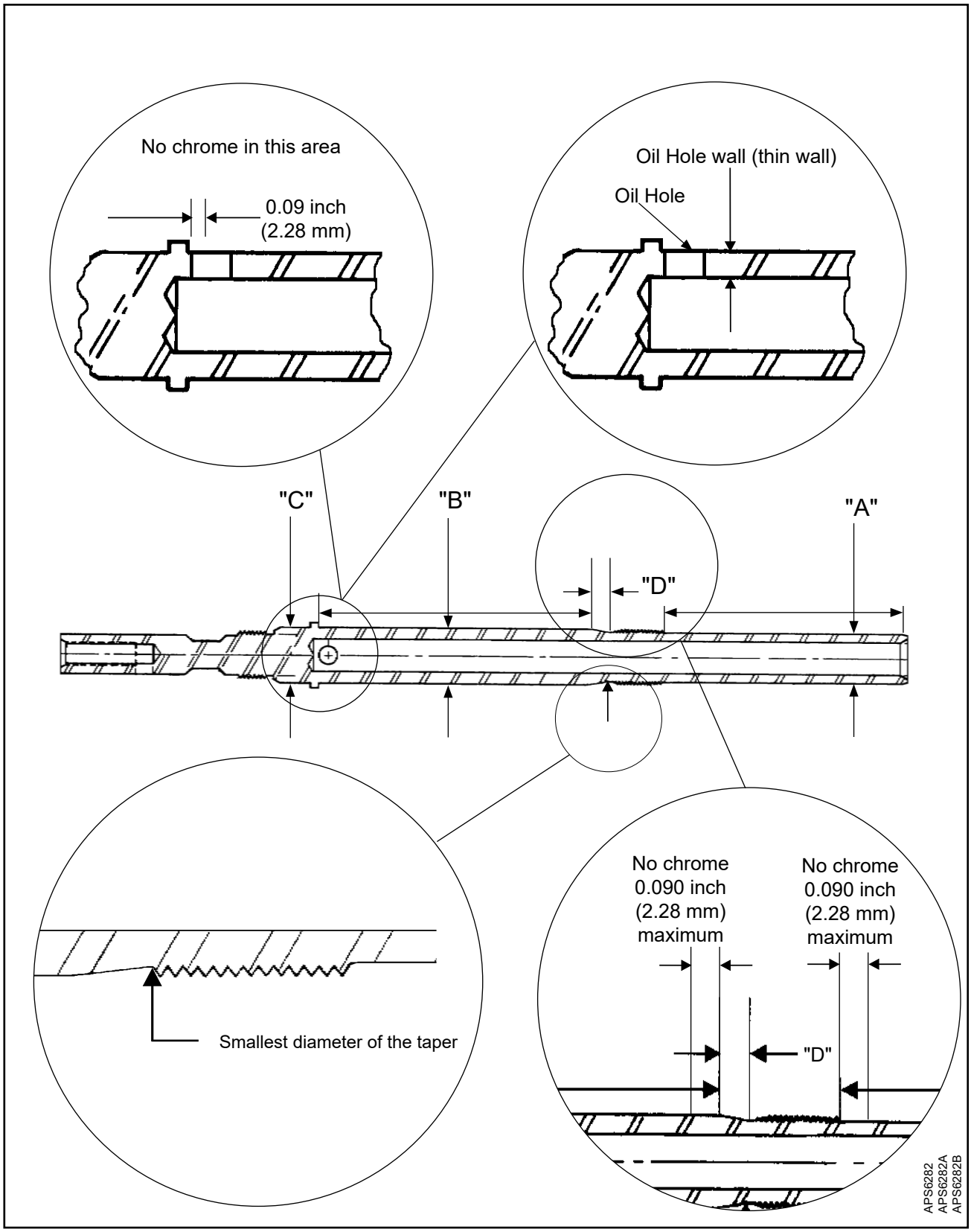
Part Number	"A" Minimum Piston OD	"B" Maximum Bore ID	"C" Maximum O-ring ID	"D" Minimum O-ring Width	"E" Max. Surface Micro Finish
B-3683	4.746 inch (120.55 mm)	0.739 inch (18.77 mm)	0.982 inch (24.94 mm)	0.146 inch (3.71 mm)	16

APS6231
PISTON.XLS

Piston Dimensional Inspection Criteria
Figure 5-4

Component Inspection Criteria
Table 5-1

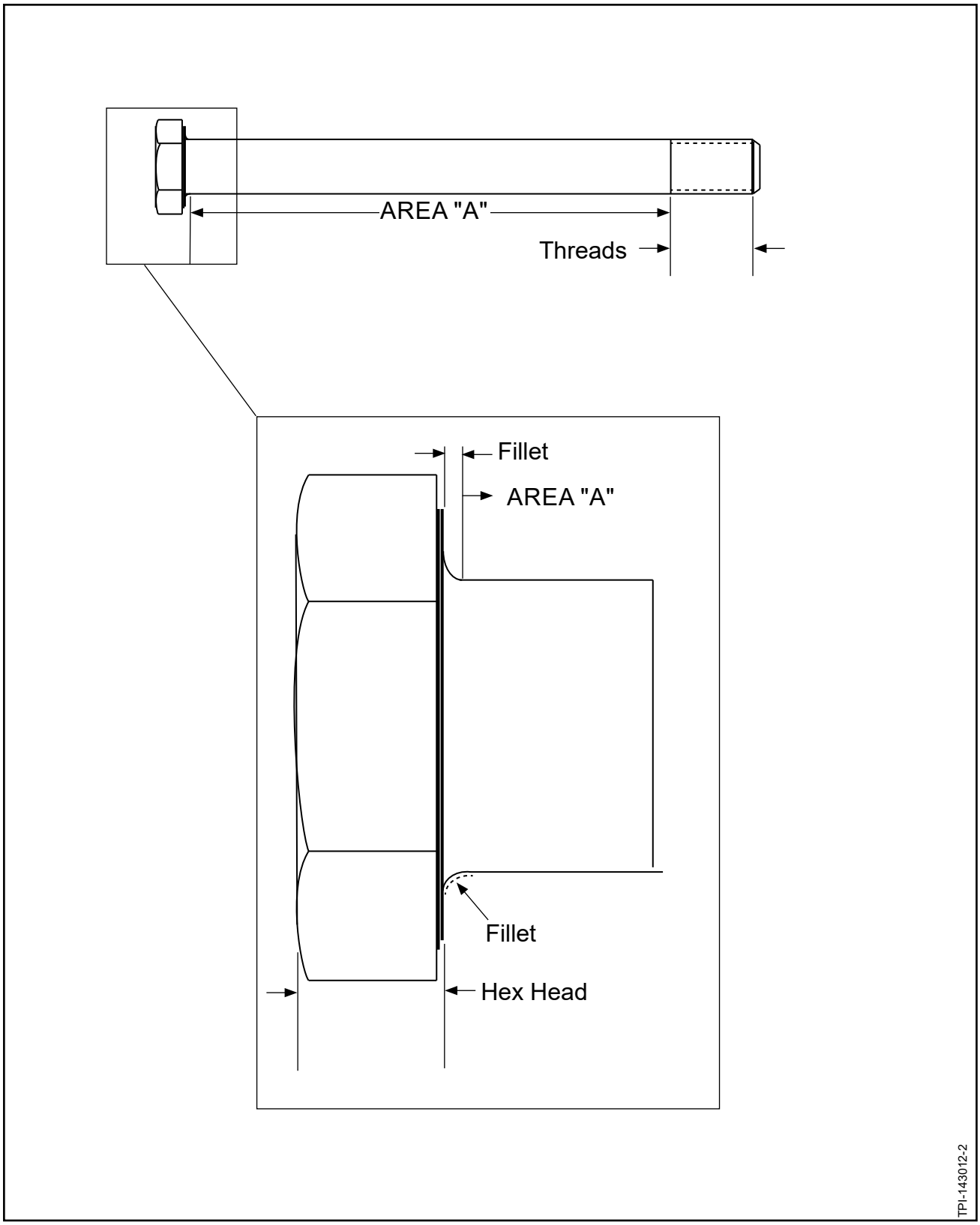
Inspect	Serviceable Limits	Corrective Action
E. PISTON (Item 180) Refer to Figure 5-4.		
(1) Visually examine the anodized surfaces of the piston (that are not referenced below or in Figure 5-4), for wear, nicks, scratches, or other damage.	The maximum permitted depth of damage is 0.005 inch (0.12 mm).	If the depth of damage is greater than the serviceable limits, replace the piston.
(2) Visually examine the piston OD for corrosion product, wear, damage, and anodize coverage.	Anodize must be present on all OD surfaces. The maximum permitted diameter of damage is 0.030 inch (0.76 mm).The maximum permitted depth of damage is 0.002 (0.50 mm). Damage must not penetrate the anodize. Pushed-up material is not permitted.	If corrosion product, wear, damage, or loss of anodize coverage is greater than the serviceable limits, replace the piston.
(3) Visually examine the piston areas "A", "B", "C", and "E".	If the piston shows wear, dimensionally inspect in accordance with Figure 5-4.	If the wear is greater than the serviceable limits, replace the piston.
(4) Visually examine the nut contact surface for corrosion product, wear, or damage.	If there is damage, dimensionally inspect Area "D" in accordance with Figure 5-4. The maximum permitted depth of damage is 0.007 inch (0.17 mm).	If the damage is greater than the serviceable limits, replace the piston.



Pitch Change Rod
Figure 5-5

Component Inspection Criteria
Table 5-1

	Inspect	Serviceable Limits	Corrective Action
F.	PITCH CHANGE ROD (Item 200) Refer to Figure 5-5.		
(1)	Visually examine the chrome plating of the pitch change rod for damage, in the areas of diameters "A and "B".	Any area worn below the chrome plating is cause for replacement.	If the wear is greater than the serviceable limits, replace the pitch change rod.
(2)	Visually examine the external threads for damage.	One damaged thread is permitted.	If the damage is greater than the serviceable limits, replace the pitch change rod.
(3)	Measure area "B" of the pitch change rod.	The minimum permitted diameter is 0.732 inch (18.60 mm).	If the diameter is less than the serviceable limits, replace the pitch change rod.
(4)	Measure area "A" of the pitch change rod.	The minimum permitted diameter is 0.662 inch (16.82 mm).	If the diameter is less than the serviceable limits, replace the pitch change rod.
(5)	Visually examine the taper area "D" for corrosion product, wear, and damage.	Corrosion product, wear, or damage is not permitted at the smallest diameter of the taper. Remaining taper surface may have a maximum damage depth of 0.004 inch (0.10 mm) over 25% of the surface area.	If damage causes high spots above the existing surface, remove only the high spots. If corrosion product, wear, or damage is more than the serviceable limits, replace the pitch change rod.
(6)	Visually examine the pitch change rod for straightness.	The rod must be straight. Bending is not permitted.	If the rod is not straight, replace the pitch change rod.
(7)	Measure area "C" of the pitch change rod.	The minimum permitted diameter is 0.732 inch (18.60 mm).	If the diameter is less than the permitted serviceable limits, replace the pitch change rod.
(8)	Magnetic particle inspect the pitch change rod.	A relevant indication is not permitted.	If there is a relevant indication, replace the pitch change rod.
(9)	Examine the oil supply bore using a borescope or fiberoptic flashlight.	Unwanted material is not permitted.	Remove all unwanted material.

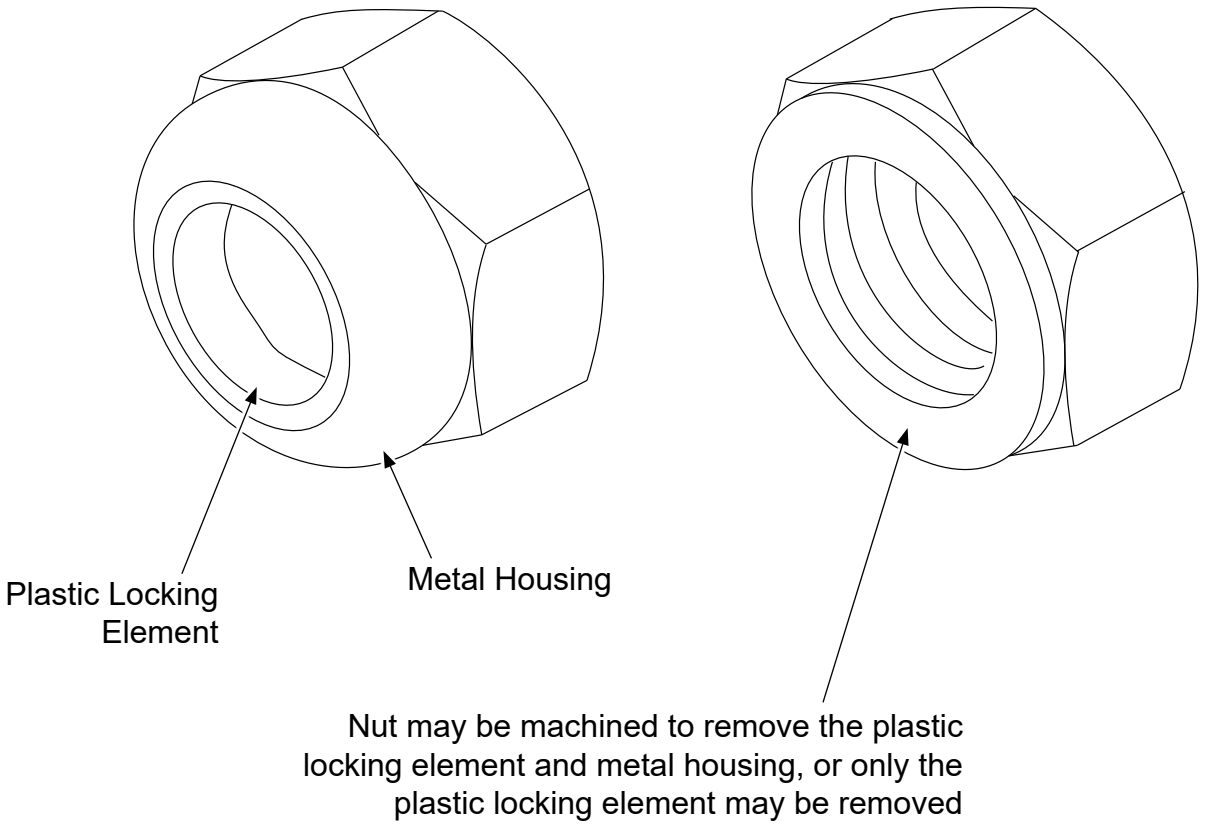


Hex Head Bolt
Figure 5-6

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
G. BOLT, 3/8-24, HEX HEAD (Item 230) Refer to Figure 5-6		
(1) Visually examine the hex head bolt for corrosion product and pitting.	Corrosion product is not permitted. The maximum permitted depth of pitting is 0.002 inch (0.05 mm). No more that 5% of the total unthreaded surface may be pitted. The maximum permitted diameter of an individual pit is 0.032 inch (0.81 mm). Pitting is not permitted in the fillet between the hex head and the grip, Area "A". Pitting must not affect the fit or function of the hex head bolt.	Remove corrosion product using glass bead cleaning in accordance with the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the hex head bolt. If the pitting is greater than the permitted serviceable limits, replace the hex head bolt.
(2) Except for the threads, visually examine the hex head bolt for damage or scratches.	The maximum permitted depth of damage or a scratch is 0.002 inch (0.05 mm). Scratches or damage must not affect the fit or function of the hex head bolt. Pushed-up material is not permitted.	Pushed up material may be removed with a thread file. Use of the thread file must not affect the fit or function of the hex head bolt. If the depth of a scratch or damage is greater than the permitted serviceable limits or if the scratch, damage, or repair affects the fit or function of the hex head bolt, replace the hex head bolt.
(3) Visually examine the hex head bolt for circumferential scoring caused by installation and removal.	Circumferential scoring that reduces the diameter of the hex head bolt is not permitted. The minimum permitted OD in Area "A" is 0.370 inch (9.40 mm).	If the scoring is greater than the permitted serviceable limits or if the OD in Area "A" is less than the permitted serviceable limits, replace the hex head bolt.
(4) Visually examine the wrenching surfaces of the head of the hex head bolt for metal movement caused by wrenching.	Limited damage from wrenching is permitted, but it must be possible to torque the hex head bolt and metal movement must not interfere with the installation of the hex head bolt or cause damage to the hub.	Remove metal movement with a file or equivalent. Only corners may be repaired. Refacing a complete surface is not permitted. If metal movement is greater than the permitted serviceable limits, replace the hex head bolt.

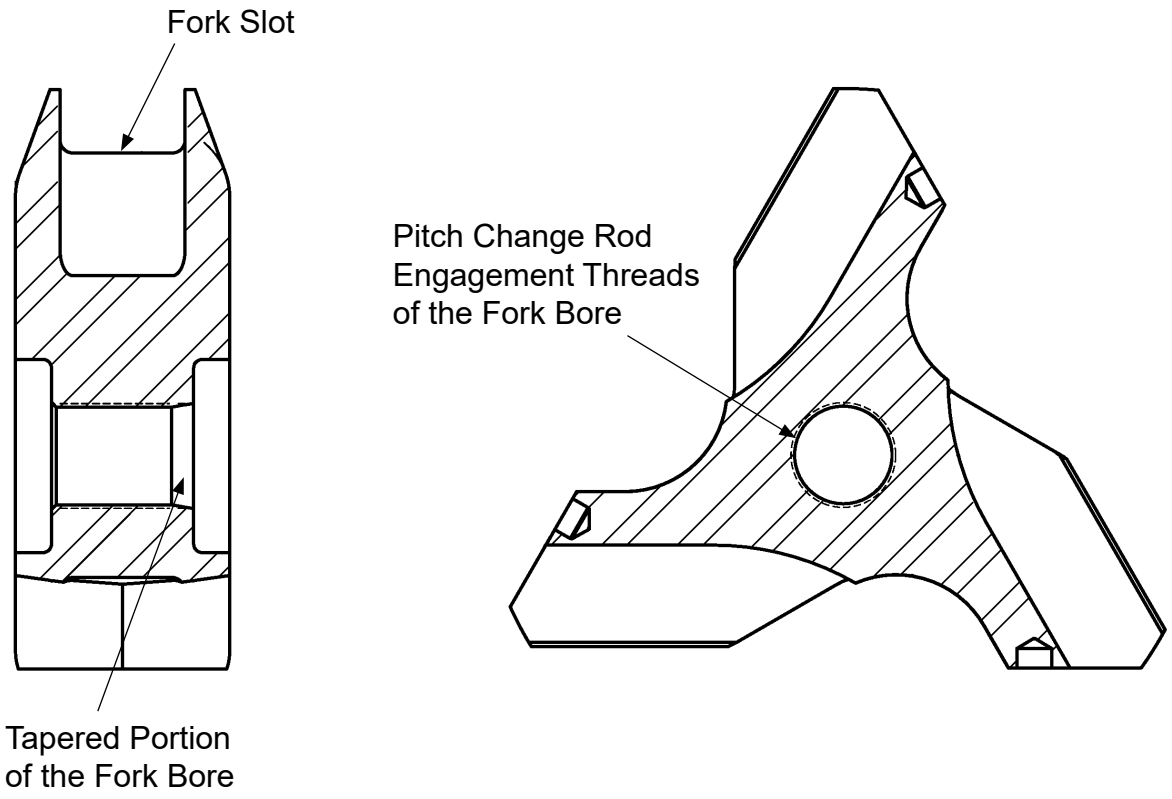
CAUTION: DO NOT USE MODIFIED A-2043-1 NUTS ON THE PROPELLER ASSEMBLY. A-2043-1 NUTS THAT HAVE BEEN MODIFIED ARE TO BE USED ONLY FOR THE HEX HEAD BOLT THREAD CHECK.



A-2043-1 Nut Modification
Figure 5-7

Component Inspection Criteria
Table 5-1

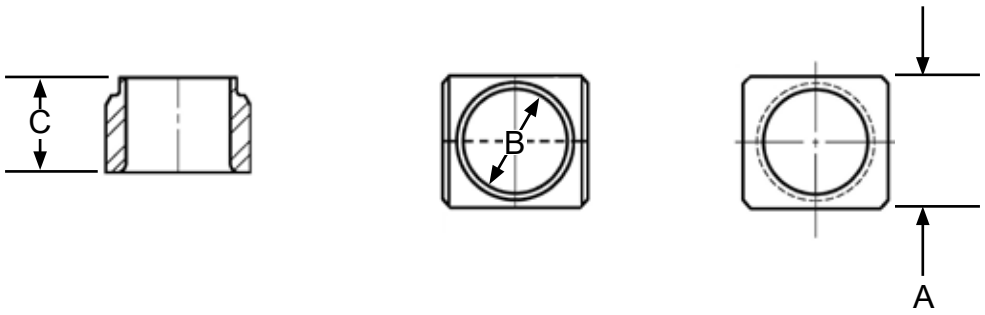
Inspect	Serviceable Limits	Corrective Action
G. BOLT, 3/8-24, HEX HEAD, CONTINUED (Item 230) Refer to Figure 5-6		
(5) Visually examine the threads of the hex head bolt for damage and pitting.	A maximum total accumulation of 3/4 thread of damage and pitting is permitted. Thread damage must not cause damage to the mating part. An A-2043-1 nut with the plastic locking element removed should be able to be freely rotated by hand on the bolt threads. For the modification of the nut, refer to Figure 5-7.	Limited thread file repair is permitted, but must be considered as thread damage. If the damage and pitting is greater than the permitted serviceable limits, replace the hex head bolt.
(6) Magnetic particle inspect each bolt in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).	A relevant indication is not permitted.	If there is a relevant indication, replace the hex head bolt.
(7) Visually examine the hex head bolt for cadmium plating coverage.	Cadmium plating must completely cover the bolt with the following exceptions: A few scratches and corners with cadmium plating missing, minor abrading of cadmium plating on the threads, or minor abrading of the cadmium plating on the hex head because of wrenching are permitted.	If cadmium plating coverage is less than the permitted serviceable limits, cadmium replate and bake for a minimum of 23 hours within four hours after plating the hex head bolt in accordance the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Fork
Figure 5-8

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
H. FORK, THREE BLADE ASSEMBLY (Item 300) Refer to Figure 5-8		
(1) Visually examine the cadmium plating of the fork (excluding the slots, threaded bore, and tapered section of the bore) for corrosion product, pitting, wear, scratches, or other damage.	Corrosion product is not permitted. If there is corrosion product, remove it in accordance with the corrective action repair limits. The maximum permitted depth of pitting, wear, scratches, or damage is 0.003 inch (0.07 mm).	Remove corrosion product using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the corrosion product cannot be removed or if the pitting, wear, scratches, or damage is greater than the permitted serviceable limits, replace the fork.
(2) Visually examine the pitch change rod engagement threads of the fork bore for damage.	One thread of total accumulated damage in each hole is permitted.	If the damage is greater than the permitted serviceable limits, replace the fork.
(3) Visually examine the tapered portion of the fork bore for wear, nicks, fretting, or other damage.	If there is wear, nicks, fretting, or damage, measure the depth of wear or damage. The maximum permitted depth of wear, nicks, fretting, or damage is 0.003 inch (0.07 mm).	If wear, nicks, fretting, or damage is greater than the permitted serviceable limits, replace the fork.
(4) Visually examine the fork slots for damage.	If there is damage, measure the depth of damage. The maximum permitted depth of damage is 0.006 inch (0.15 mm).	If the damage is greater than the permitted serviceable limits, replace the fork.
(5) Perform a magnetic particle inspection of the fork in accordance with the Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).	A relevant indication is not permitted	If a relevant indication can be repaired and is within the permitted serviceable limits in this section, cadmium replate and bake the fork in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the relevant indication cannot be repaired within the permitted serviceable limits, replace the fork.

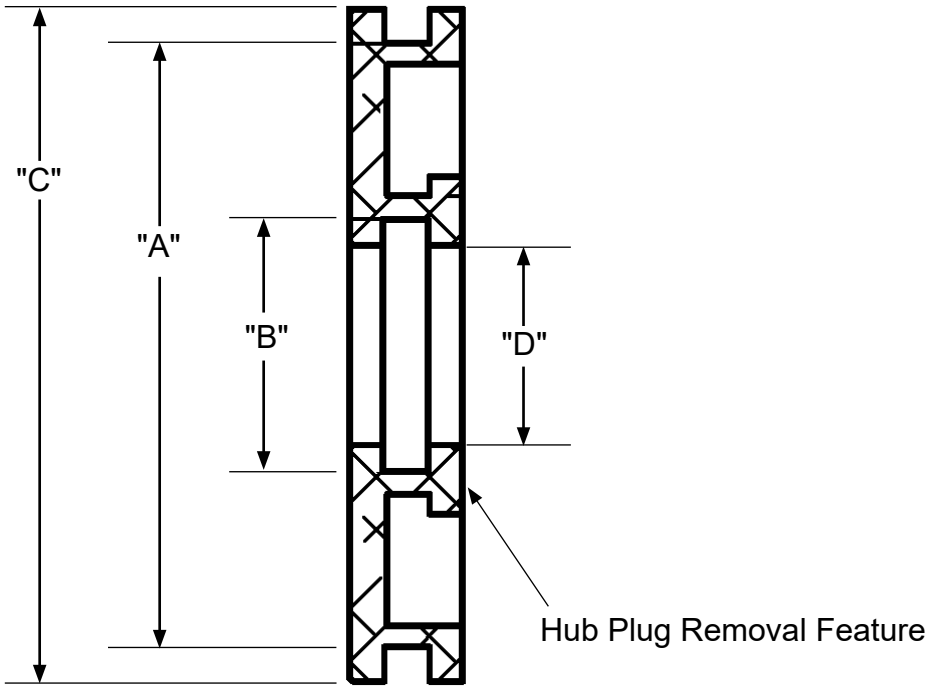


Part Number	"A" Minimum	"B" Maximum	"C" Minimum
105733	0.869 inch (22.08 mm)	0.6890 inch (17.500 mm)	0.575 inch (14.61 mm)

Pitch Change Block
Figure 5-9

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
I. PITCH CHANGE BLOCK (Item 320) Refer to Figure 5-9		
(1) Visually examine the pitch change block for damage.	If there is damage, measure the depth of damage. The maximum permitted depth of damage is 0.005 inch (0.12 mm).	If the depth of damage is greater than the permitted serviceable limits, replace the pitch change block.
(2) Visually examine the pitch change block for wear.	If there is wear, measure the pitch change block. Refer to Figure 5-9 for the maximum permitted wear dimensions.	If the wear is greater than the permitted serviceable limits, replace the pitch change block.
(3) Magnetic particle inspect the pitch change block in accordance with Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).	A relevant indication is not permitted.	If there is a relevant indication, replace the pitch change block.

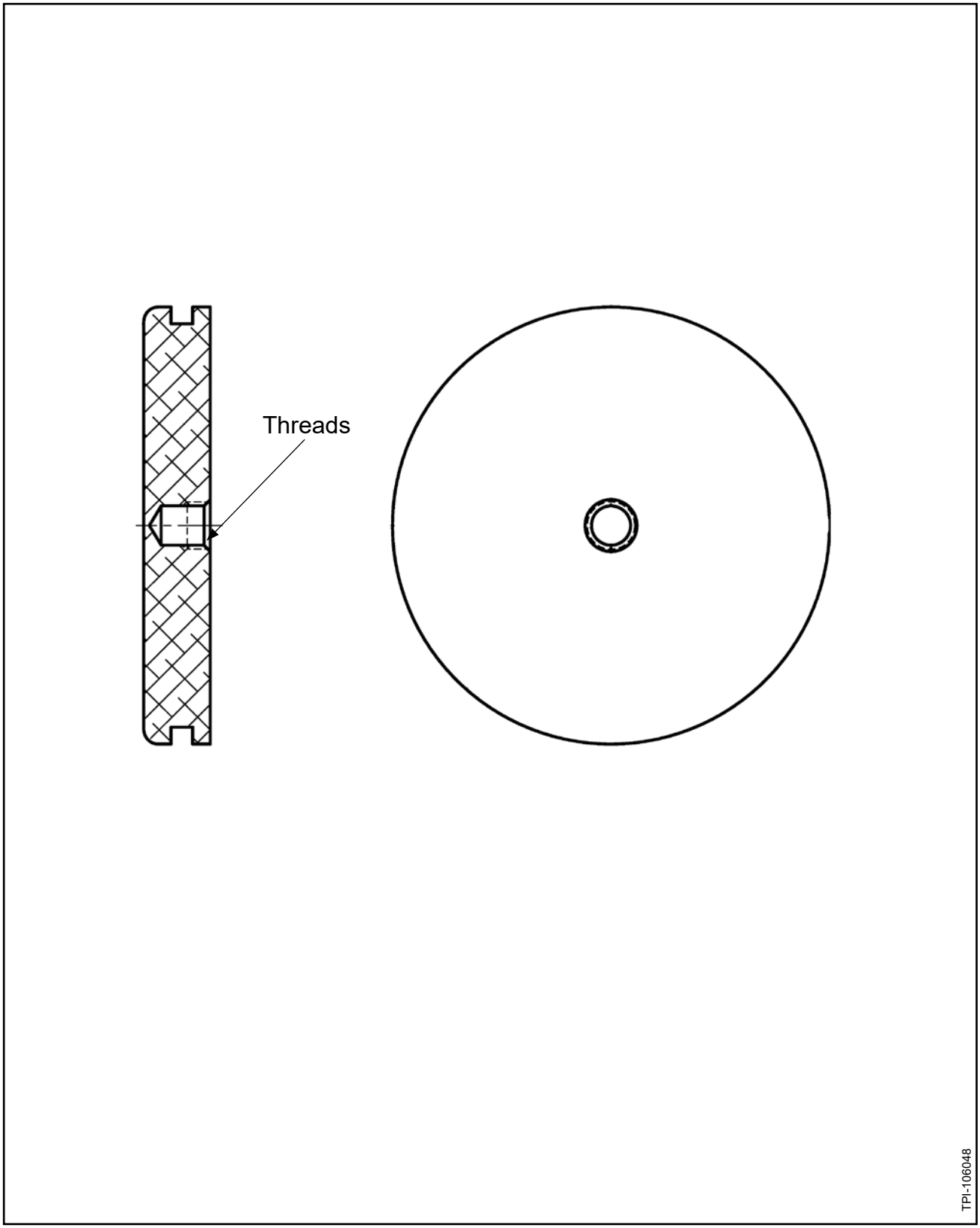


Part Number	"A" Minimum O-ring Groove OD	"B" Maximum O-ring Groove ID	"C" Minimum Plug OD	"D" Maximum Bore ID
A-2481	2.015 inch (51.18 mm)	0.846 inch (21.48 mm)	2.246 inch (57.05 mm)	0.670 inch (17.01 mm)

Hub Plug
Figure 5-10

Component Inspection Criteria
Table 5-1

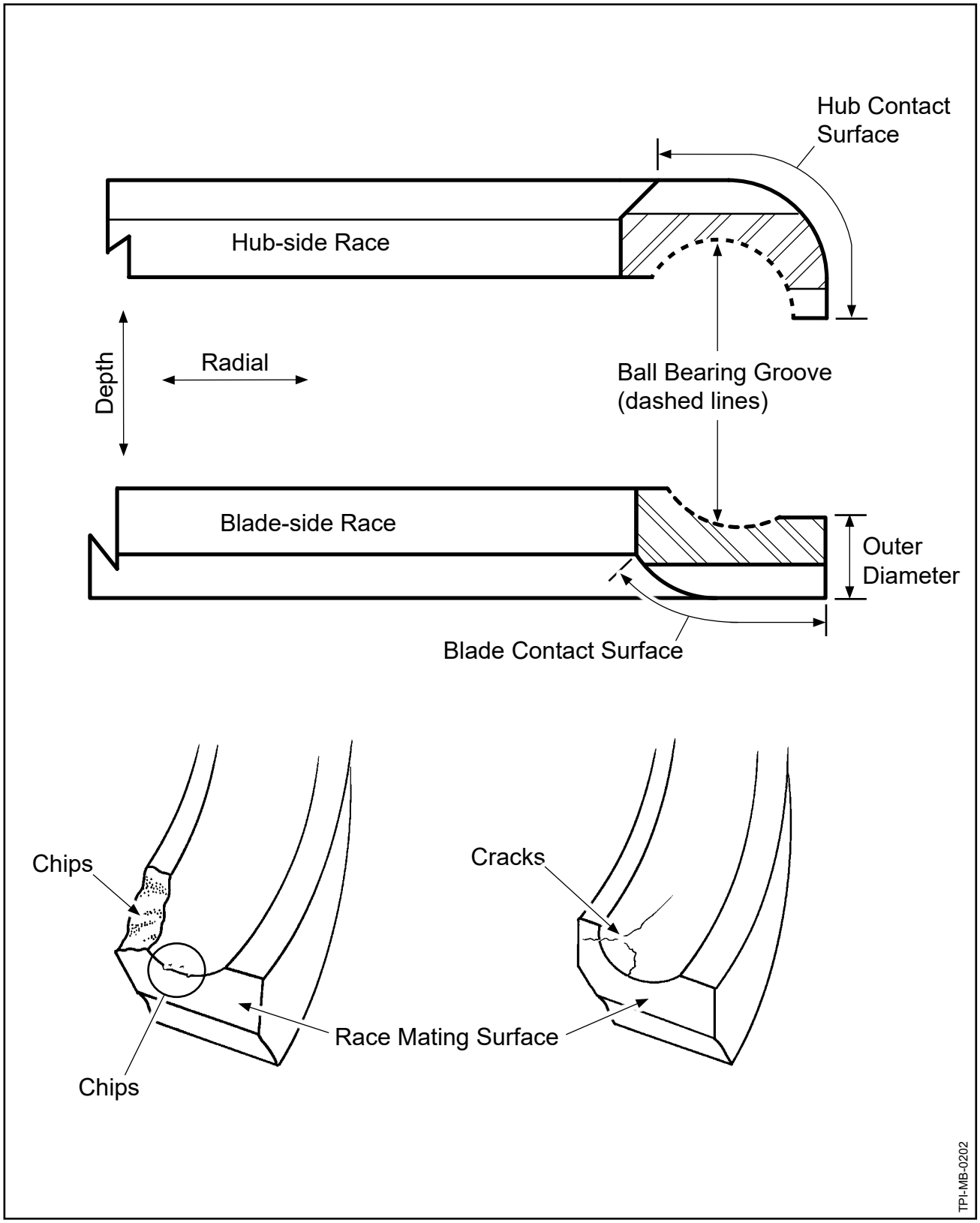
Inspect	Serviceable Limits	Corrective Action
J. HUB PLUG (Item 370) Refer to Figure 5-10		
(1) Visually examine the hub plug for corrosion.	Corrosion product is not permitted.	If there is corrosion product, replace the hub plug.
(2) Visually examine the O-ring groove OD "A".	If the hub plug O-ring groove OD "A" is worn or damaged, measure in accordance with Figure 5-10.	If the hub plug O-ring groove OD "A" is less than the permitted serviceable limits, replace the hub plug.
(3) Visually examine the O-ring groove ID "B".	If the hub plug O-ring groove ID "B" is worn or damaged, measure in accordance with Figure 5-10.	If the hub plug O-ring groove ID "B" is greater than the permitted serviceable limits, replace the hub plug.
(4) Visually examine the hub plug OD "C".	If the hub plug OD "C" is worn or damaged, measure in accordance with Figure 5-10.	If the hub plug OD "C" is less than the permitted serviceable limits, replace the hub plug.
(5) Visually examine the hub plug ID bore "D".	If the hub plug ID bore "D" is worn or damaged, measure in accordance with Figure 5-10.	If the hub plug ID bore "D" is greater than the permitted serviceable limits, replace the hub plug.
(6) Visually examine the hub plug removal feature for damage.	Slight damage is permitted. Damage must not interfere with the ability to remove the hub plug from the hub.	If the damage is greater than the permitted serviceable limits, replace the hub plug.



Blade Plug Inspection Area
Figure 5-11

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
K. BLADE PLUG (Item 610) Refer to Figure 5-11		
(1) Visually examine the blade plug for corrosion product and pitting.	Corrosion product is not permitted. If there is corrosion product, remove it in accordance with the corrective action repair limits. The maximum permitted depth of pitting is 0.010 inch (0.25 mm). The maximum permitted total area of pitting is 20% of the blade plug surface.	Remove corrosion productto a maximum depth of 0.010 inch (0.25 mm) using glass bead cleaning. If the corrosion product cannot be removed, replace the blade plug. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the depth or amount of pitting is greater than the permitted serviceable limits, replace the blade plug.
(2) Visually examine the threads of the blade plug for damage.	A maximum of one thread of total accumulated damage is permitted.	If the damage is greater than the permitted serviceable limits, replace the blade plug.
(3) Visually examine the blade plug for scratches, gouges, or other damage.	The maximum permitted depth of a scratch, gouge, or other damage is 0.010 inch (0.25 mm). Damage must not interfere with the fit of the blade plug in the blade bore.	Using an abrasive pad CM47 or equivalent, polish pushed up material to blend with the surrounding surfaces. If a scratch, gouge, or other damage is greater than the permitted serviceable limits, replace the blade plug.



Race
Figure 5-12

Component Inspection Criteria
Table 5-1

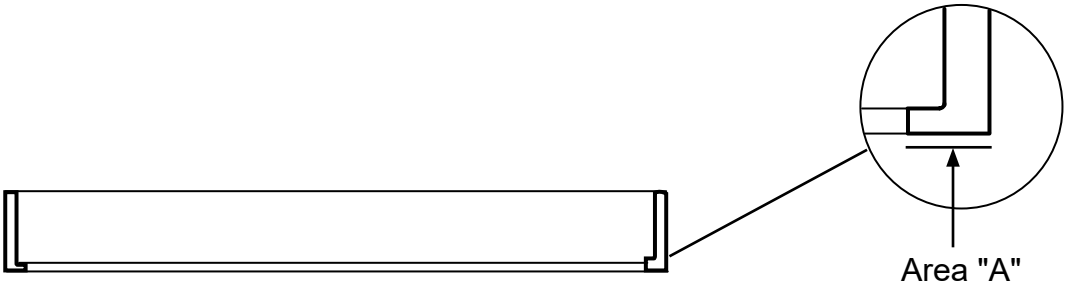
	Inspect	Serviceable Limits	Corrective Action
L.	RACE (Item 630 and Item 660) (Refer to Figure 5-12)		
	(1) Visually examine the ball bearing groove in each race for corrosion.	Corrosion product is not permitted. If there is corrosion product, remove it in accordance with the corrective action repair limits.	Remove corrosion product using glass bead cleaning. For glass bead cleaning refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the corrosion product cannot be removed, replace the race.
	(2) Visually examine the ball bearing groove in each race for pitting, wear, fretting, and damage.	The maximum permitted depth of pitting is 0.003 inch (0.076 mm) in the ball bearing groove. The maximum permitted diameter of a pit is 0.032 inch (0.81 mm). The maximum permitted total area of pitting in the ball bearing groove on a complete race is 0.12 square inch (77.4 square mm) (two races for each bearing set). Pitting must not interfere with bearing ball movement or support.	If the pitting is greater than the serviceable limits, replace the race.
		If the ball bearing groove has wear, measure the wear. The maximum permitted depth of wear is 0.005 inch (0.12 mm).	If the wear is greater than the permitted serviceable limits, replace the race.
		Fretting damage is not permitted.	If there is fretting damage, replace the race.
		For damage other than pitting or fretting, the maximum permitted depth of damage is 0.003 inch (0.076 mm) and must not interfere with bearing ball movement or support.	If damage is greater than the permitted serviceable limits, replace the race.

Component Inspection Criteria
Table 5-1

	Inspect	Serviceable Limits	Corrective Action
L.	RACE, CONTINUED (Item 630 and Item 660) (Refer to Figure 5-12)		
	(3) Except for the ball bearing groove, visually examine all other surfaces of each race for corrosion.	Corrosion product is not permitted. If there is corrosion product, remove it in accordance with the corrective action repair limits.	Remove corrosion product using glass bead cleaning. For glass bead cleaning refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the corrosion product cannot be removed, replace the race.
	(4) Except for the ball bearing groove, visually examine all other surfaces of each race for pitting, wear, fretting, and damage.	The maximum permitted depth of pitting is 0.005 inch (0.12 mm). The maximum permitted diameter of a pit is 0.062 inch (1.57 mm). The maximum permitted total area of pitting on all surfaces except the ball bearing groove of a complete race is 0.25 square inch (161.2 square mm) (two races for each bearing set).	If the pitting is greater than the permitted serviceable limits, replace the race.
		Fretting damage is permitted on the outer diameter of the races that interface with the bearing retaining ring (670). Fretting must not loosen the tight fit with the bearing retaining ring (670).	Clean the fretted area thoroughly using an abrasive pad CM47 or equivalent to decrease fretting damage to a minimum. If the fit of the bearing retaining ring (670) to the race is not tight, replace the race.
		Wear is not permitted.	If there is wear, replace the race.
		For damage other than pitting, the maximum permitted depth of damage is 0.005 inch (0.12 mm) and must not interfere with the mating surfaces.	If the damage is greater than the permitted serviceable limits, replace the race.

Component Inspection Criteria
Table 5-1

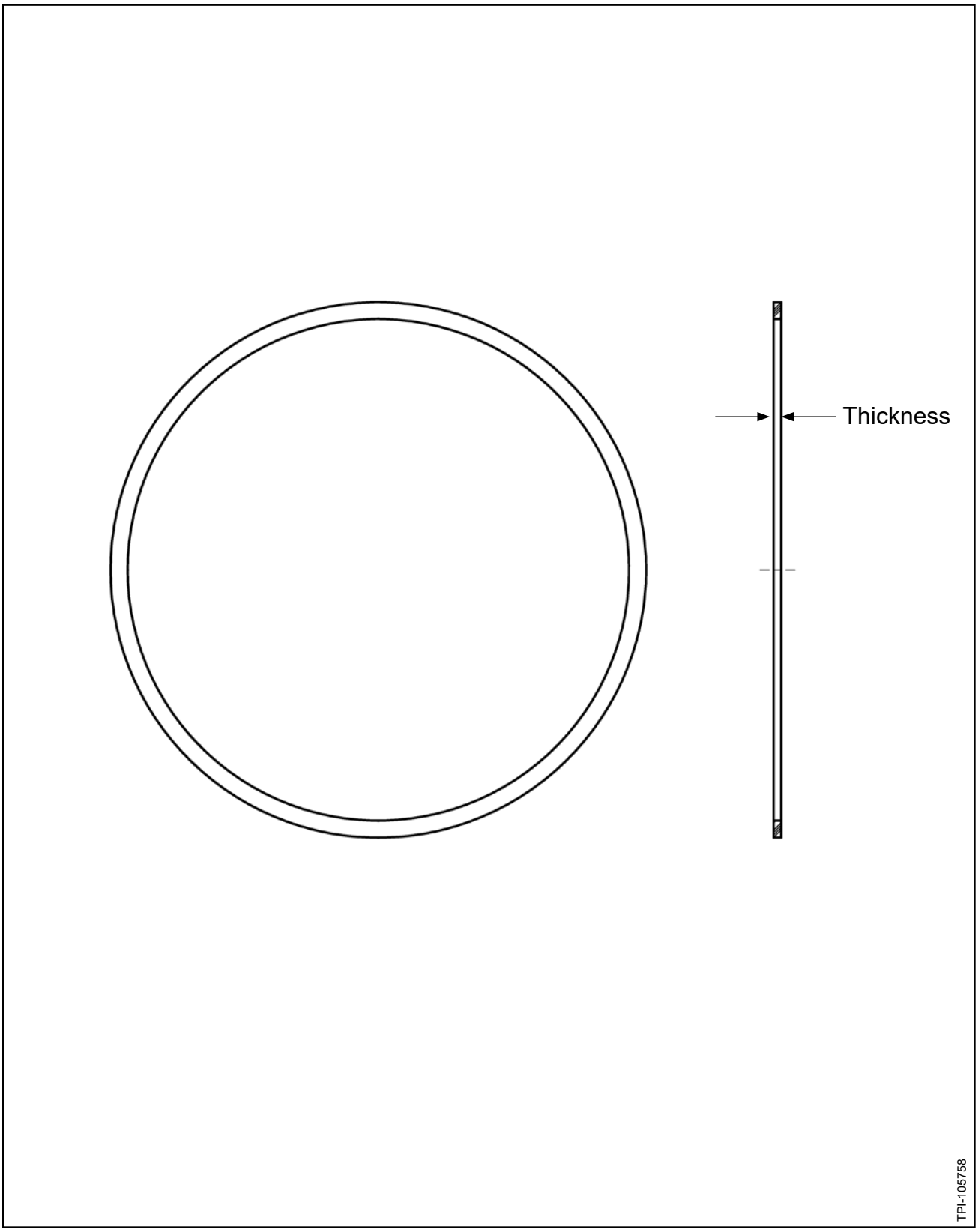
	Inspect	Serviceable Limits	Corrective Action
L.	RACE, CONTINUED (Item 630 and Item 660) (Refer to Figure 5-12)		
	(5) Visually examine the race for chips or cracks that are adjacent to the mating surfaces of the race.	Chips or cracks that are adjacent to the mating surfaces of the race are not permitted.	If there are chips or cracks adjacent to the mating surfaces of the race, replace the race.
	(6) Magnetic particle inspect each race in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).	A relevant indication is not permitted.	If there is a relevant indication, replace the race.



Bearing Retaining Ring
Figure 5-13

Component Inspection Criteria
Table 5-1

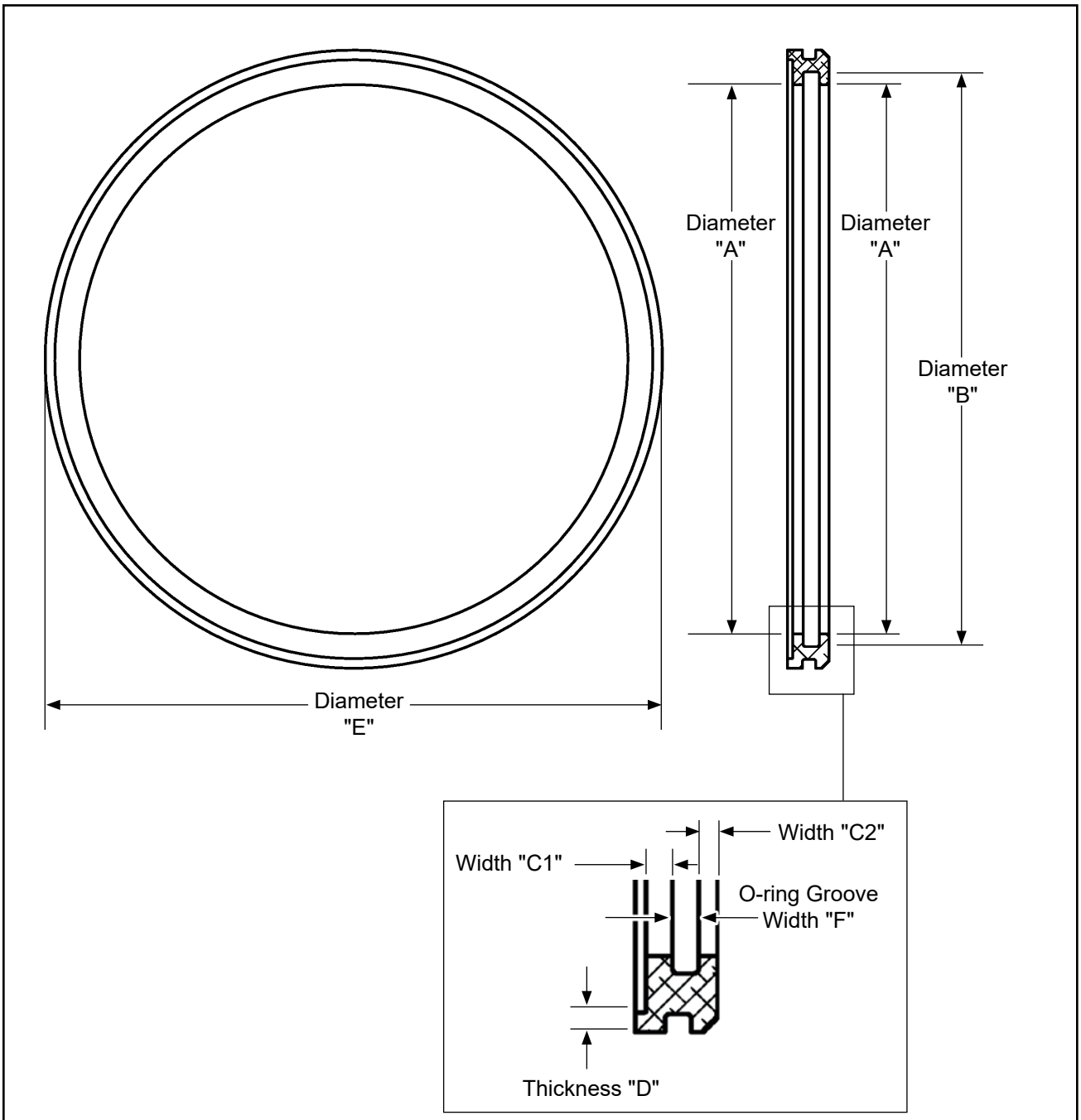
Inspect	Serviceable Limits	Corrective Action
M. BEARING RETAINING RING (Item 670) Refer to Figure 5-13		
(1) Except for Area “A”, visually examine the bearing retaining ring for corrosion product and pitting.	Corrosion product is not permitted. If there is corrosion product, remove it in accordance with the corrective action repair limits. The maximum permitted depth of pitting is 0.005 inch (0.12 mm). Pitting must not interfere with the ability of the bearing retaining ring to fit tightly to the blade and the bearing race.	Remove corrosion product using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the corrosion product cannot be removed, replace the bearing retaining ring. If the corrosion product or pitting is greater than the permitted serviceable limits, replace the bearing retaining ring.
(2) Visually examine the bearing retaining ring for corrosion product, pitting, or wear in Area "A”.	Corrosion product, pitting, or wear through the cadmium plating in Area "A" is not permitted.	If there is corrosion product, pitting, or wear through the cadmium plating, replace the bearing retaining ring.
(3) Except for Area "A", visually examine the bearing retaining ring for wear, damage, or fretting.	The bearing retaining ring must fit tightly to the blade and the bearing race when installed over the blade and bearing race.	If wear, damage, or fretting is greater than the permitted serviceable limits, replace the bearing retaining ring.
(4) Visually examine the entire bearing retaining ring for cadmium plating coverage.	A few random scratches and corners with cadmium plating missing are permitted; otherwise, complete coverage is required.	If cadmium plating is not on all surfaces, replate the bearing retaining ring in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Blade Shim
Figure 5-14

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
N. BLADE SHIM (Item 680) Refer to Figure 5-14		
(1) Visually examine the blade shim for damage, missing material, separation, or form irregularities as a continuous ring.	Damage, missing material, separation, or form irregularities are not permitted.	If there is damage, missing material, separation, or form irregularities, replace the blade shim.
(2) Measure the thickness of the blade shim.	The minimum permitted thickness of the blade shim is 0.040 inch (1.02 mm).	If the thickness is less than the permitted serviceable limits, replace the blade shim.
(3) Measure the thickness variation of the blade shim at five equally spaced places on the blade shim.	The maximum permitted thickness variation is 0.005 inch (0.12 mm).	If the thickness variation is greater than the permitted serviceable limits, replace the blade shim.

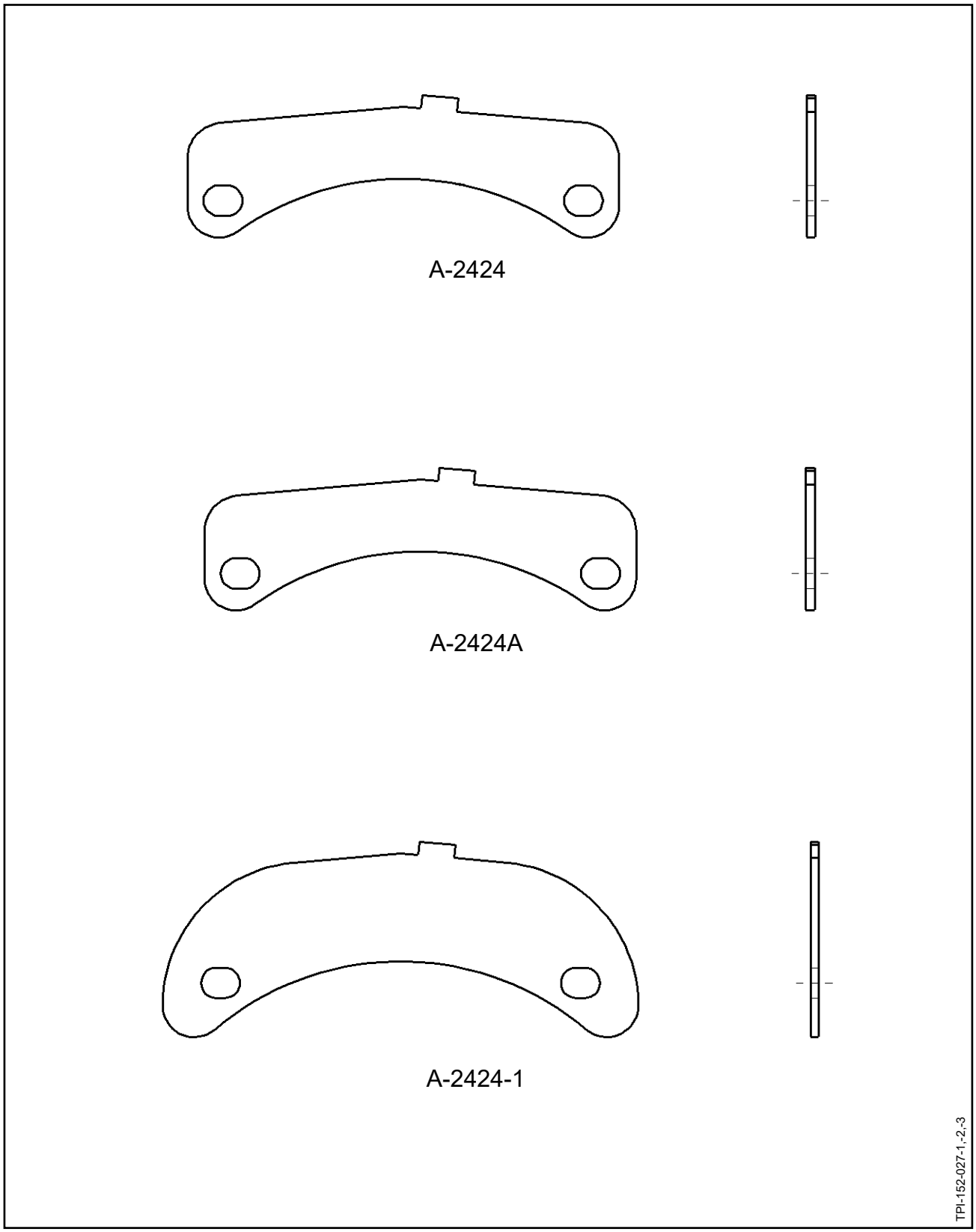


"A" MAXIMUM DIAMETER	"B" MAXIMUM DIAMETER	"C1" MINIMUM WIDTH	"C2" MINIMUM WIDTH	"D" MINIMUM THICKNESS	"E" MINIMUM DIAMETER	"F" MAXIMUM WIDTH
4.550 inches (115.57 mm)	4.750 inches (120.65 mm)	0.060 inch (1.53 mm)	0.050 inch (1.27 mm)	0.065 inch (1.66 mm)	5.075 inches (128.91 mm)	0.175 inches (4.44 mm)

Blade Seal
Figure 5-15

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
O. BLADE SEAL (Item 700) Refer to Figure 5-15 NOTE: Blade seals identified as 106117 (Rev. B or before), must be replaced with blade seals identified as 106117 (Rev. C or later) or 107223.		
(1) Visually examine the blade seal for corrosion product, pitting, wear, or damage.	Corrosion productis not permitted. If there is corrosion product, remove it in accordance with the corrective action repair limits. If there is pitting, wear, or damage, measure the depth. The maximum permitted depth of pitting, wear or damage is 0.007 inch (0.17 mm).	Using an abrasive pad CM47 or equivalent, polish to remove corrosion product, pitting, wear, or damage to a maximum depth of 0.010 inch (0.25 mm). If the depth of corrosion product, pitting, wear, damage, or repair is greater than the permitted serviceable limits or the corrective action limits, replace the blade seal.
(2) Measure the O-ring groove Width "F".	The maximum permitted O-ring groove Width "F" is 0.175 inch (4.44 mm).	If the O-ring groove Width "F" is not within the permitted serviceable limits, replace the blade seal.
(3) Measure the O-ring groove Width "F" for uniform width variation.	The maximum permitted width variation is 0.015 inch (0.38 mm).	If the width variation is greater than the permitted serviceable limits, replace the blade seal.
(4) Measure the blade seal features "A", "B", "C1", "C2", "D", and "E".	The permitted limits are given in the table in Figure 5-15.	If any measurement is not within the permitted serviceable limits, replace the blade seal.



Balance Weight
Figure 5-16

Component Inspection Criteria
Table 5-1

	Inspect	Serviceable Limits	Corrective Action
P.	BALANCE WEIGHT (Item 810) Refer to Figure 5-16.		
(1)	Visually examine the balance weight for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action instructions.	Remove corrosion product using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the corrosion product cannot be removed, replace the balance weight.
(2)	Visually examine the balance weight for pitting, wear, or damage.	The maximum permitted depth of pitting, wear, or damage is 0.003 inch (0.07 mm).	Using an abrasive pad CM47 or equivalent, polish to a maximum depth of 0.005 inch (0.12 mm). If the depth of pitting, wear, or damage is greater than the permitted serviceable limits or the corrective action limits replace the balance weight.
(3)	For an aluminum (gray color) balance weight: Visually examine the balance weight for anodize coverage.	Except for a few scratches and corners with anodize coating missing, complete coverage is required.	If the coverage is less than the permitted serviceable limits, re-anodize the weight in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(4)	For a steel (silver color) balance weight: Visually examine for cadmium plating coverage.	Except for a few scratches and corners with cadmium plating missing, complete coverage is required.	If the coverage is less than the permitted serviceable limits, replate the weight in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(Blank Page)

REPAIR - CONTENTS

LIST OF FIGURES

(Blank Page)

WARNING 1: DO NOT ATTEMPT IN THE FIELD ANY REPAIR, REPLACEMENT, REPLATING, RE-ANODIZING, OR RE-SHOT PEENING PROCEDURE NOT SPECIFICALLY AUTHORIZED BY HARTZELL PROPELLER INC. OR NOT SPECIFICALLY REFERRED TO IN HARTZELL PROPELLER INC. MANUALS. CONTACT HARTZELL PROPELLER INC. FOR GUIDANCE ABOUT THE AIRWORTHINESS OF ANY PART WITH UNUSUAL WEAR
OR DAMAGE.

WARNING 2: ADHESIVES AND SOLVENTS ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES, AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT AND BREATHING OF VAPORS. USE SOLVENT RESISTANT GLOVES TO MINIMIZE SKIN CONTACT AND WEAR SAFETY GLASSES FOR EYE PROTECTION. USE IN A WELL VENTILATED AREA AWAY FROM SPARKS AND FLAME. READ AND OBSERVE ALL WARNING LABELS.

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 IN THIS MANUAL FOR IDENTIFICATION OF PROPELLER CRITICAL PARTS.

1. General Repair Requirements (Rev. 2)

   A. Shot Peening

      CAUTION: THE PEENING MARKS ON CERTAIN PROPELLER PARTS ARE NOT TOOL MARKS AND SHOULD NOT BE REMOVED.

      (1) Some propeller assembly parts have been shot peened at Hartzell Propeller Inc. to improve fatigue strength.

      (2) Shot peened surfaces may require re-shot peening because of rust, corrosion, fretting, or nicks. For shot peening procedures, refer to the Shot Peening chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

         WARNING: FAILURE TO CORRECTLY SHOT PEEN APPLICABLE PROPELLER PARTS MAY CREATE AN UNSAFE CONDITION THAT MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. A QUALITY SHOT PEENING PROCESS IS CRITICAL FOR FLIGHT SAFETY. SHOT PEENING OF PROPELLER PARTS REQUIRES SPECIAL TECHNIQUES, TRAINING, MATERIALS, AND EQUIPMENT.

(a) Only repair stations that are properly certified by Hartzell Propeller Inc. should shot peen Hartzell propeller parts.

1 For certification requirements, refer to the Approved Facilities chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

2 For a list of repair stations that are certified by Hartzell Propeller Inc. to perform shot peening on Hartzell propeller parts:

a Go to the Sample Program Approvals page on the Hartzell Propeller Inc. website at www.hartzellprop.com

b Contact Hartzell Propeller Inc. Product Support

(1) Refer to the section, "Contact Information" in the Introduction chapter of this manual.

B. Aluminum and Steel Parts

(1) Remove scratches, nicks, burrs, and other minor damage using a fine emery cloth or abrasive pad, such as CM47.

(a) Blend the polished area in with the surrounding area.

(b) Use extreme care to completely remove the damage while removing as little material as possible.

(2) After any repair, inspect the part in accordance with the applicable inspection criteria to be sure it is within the permitted limits.

2. Repair/Modification Procedures (Rev. 2)

A. Propeller Components (Except for those listed separately in this section)

(1) For repair and modification procedures of propeller components (except for those listed separately in this section), refer to the applicable section in this chapter.

B. Hubs

(1) Aluminum Hubs: Refer to the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

C. Blades

(1) Aluminum Blades: Refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(2) Composite Blades: Refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

D. Spinner Assemblies

(1) Metal Spinners: Refer to Hartzell Propeller Inc. Metal Spinner Maintenance Manual 127 (61-16-27).

(2) Composite Spinners: Refer to Hartzell Propeller Inc. Composite Spinner Maintenance Manual 148 (61-16-48).

E. Ice Protection Systems

(1) For ice protection systems supplied by Hartzell, refer to Hartzell Propeller Inc. Ice Protection System Manual 180 (30-61-80).

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

3. Specific Repair Requirements

A. Brass Counterweight Slug Mounting Hole Repair

(1) General

(a) This procedure provides the instructions to remove wear around the counterweight slug mounting through hole.

(2) Procedure

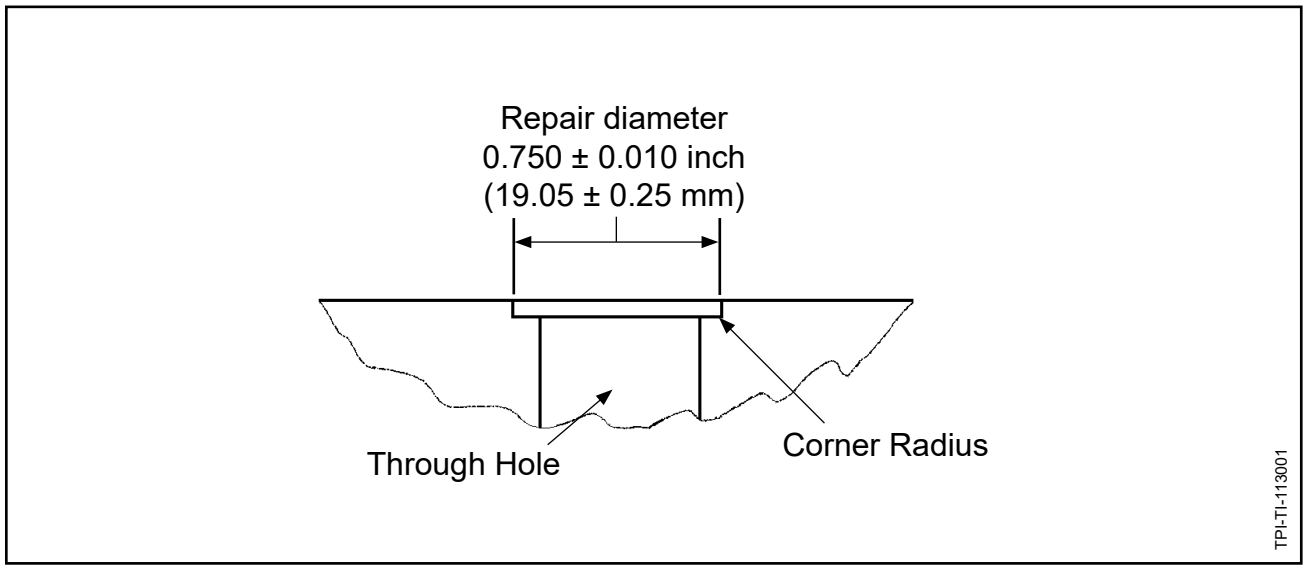
(a) Use a locally procured end mill cutter that is 0.750 ± 0.010 inch (19.05 ± 0.25 mm) outside diameter. Refer to Figure 6-1.

1 The corner radius blending between the outside diameter and the cutting end must be 0.005 to 0.033 inch (0.13 to 0.83 mm).

(b) Put the brass weight slug in the end mill.

CAUTION: MAKE SURE THAT THE BRASS WEIGHT SLUG IS HELD TIGHTLY IN PLACE WITH THE THROUGH HOLE CENTERED UNDER THE END MILL CUTTER.

(c) Center the through hole that will be repaired under the end mill cutter and make sure that the brass weight slug is held tightly in place.



Brass Counterweight Slug Mounting Hole Repair
Figure 6-1

CAUTION: DO NOT SPOTFACE DEEPER THAN THE MAXIMUM PERMITTED DEPTH.

(d) Spotface the brass weight slug to remove wear damage.

1 The maximum permitted depth of repair is 0.020 inch (0.50 mm).

2 Spotface to a greater depth is not permitted.

3 If the repair is greater than the maximum permitted depth of repair, replace the brass weight slug.

(e) Remove all burrs.

(f) Break any sharp corners.

(g) Visually examine the repair to make sure that the repair is centered on the through hole.

(h) Cadmium plate of any bare brass surface is required. Refer to the Check chapter of this manual.

B. Repair of the B-1593 Start Lock Housing

(1) General

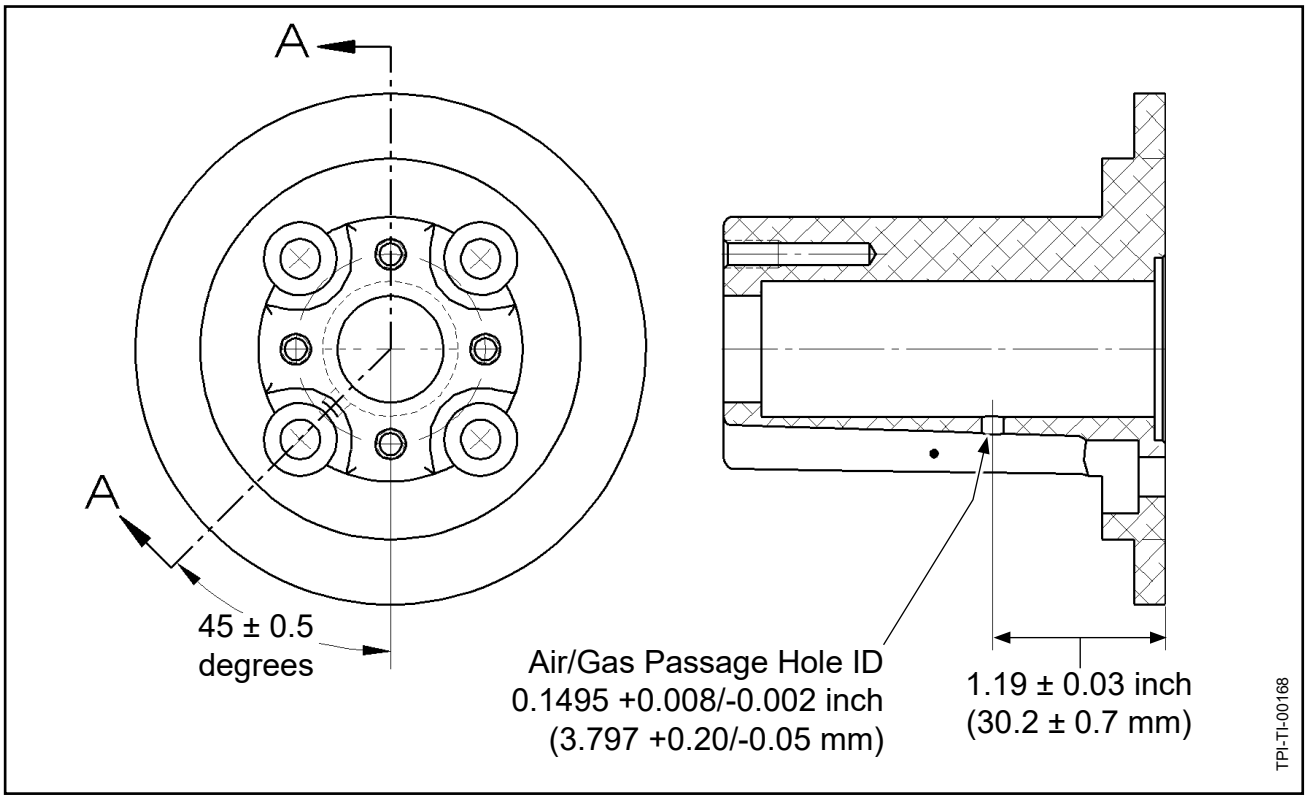
(a) This repair procedure provides the instructions for adding an air/gas passage hole to the B-1593 start lock housing.

(2) Procedure

(a) Drill a hole in the B-1593 start lock housing in accordance with the dimensions specified in Figure 6-2.

(b) The surface finish of the newly drilled hole must not exceed 89RA.

(c) Apply a layer of chemical conversion coating to the ID of the newly drilled hole in accordance with Chromic Acid and Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Repair of the B-1593 Start Lock Housing
Figure 6-2

C. Pitch Change Block Button Modification

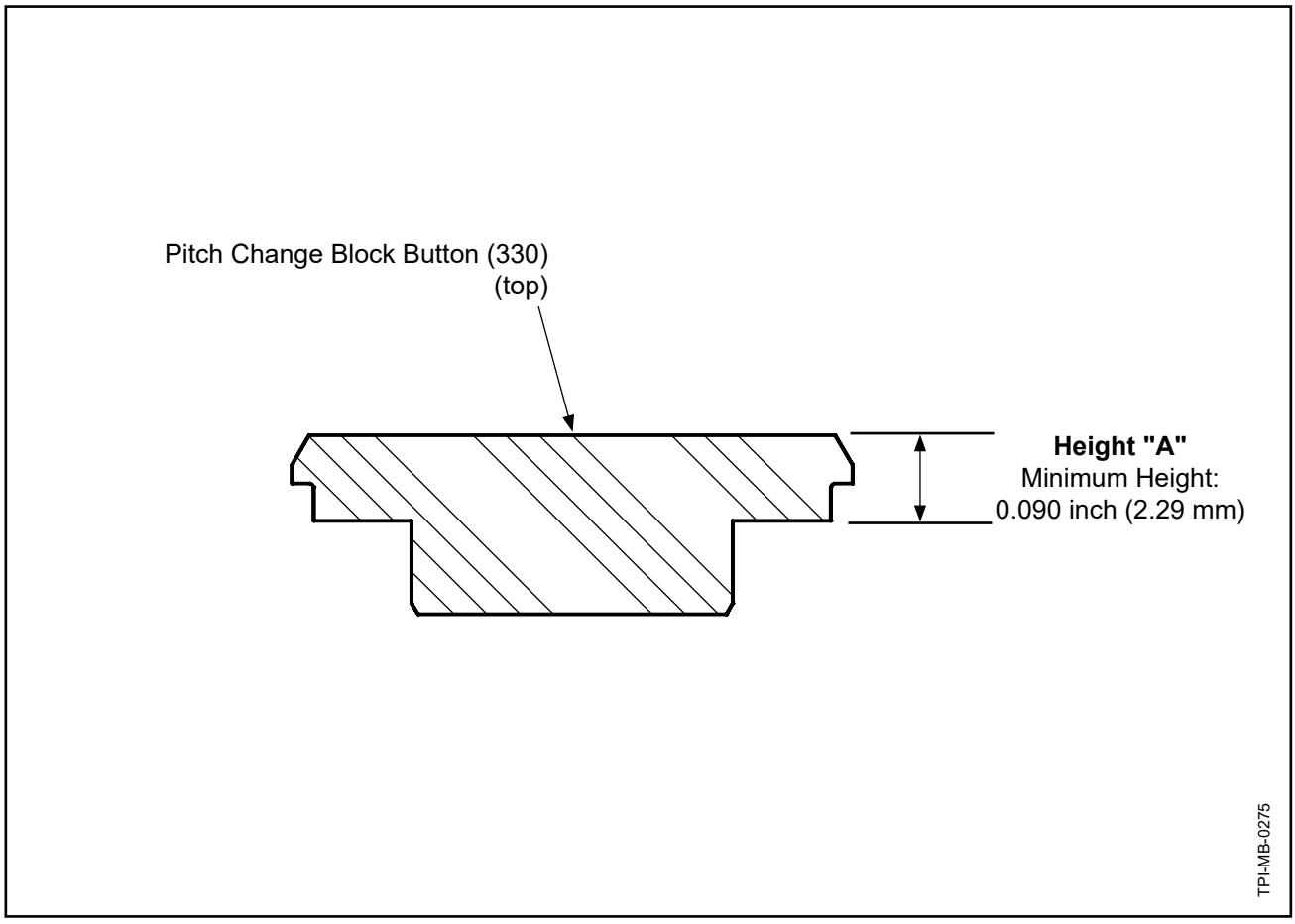
(1) General

(a) To improve the response rate of the propeller when going from low pitch to high pitch, modify the pitch change block buttons (330) in accordance with the procedure below.

(2) Procedure

(a) Using an abrasive pad CM47, sandpaper, or equivalent, polish the top surface of the pitch change block button (330) to reduce the height "A" of the button. Refer to Figure 6-3.

1 The minimum permitted height "A" of the pitch change block button (310) is 0.090 inch (2.29 mm).



Pitch Change Block Button Modification
Figure 6-3

ASSEMBLY - CONTENTS

ASSEMBLY - CONTENTS, continued

LIST OF FIGURES

LIST OF FIGURES, continued

LIST OF TABLES

(Blank Page)

1. General (Rev. 5)

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

WARNING 2: ADHESIVES AND SOLVENTS ARE FLAMMABLE AND TOXIC TO THE SKIN, EYES, AND RESPIRATORY TRACT. SKIN AND EYE PROTECTION ARE REQUIRED. AVOID PROLONGED CONTACT AND BREATHING OF VAPORS. USE SOLVENT RESISTANT GLOVES TO MINIMIZE SKIN CONTACT AND WEAR SAFETY GLASSES FOR EYE PROTECTION. USE IN A WELL VENTILATED AREA AWAY FROM SPARKS AND FLAME. READ AND OBSERVE ALL WARNING LABELS.

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 IN THIS MANUAL FOR IDENTIFICATION OF PROPELLER CRITICAL PARTS.

CAUTION 2: THE USE OF BLADE PADDLES TO MOVE THE BLADES CAN RESULT IN OVERLOAD AND DAMAGE OF THE BLADE PITCH CHANGE MECHANISM. THIS DAMAGE IS NOT REPAIRABLE AND CAN RESULT IN SEPARATION BETWEEN THE BLADE AND THE PITCH CHANGE MECHANISM, CAUSING LOSS OF PITCH CONTROL DURING FLIGHT.

A. Important Information

(1) Read all assembly instructions before beginning the assembly procedures.

(2) Protect all unassembled components from damage.

(3) Use applicable torque values. Refer to Table 8-1, "Torque Values", in the Fits and Clearances chapter of this manual.

(4) Unless specified differently, safety wire in accordance with NASM33540 using 0.032 inch (0.81 mm) safety wire.

(5) For information about additional weight slugs that may be required to be attached to the counterweight, refer to the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

B. Ice Protection Systems

(1) If installing an ice protection system supplied by Hartzell, refer to Hartzell Propeller Inc. Ice Protection System Manual 180 (30-61-80).

(2) If installing an ice protection system not supplied by Hartzell, refer to the applicable TC or STC holder’s Instructions for Continued Airworthiness (ICA).

C. O-rings

(1) Unless specified differently, lubricate all O-rings with lubricant CM12 before installing them in the propeller assembly.

(2) Hartzell Propeller Inc. recommends that the lot number and cure date for each O-ring be recorded with all work orders when an O-ring is installed in any propeller assembly.

D. Blade Bore Plug/Bearing Installation

(1) For aluminum blades, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(2) For composite blades, refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

E. Blade Angle Information

(1) For specific blade angle information, refer to the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

2. Hub Assembly Procedures

CAUTION 1: ACTUATION OF PROPELLERS MUST BE ACCOMPLISHED USING EITHER COMPRESSED AIR THAT HAS BEEN FILTERED FOR MOISTURE, OR NITROGEN.

CAUTION 2: DO NOT USE A PRESSURE THAT IS GREATER THAN 175 PSI (12.06 BARS) WHEN ACTUATING PROPELLERS THAT ARE INCLUDED IN THIS MANUAL.

CAUTION 3: USE ENOUGH PRESSURE TO MAKE SURE THAT THE PROPELLER ACTUATES AGAINST EACH POSITIVE STOP.

A. Hub Unit/Mounting Flange Components

(1) Install components of the hub unit (240) in accordance with Appendix B in the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(a) The inspection criteria for hub assembly components is located in Appendix B in the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) Install the propeller flange mounting hardware (mounting studs, dowel pins, etc.) in accordance with Appendix B in the Aluminum Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

B. Mounting the Hub on the Propeller Stand

(1) Install the hub plug (370). Refer to Figure 7-1.

(a) Install the internal spiral retaining ring (360) in the groove provided for it in the bore of the engine-side of the hub (240).

(b) Apply a light layer of lubricant CM12 to the hub plug OD O-ring (390).

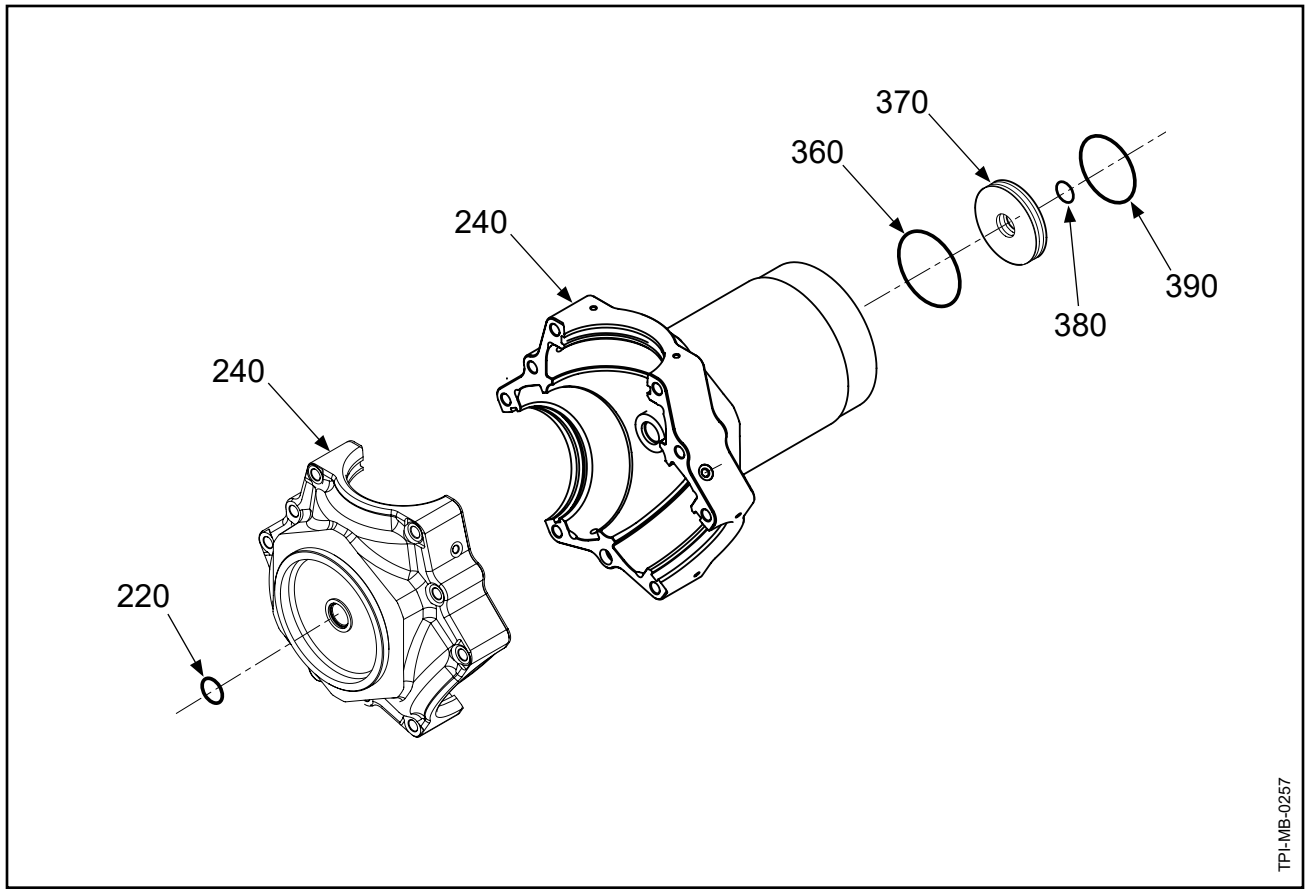
(c) Install the O-ring (390) in the groove on the OD of the hub plug (370).

(d) Apply a light layer of lubricant CM12 to the hub plug ID O-ring (380).

(e) Install the O-ring (380) in the groove on the ID of the hub plug (370).

(2) Apply a light layer of lubricant CM12 to the pitch change rod O-ring (220).

(3) Install the pitch change rod O-ring (220) in the cylinder-side of the hub (240).



Hub Assembly
Figure 7-1

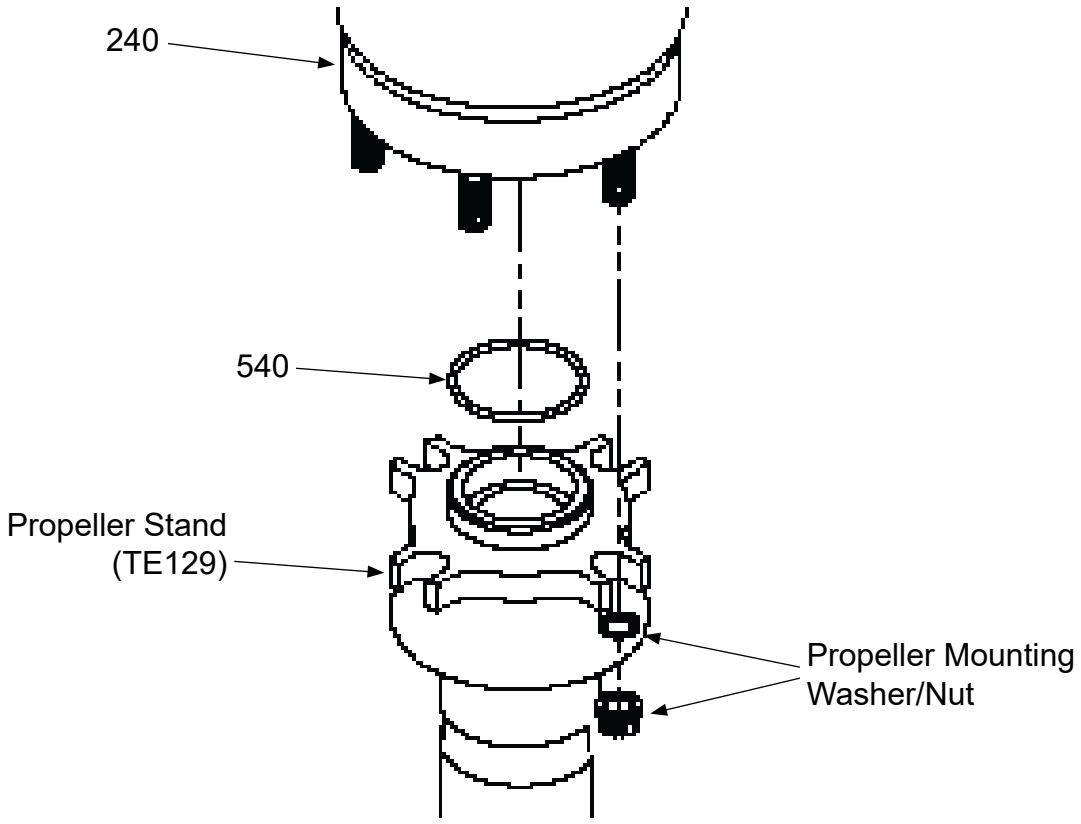
(4) Mounting flange O-ring (540):

(a) Apply a layer of lubricant CM12 to the mounting flange O-ring (540).

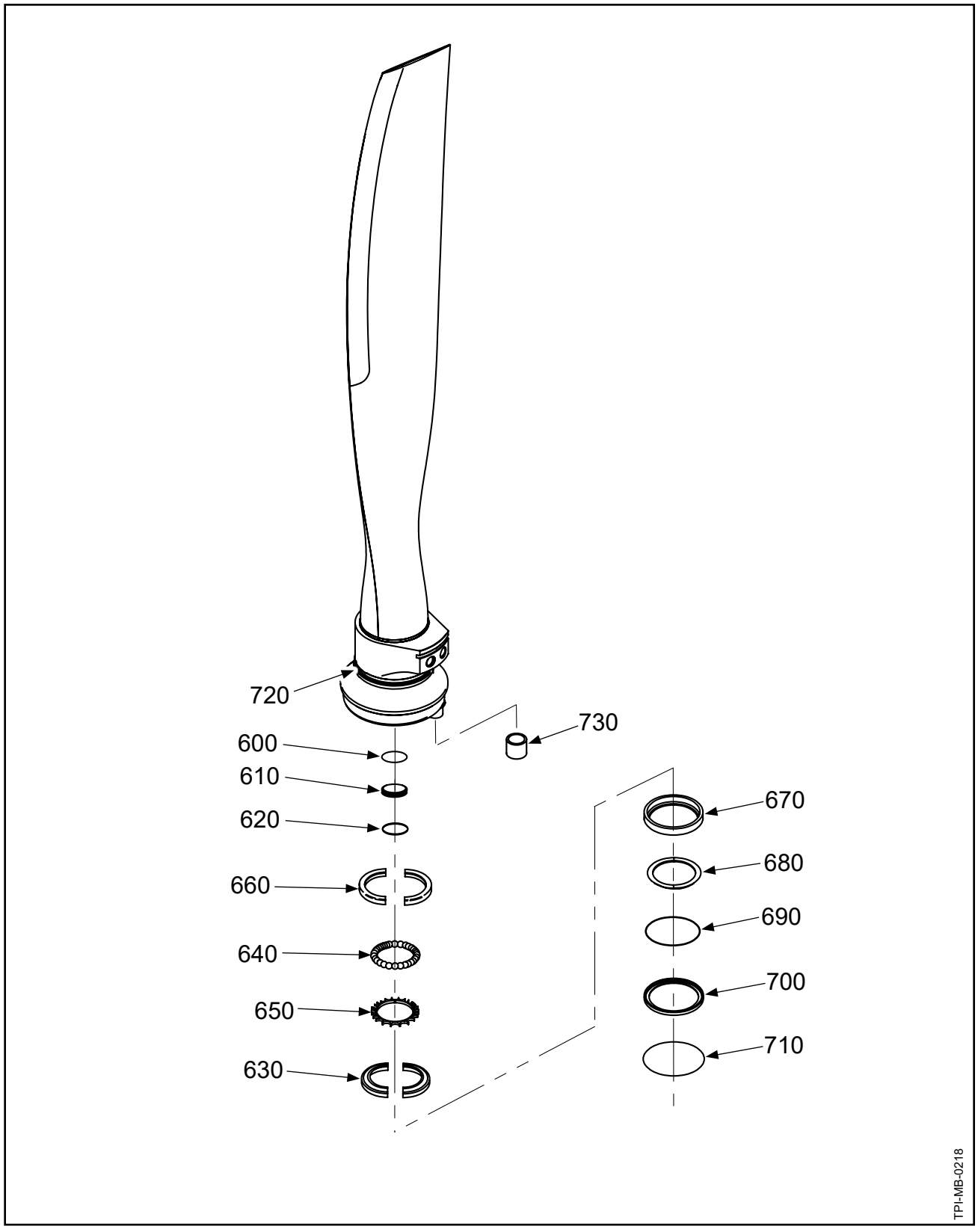
(b) Install the flange mounting O-ring (540) on the engine-side half of the hub (240). Refer to Figure 7-1.

(5) Install the engine-side half of the hub (240) on the propeller assembly table TE129 using the propeller mounting washers/nuts as shown in Figure 7-2.

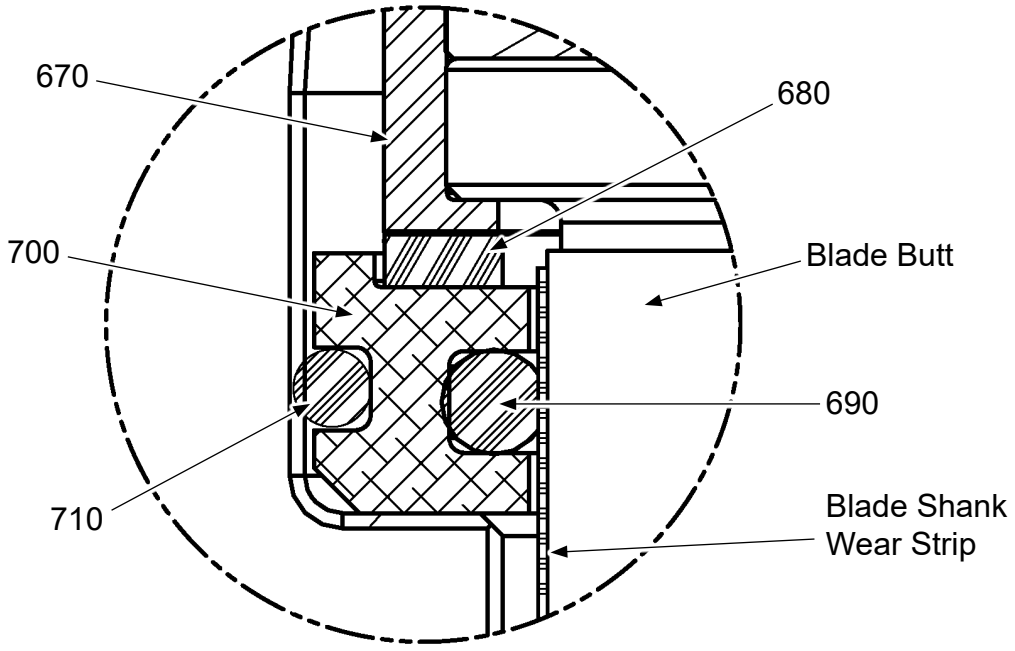
(a) Apply a layer of lubricant CM12 to the bearing seats of the blade retention sockets and the blade O-ring grooves.



Hub/Propeller Stand
Figure 7-2



Blade Assembly
Figure 7-3



Blade Seal and Blade Shim Installation
Figure 7-4

3. Blade Assembly and Installation

A. Blade Assembly

(1) The following procedure assumes that the blade has been inspected and repaired and that the blade wear strip, blade side bearing race, and bearing retaining ring are installed on each blade in accordance with Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

(2) Install the pitch change knob bushing (730) in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(3) Install the blade plug (610) in the bore of each blade in accordance with Figure 7-3 and the following steps:

(a) Apply a light layer of lubricant CM12 to the blade plug O-ring (600).

(b) Install the blade plug O-ring (600) on the OD of the blade plug (610).

(c) Install the blade plug (610) in the bore of the blade.

(d) Install the internal spiral retaining ring (620) in the groove provided for it in the bore of the blade.

(4) Install the blade seal (700), O-rings (690, 710), and the blade O-ring (720) in accordance with Figure 7-3, Figure 7-4, and the following steps:

(a) Using lubricant CM12, lubricate the blade O-ring (720).

(b) Install the blade O-ring (720) on the outboard blade wear strip on the blade. Refer to Figure 7-3.

(c) Using lubricant CM12, lightly lubricate O-rings (690 and 710).

(d) Install the O-ring (690) in the groove provided for it on the ID of the blade seal (700). Refer to Figure 7-4.

(e) Install the O-ring (710) in the groove provided for it on the OD of the blade seal (700). Refer to Figure 7-4.

1 Make sure that the O-rings (690, 710) are seated in the grooves of the blade seal (700) as shown in Figure 7-4.

(f) Install the blade seal (700) with the blade shim (680) and the O-rings (690, 710) on the blade.

1 The thickness of the blade shim (680) that was measured at disassembly will help determine the thickness of the shim to be installed.

a Use a blade shim (680) that is slightly thicker than the shim that was removed to offset wear on the components. Refer to Table 7-1.

2 Using lubricant CM12, lightly lubricate the O-rings (690, 710) before installing the blade seal (700) with the blade shim (680) and the O-rings (690, 710) on the blade.

3 Using lubricant CM12, lubricate the inboard blade shank wear strip.

4 With the blade shim (680) pointing toward the bearing retaining ring (670), install the blade seal (700) with the blade shim (680) and the O-rings (690, 710) on the blade as shown in Figure 7-4.

5 Firmly seat the blade seal (700) with the blade shim (680) and the O-rings (690, 710) against the bearing retaining ring (670).

CAUTION: MAKE SURE THAT THE O-RINGS (690, 710) ARE SEATED IN THE GROOVES OF THE BLADE SEAL (700) WHEN THE BLADE SEAL (700) IS INSTALLED ON THE BLADE.

6 Make sure that the O-rings (690, 710) are seated in the grooves of the blade seal (700).

Part Number	Thickness (inch)	Thickness (mm)
105758-050	0.050	1.27
105758-055	0.055	1.39
105758-060	0.060	1.52
105758-063	0.063	1.60
105758-065	0.065	1.65
105758-067	0.067	1.70
105758-070	0.070	1.78
105758-073	0.073	1.85
105758-075	0.075	1.90
105758-077	0.077	1.95

Blade Shim Thickness
Table 7-1

(5) Installation of the Bearing Balls and Hub-side Bearing Race - Refer to Figure 7-5

(a) Using lubricant CM12, lubricate the blade-side bearing race (630).

(b) Put the ball spacer (650) on the blade-side bearing race (630).

CAUTION: ALL THE BEARING BALLS IN A SINGLE BEARING MUST BE OF THE SAME SIZE AND GAUGE. BEARING BALLS SUPPLIED BY HARTZELL PROPELLER INC. ARE THE SAME GAUGE.

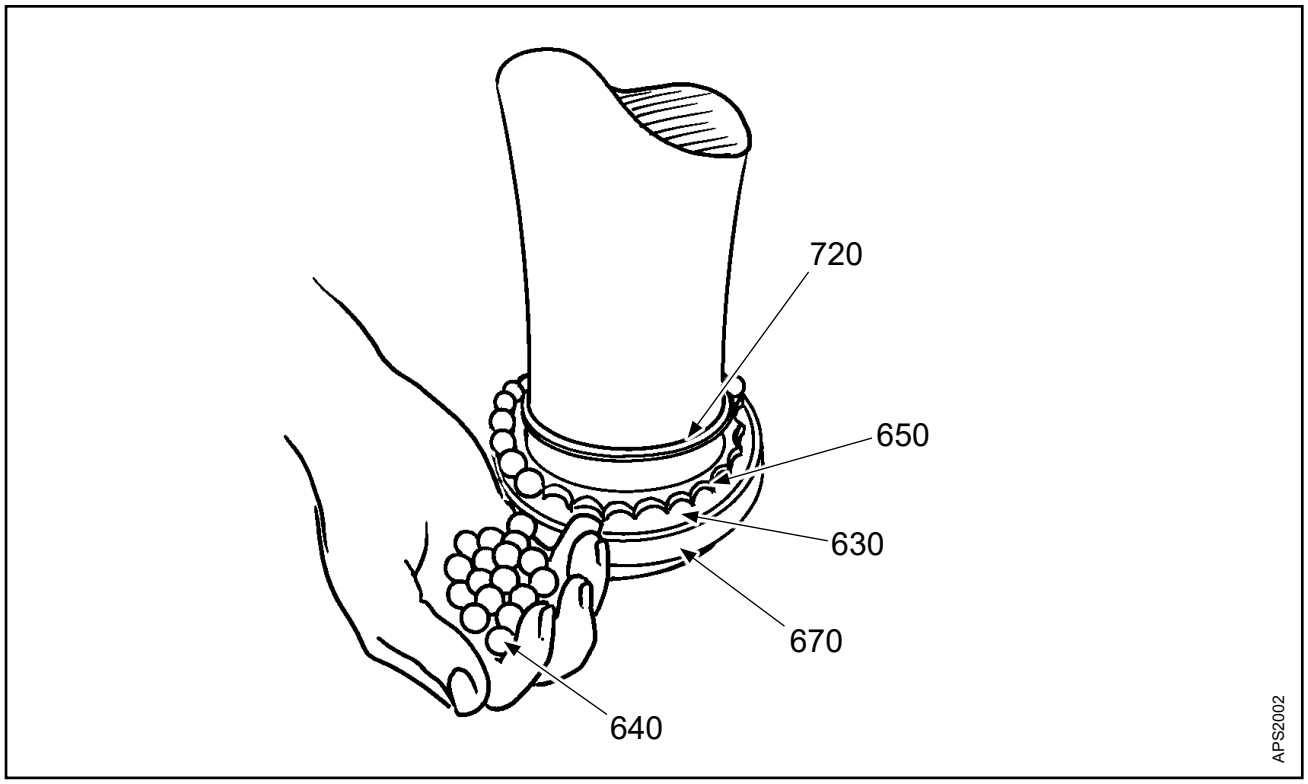
(c) Put the bearing balls (640) in the openings of the ball spacer (650) on the blade-side bearing race (630).

CAUTION: THE BEARING RACE HALVES MUST HAVE MATCHING SERIAL NUMBERS.

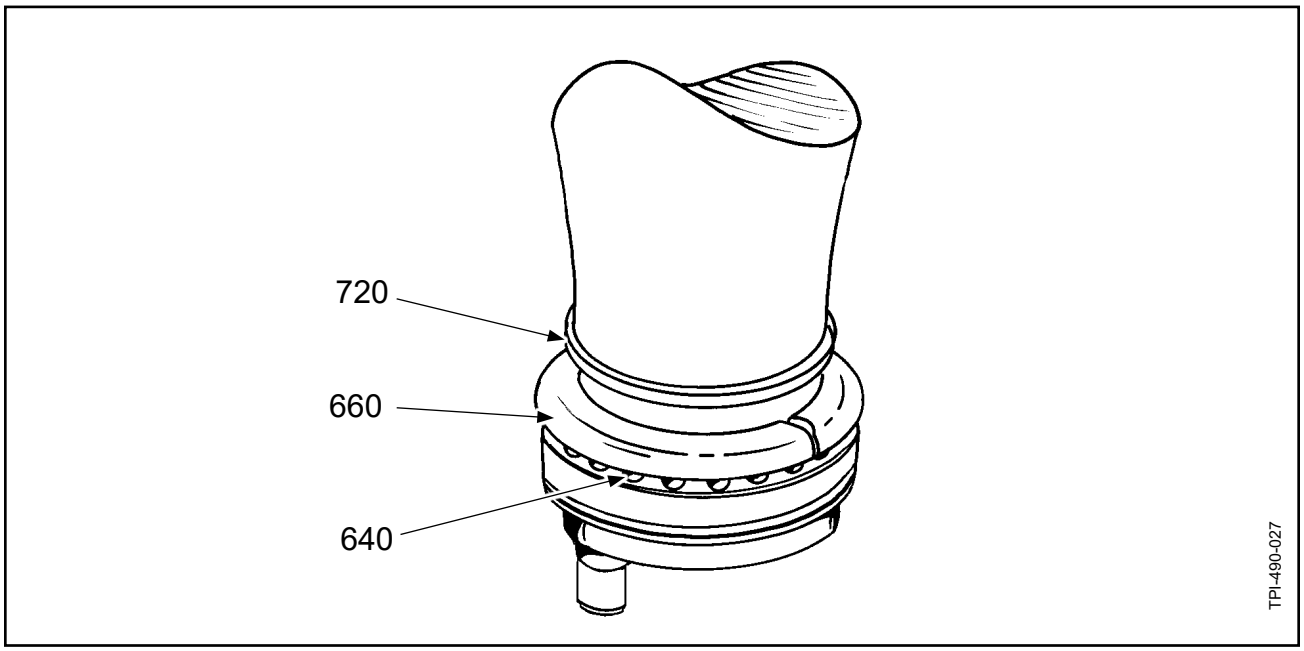
(d) Put the hub side bearing race (660) on the bearing balls (640) as shown in Figure 7-6.

1 Install the hub-side bearing race with the parting line perpendicular to the hub parting line when installed in the hub (240) as shown in Figure 7-7.

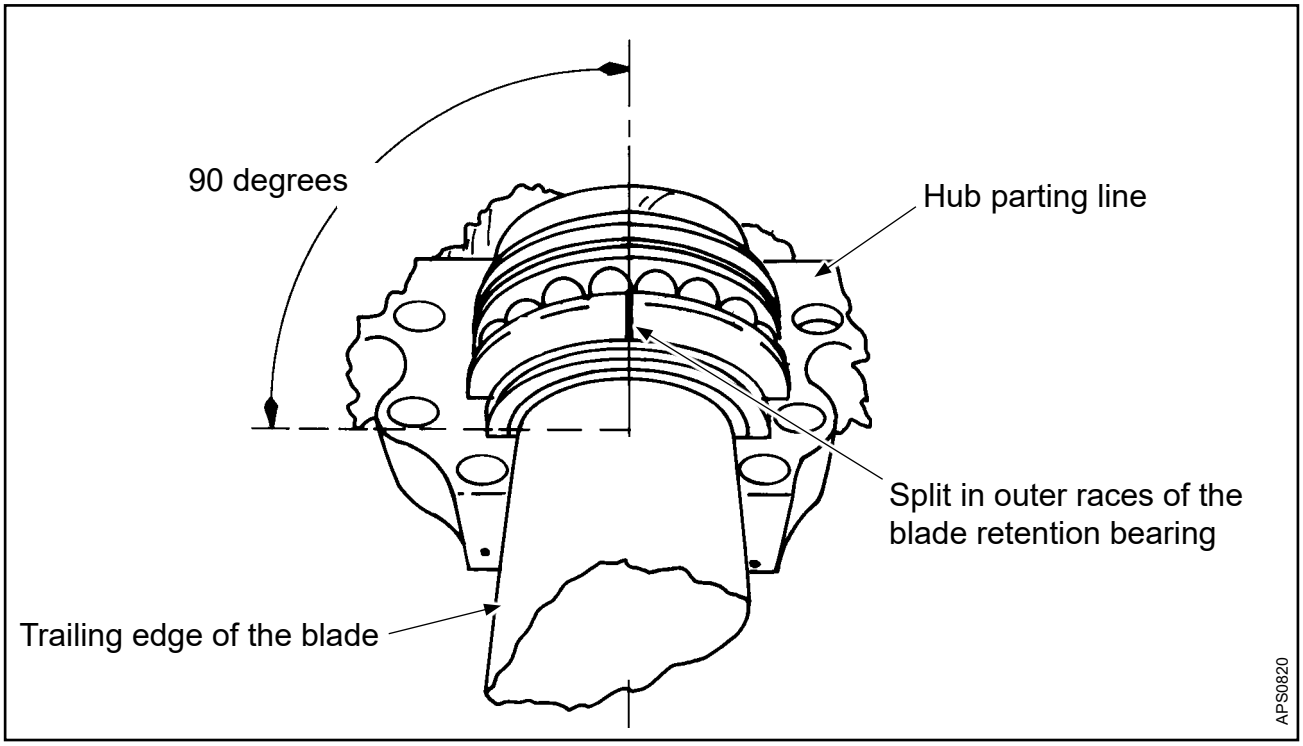
(e) Repeat steps (4) thru (5)(d)1 of this procedure for the remaining blades.



Bearing Ball Installation
Figure 7-5



Bearing Race Installation
Figure 7-6



Installing a Blade in the Hub Socket
Figure 7-7

B. Blade Installation

CAUTION: TO AVOID BLADE OR HUB DAMAGE, DO NOT USE FORCE TO INSTALL THE BLADE INTO THE SOCKET.

(1) Apply a thin film of lubricant CM12 to the blade retention radii and the O-ring grooves of the hub (220).

CAUTION: EACH BLADE MUST BE SHIMMED IN THE HUB SOCKET THAT IT WILL OCCUPY WHEN ASSEMBLED. DO NOT SHIM ALL THE BLADES IN THE SAME SOCKET.

(2) Install each previously constructed blade assembly using the following steps:

NOTE: Blade clamp TE25 may be used to hold the parts together when installing a blade.

(a) Install a blade assembly into the socket of the engine-side half of the hub (240).

(b) Using a feeler gage, measure the gap between the hub and the hub-side bearing race while pushing the blade bearing down into the hub socket. A gap of 0.005-0.008 inch (0.13-0.20 mm) is recommended.

1 If the gap is less than 0.005 inch (0.13 mm), remove the blade and replace the blade shim (680) with a thinner blade shim. Refer to Table 7-1.

2 If the gap is greater than 0.008 inch (0.20 mm), remove the blade and replace the blade shim (680) with a thicker blade shim. Refer to Table 7-1.

(3) Make sure that the parting line of the hub-side bearing race (660) is perpendicular to the hub parting line when the blade is installed in the hub (240). Refer to Figure 7-7.

(4) When all the blades have been successfully installed in the sockets of the hub (240), temporarily install the cylinder-side half of the hub (240).

(a) Install one bolt (210) in the hub clamping bolt hole next to the leading edge of each blade.

(b) Install a washer (200) and a nut (190) on each hub clamping bolt (210).

(c) Tighten the nuts (190) until snug. Do not torque the nuts (190) at this time.

CAUTION: INCORRECT SHIMMING CAN CAUSE THE BLADES TO BE TOO LOOSE OR TOO TIGHT IN THE HUB.

(5) Examine each blade for free rotation and end play.

(a) Free rotation

1 If the blade does not rotate freely in the hub socket, make sure that the blade O-ring (720) is seated correctly in the hub socket.

(b) Blade End Play and Fore-and-Aft Movement

1 Using one finger and thumb, apply a light load of approximately 5 lbs. (0.45 kg) to the blade in the direction of the check being performed.

a Apply the load at the mid-span of the blade approximately in line with the blade decal.

2 Measure the blade movement at the tip of the blade

a Make sure that the blade end play and fore-and-aft movement is within the limits specified in the Fits and Clearances chapter of this manual.

(6) If any blade does not rotate freely in the hub socket, or if blade end play for any blade is greater than the limits specified in the Fits and Clearances chapter of this manual:

(a) Remove the cylinder-side half of the hub (240).

(b) Remove the blade.

(c) Remove the blade seal (700) and O-rings (690, 710).

(d) Remove the blade shim (680).

(e) Replace the blade shim (680) with the next thinner or next thicker blade shim (680), as necessary. Refer to Table 7-1.

(f) Install the blade shim (680) in the recess of the blade seal (700).

(g) Using lubricant CM12, lightly lubricate O-rings (690, 710) before installation of the blade shim (680) and blade seal (700) with O-rings (690, 710) on the blade.

(h) With the blade shim (680) pointing toward the bearing retaining ring (670), install the blade shim (680) and blade seal (700) with O-rings (690, 710) on the blade.

(i) Firmly seat the blade seal (700) against the blade shim (680).

CAUTION: MAKE SURE THAT THE O-RINGS (690, 710) ARE SEATED IN THE GROOVES OF THE BLADE SEAL (700) WHEN THE BLADE SEAL (700) IS INSTALLED ON THE BLADE.

(j) Make sure that the O-rings (690, 710) are seated in the grooves of the blade seal (700).

(k) Install the cylinder-side half of the hub (240).

(l) Install the hub clamping bolts (230) in the hub clamping bolt holes that are next to the leading edge of each blade.

1 Install a washer (340) and a nut (350) on each hub clamping bolt (230).

2 Tighten the nuts (350) until snug. Do not torque the nuts at this time.

(m) Examine each blade for free rotation.

(7) Repeat steps (5) thru (6)(m) of this procedure until all blades rotate freely in the hub (240) and the maximum permitted blade end play and fore-and-aft movement is within the limits specified in the section, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(8) Remove the cylinder-side half of the hub (240).

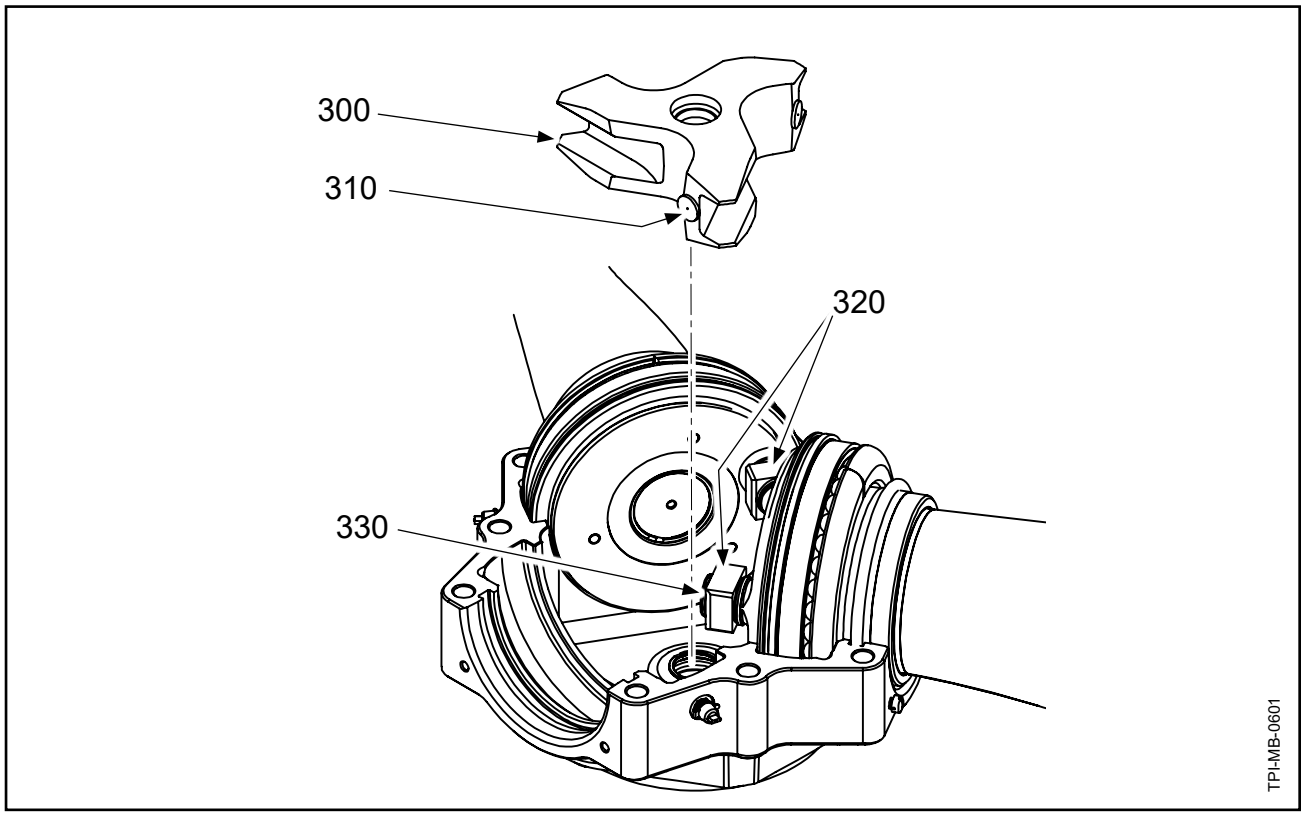
(9) Remove blade number one.

(10) Install the fork (300) in accordance with Figure 7-8 and the following steps:

(a) Install the fork bumpers (310) on the fork (300). Refer to Figure 7-8.

(b) Install one pitch change block button (330) into each pitch change block (320).

(c) Apply anti-seize compound CM118 to the outside of each pitch change knob bushing (730).



Fork Installation
Figure 7-8

(d) Apply anti-seize compound CM118 to the threads of the fork (300) and to each pitch change block groove of the pitch change fork (300).

(e) With the round extension of the pitch change block (320) pointing away from the blade, install a pitch change block (320) on each pitch change knob.

1 When installing a new pitch change block (320), make sure that the pitch change block (320) is installed with the thin wall pointing in the correct direction.

a At initial assembly, install the pitch change blocks (320) in the fork (300) with the thin wall pointing toward the engine-side half of the hub (240).

b For a pitch change block (320) that has been marked during disassembly to indicate the direction that the thin wall is pointing, install the pitch change block (320) in accordance with the marking.

CAUTION: BE SURE THE TAPER IN THE FORK (300) MATCHES THE TAPER IN THE PITCH CHANGE ROD (200). IF THE PITCH CHANGE ROD IS INCORRECTLY ATTACHED TO THE FORK, THE SEATING AREA OF THE PITCH CHANGE ROD WILL BE DAMAGED.

(f) Install the fork (300) on the pitch change blocks (320) of blades number two and three.

(11) Reinstall blade number one in the engine-side hub half socket.

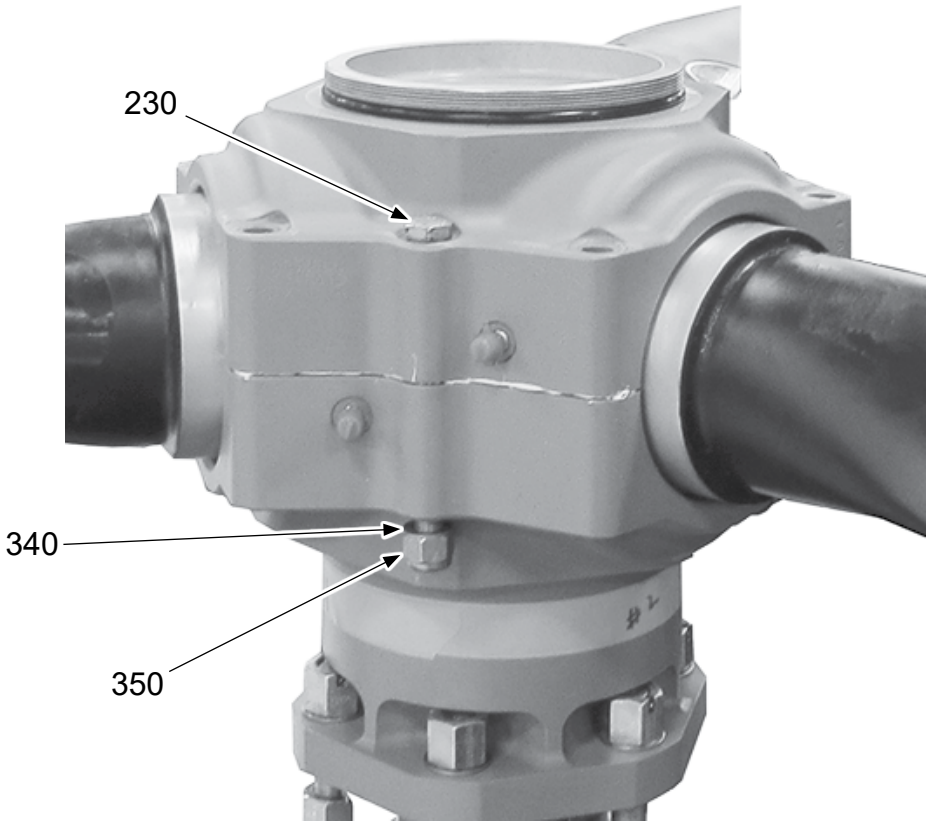
(a) Put the pitch change block (320) that is installed on the blade assembly into the fork (300), then install the blade into the socket of the engine-side half of the hub (240).

(12) Install the cylinder-side half of the hub (240) in accordance with Figure 7-9 and the following steps:

(a) Install one bolt (230) in the hub clamping bolt hole centered between each blade as shown in Figure 7-9.

1 Install a washer (340) and a nut (350) on each bolt (230).

2 Torque the nuts (350) in accordance with Table 8-1, "Torque Values", in the Fits and Clearances chapter of this manual.



Cylinder-side Hub Half Installation
Figure 7-9

4. Pitch Change Rod Installation and Blade Angle Check

A. Pitch Change Rod Installation

(1) Insert the pitch change rod (200) through the cylinder-side of the hub (240) and start the pitch change rod in the threads of the fork (200).

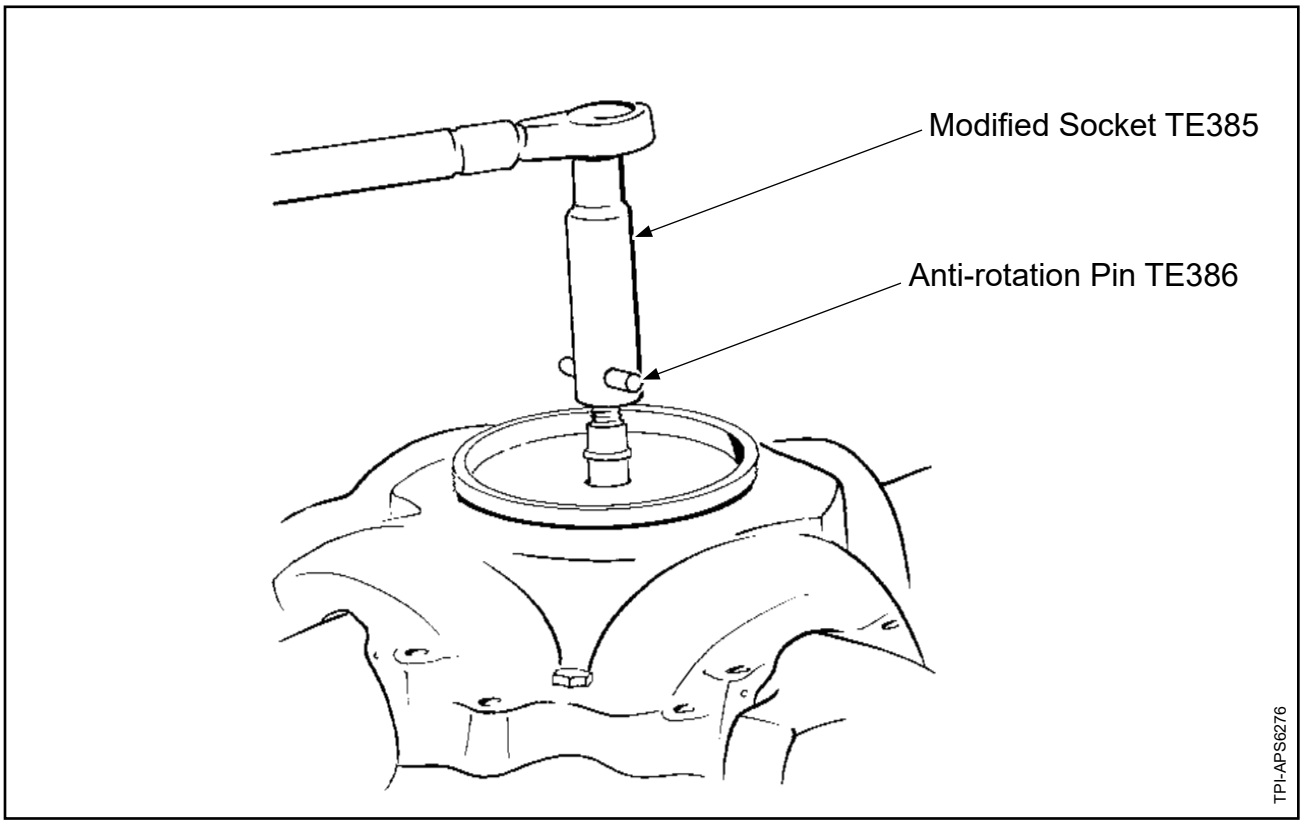
(2) Put the modified socket TE385 of the torque wrench adaptor TE6 in place on the pitch change rod (200) as shown in Figure 7-10.

(3) Insert the anti-rotation pin TE386 of the torque wrench adaptor TE6 into the hole in the modified socket TE385. Make sure the flat side of the anti-rotation pin is toward the pitch change rod (200).

NOTE: The anti-rotation pin TE386 keeps the socket from turning on the pitch change rod.

(4) Torque the pitch change rod (200) in accordance with Table 8-1 "Torque Values", in the Fits and Clearances chapter of this manual.

(5) Move the blades by hand to make sure the blades have a full range of movement from low pitch to feather pitch.



Torquing the Pitch Change Rod
Figure 7-10

B. Blade Angle Tolerance Check

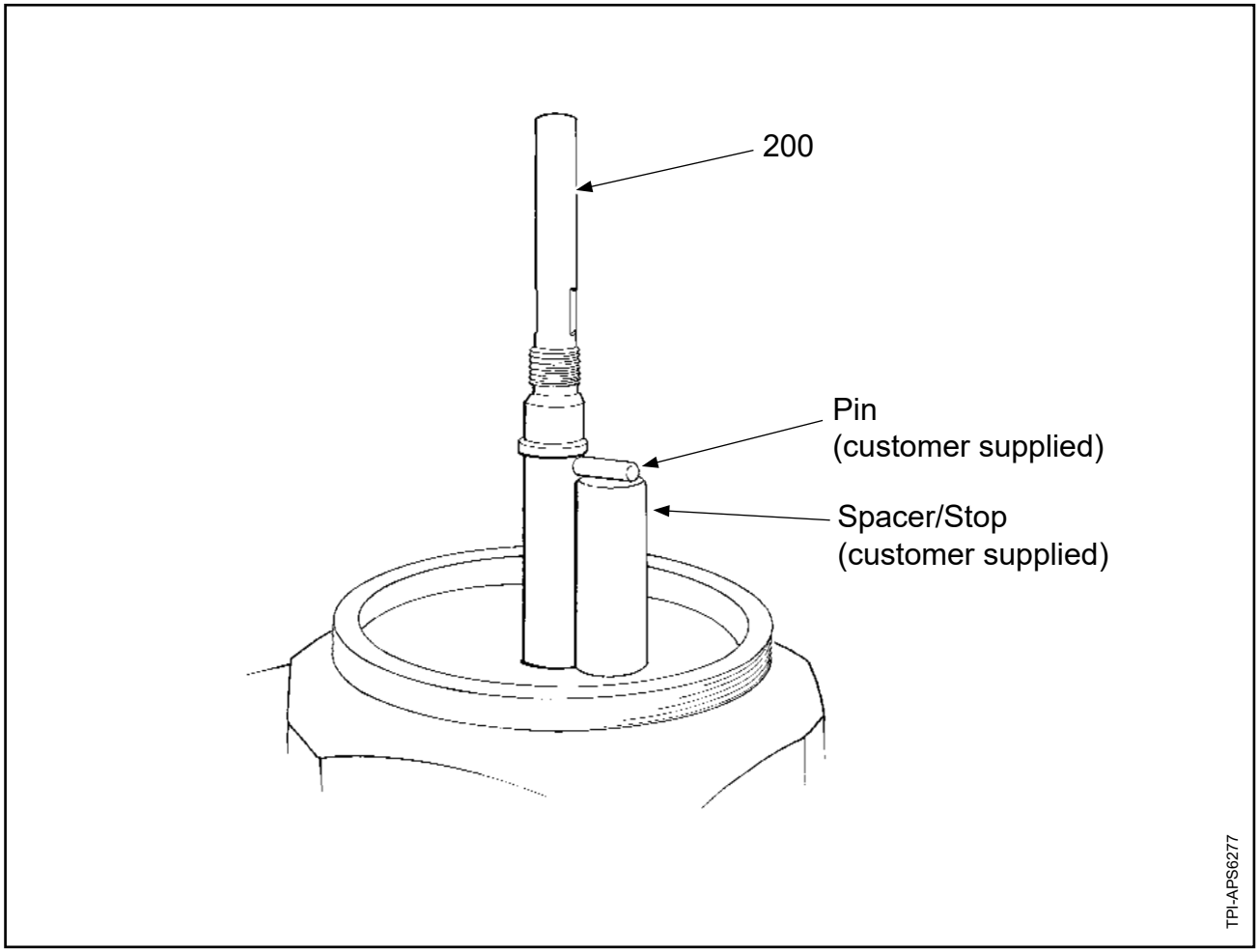
(1) Insert a pin with appropriate diameter into the hole in the pitch change rod (200) as shown in Figure 7-11.

(2) Place a spacer/stop between the pin and the hub.

NOTE: The spacer/stop should be long enough, approximately 2.25 inches (5.7 cm), to allow measurement of the blade angles near low pitch.

(3) Rotate the blades by hand until the pin contacts the stop, checking that the pitch change parts are firmly engaging the pitch change knob of the blades.

NOTE: Rotate the blades by hand toward high pitch to remove any slight blade angular looseness.



Using a Spacer/Stop to Check Blade Angles
Figure 7-11

CAUTION 1: DO NOT ETCH, SCRIBE, PUNCH MARK OR SIMILARLY IDENTIFY PARTS IN ANY MANNER THAT MAY BE HARMFUL TO THE STRENGTH OR FUNCTION OF THE PROPELLER.

CAUTION 2: GRAPHITE ("LEAD") PENCIL MARKS WILL CAUSE CORROSION.

(4) Mark a line on each blade at the 30-inch reference blade radius.

NOTE: The line at the 30-inch reference blade radius is for measurement reference purposes and will also be used when checking the feather angle of the blade.

(5) Check all the blade angles at the 30-inch reference blade radius for 0.2 degree maximum tolerance between blades.

(6) If the blade angle differs more than 0.2 degree between blades, turn one or more of the pitch change blocks (320).

(a) To turn the blocks, remove the pitch change rod (200), and the cylinder-side of the hub (240).

(b) Make the appropriate adjustments to the pitch change blocks (320).

NOTE: Pitch change blocks (320) should be installed in the fork (300) with the thin wall toward the engine-side half of the hub (240) during initial assembly. Rotating the pitch change block 180 degrees will decrease the pitch of the corresponding blade approximately 0.3 to 0.4 degree on a tractor propeller. Rotating the pitch change block 180 degrees will increase the pitch of the corresponding blade approximately 0.3 to 0.4 degree on a pusher propeller. It is possible to bring pitch angles differing as much as 0.5 degree into 0.2 tolerance by rotating the pitch change blocks.

(7) Reassemble the propeller, then recheck the blade angle tolerance between blades following steps (1) thru (6)(b) of this procedure.

C. Sealing the Cylinder-side Hub Half

CAUTION: HUB MATING SURFACES MUST BE CLEAN AND FREE OF ALL CONTAMINANTS TO PERMIT SEALING OF THE HUB PARTING LINE.

(1) Using solvent MEK CM106 or MPK CM219, clean the cylinder-side and engine-side hub mating surfaces to make sure that all oil, grease, and unwanted material have been removed.

(2) Permit the solvent MEK CM106 or MPK CM219 to dry.

(3) Install the hub guide bushing (260) in the hole provided for it in the engine-side half of the hub (240).

(4) Apply a bead of sealant CM92 on the cylinder-side and engine-side hub mating surfaces in accordance with Figure 7-12.

(a) The quantity of sealant applied to the mating surfaces must be sufficient to permit a small amount to be squeezed out along the entire parting surface when the hub bolts are correctly torqued.

(b) Do not permit the sealant CM92 to enter any of the hub clamping bolt holes.

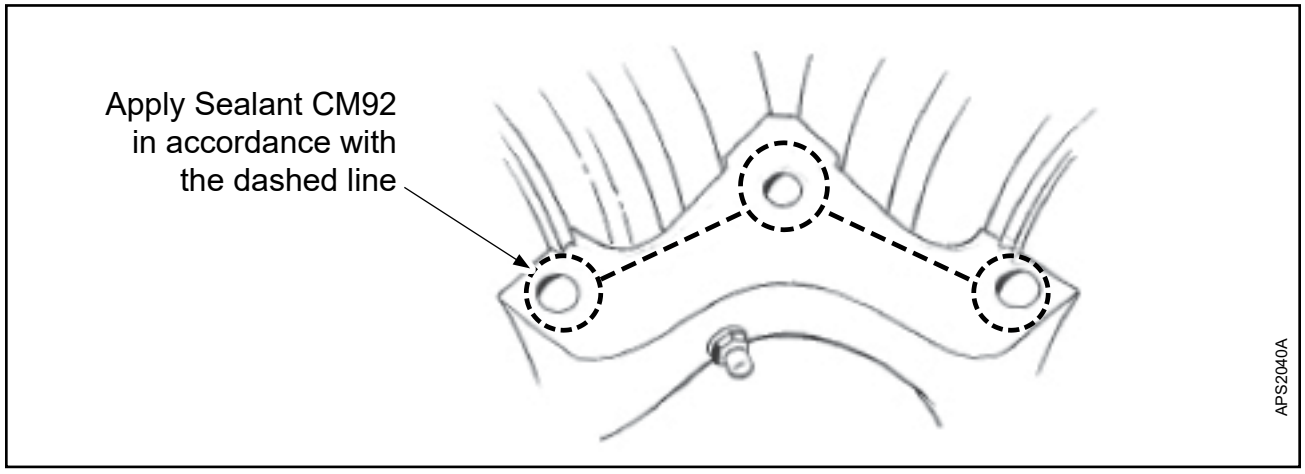
(c) Do not permit the sealant CM92 to enter the blade O-ring groove.

(5) Install the cylinder-side half of the hub (240).

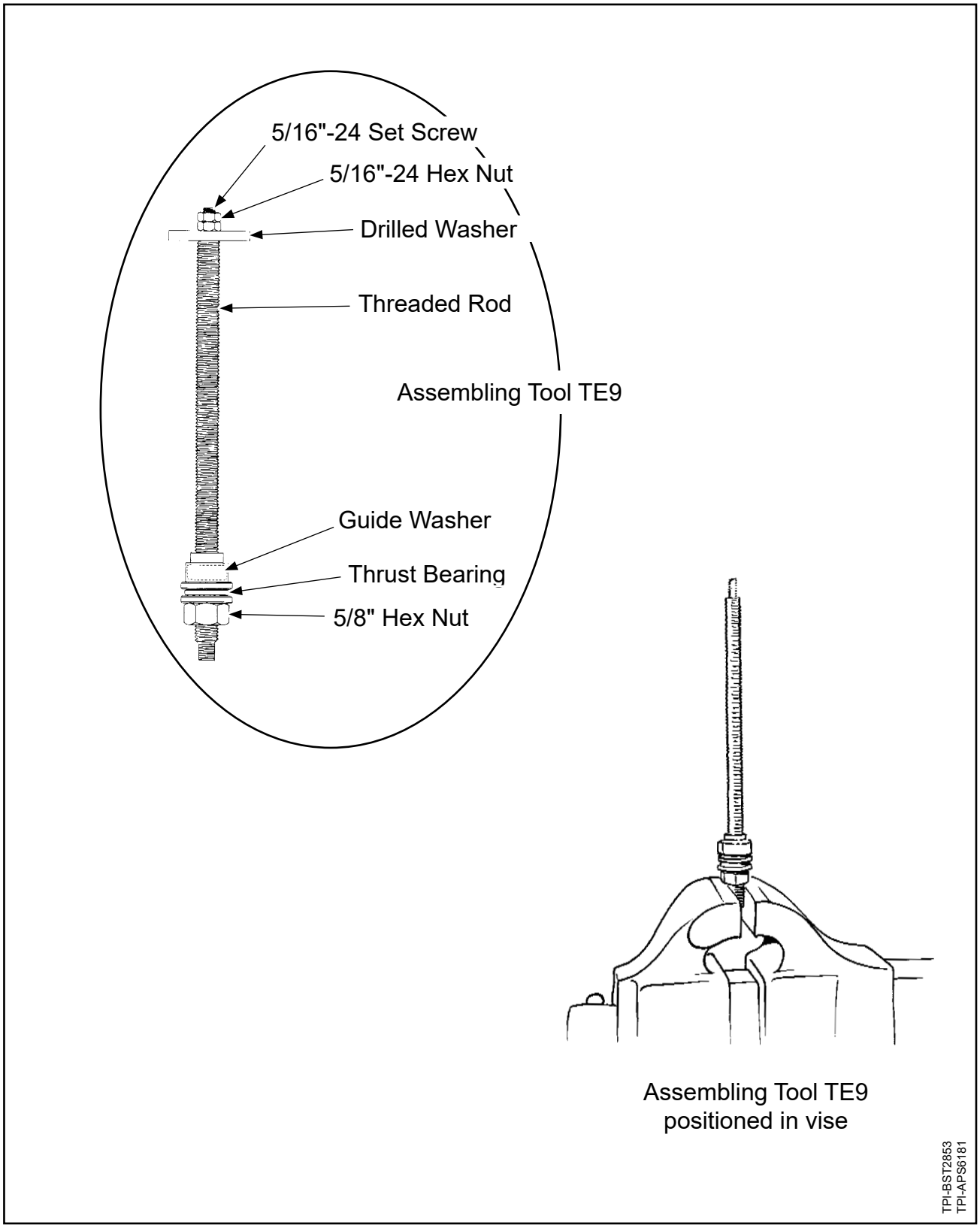
(6) Install all bolts (230), washers (340), and nuts (350). Refer to Figure 7-8.

(a) When the propeller is assembled without the bulkhead, additional washers may be used to help with clamping the halves of the hub (240) during the cure of the sealant CM92.

(7) Torque the nuts (350) in accordance with Table 8-1 "Torque Values", in the Fits and Clearances chapter of this manual.



Sealing the Hub Halves
Figure 7-12



Using the Assembling Tool TE9
Figure 7-13

5. Cylinder Assembly/Installation

A. Cylinder Spring Assembly

CAUTION: ASSEMBLING TOOL TE9 MUST BE USED TO COMPRESS THE CYLINDER MOUNTED SPRING.

(1) Place the assembling tool TE9 in a vise with the flattened portion of the threaded rod between the jaws of the vise as shown in Figure 7-13.

CAUTION: DO NOT ATTEMPT TO INSTALL THE SPRING ASSEMBLY WITH THE CYLINDER TORQUE WRENCH ADAPTER TE153 ATTACHED TO THE CYLINDER.

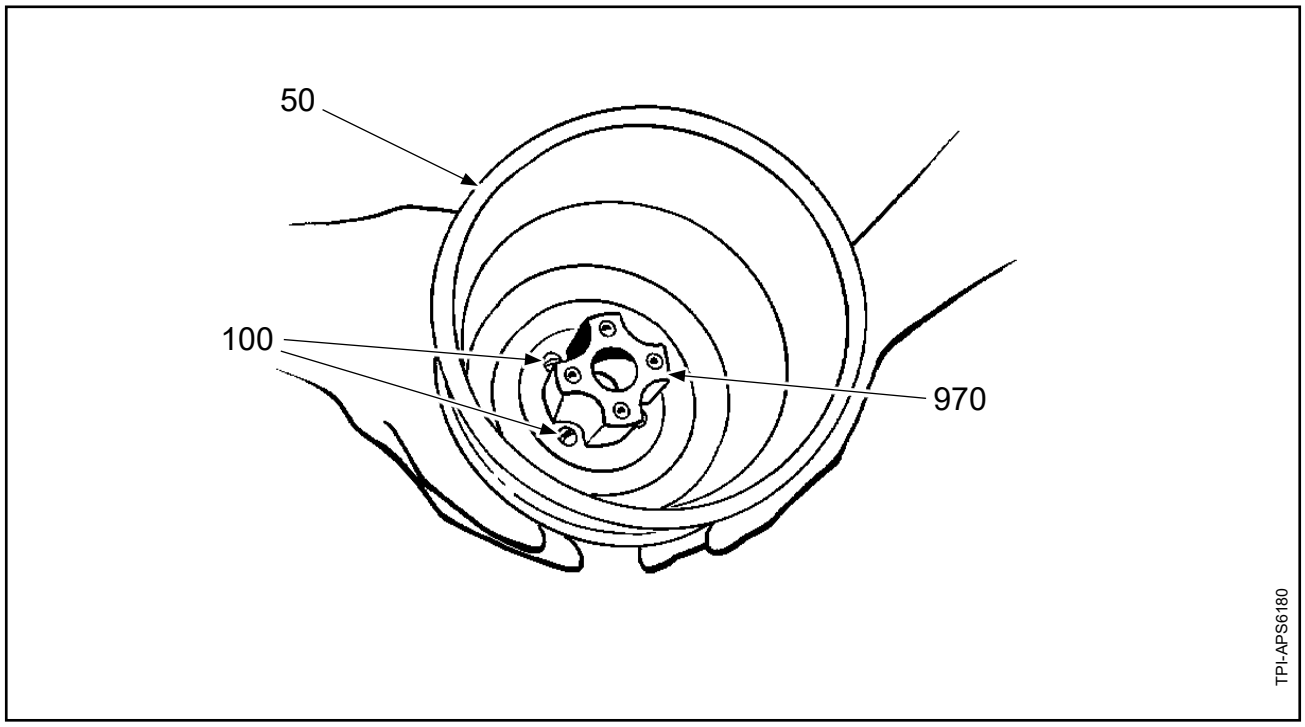
(2) Put the start lock housing (970) in the cylinder (50) and align the holes in the start lock housing with the holes in the cylinder.

(3) Apply thread locking compound CM21 to the screws (100).

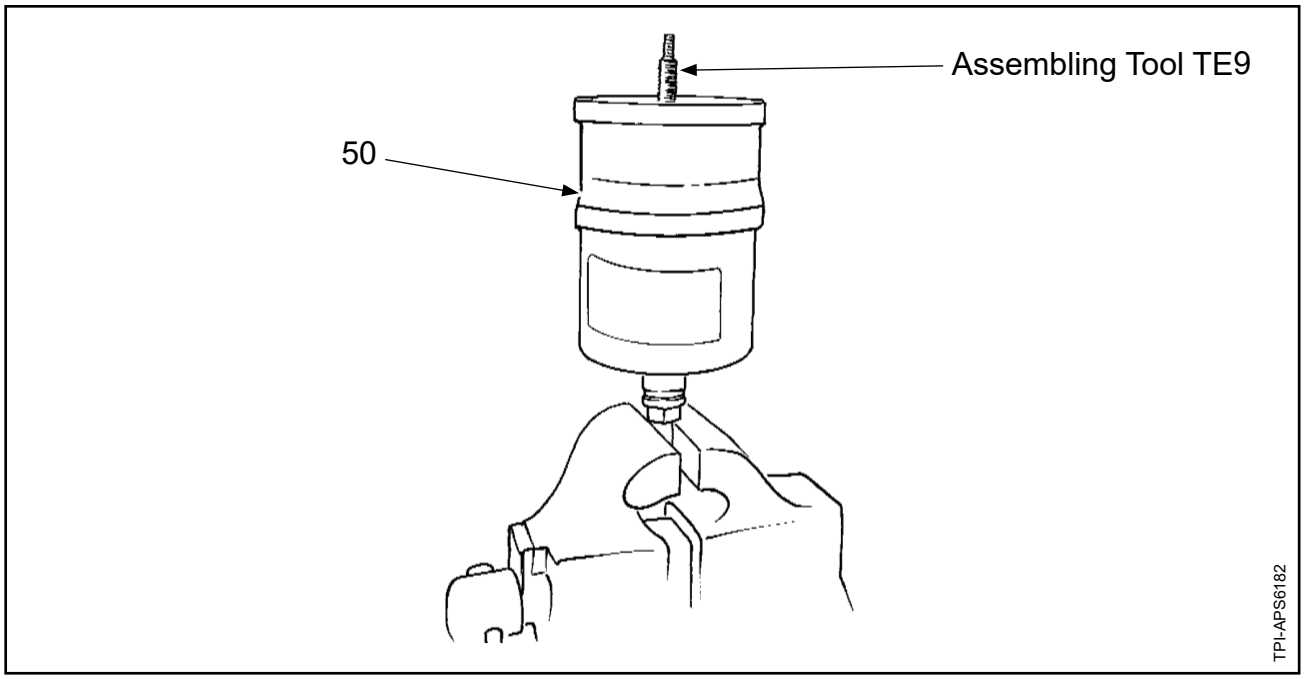
(4) Attach the start lock housing (970) to the cylinder (50) with screws (100). Refer to Figure 7-14.

(5) Torque the screws (100) in accordance with Table 8-1 "Torque Values", in the Fits and Clearances chapter of this manual.

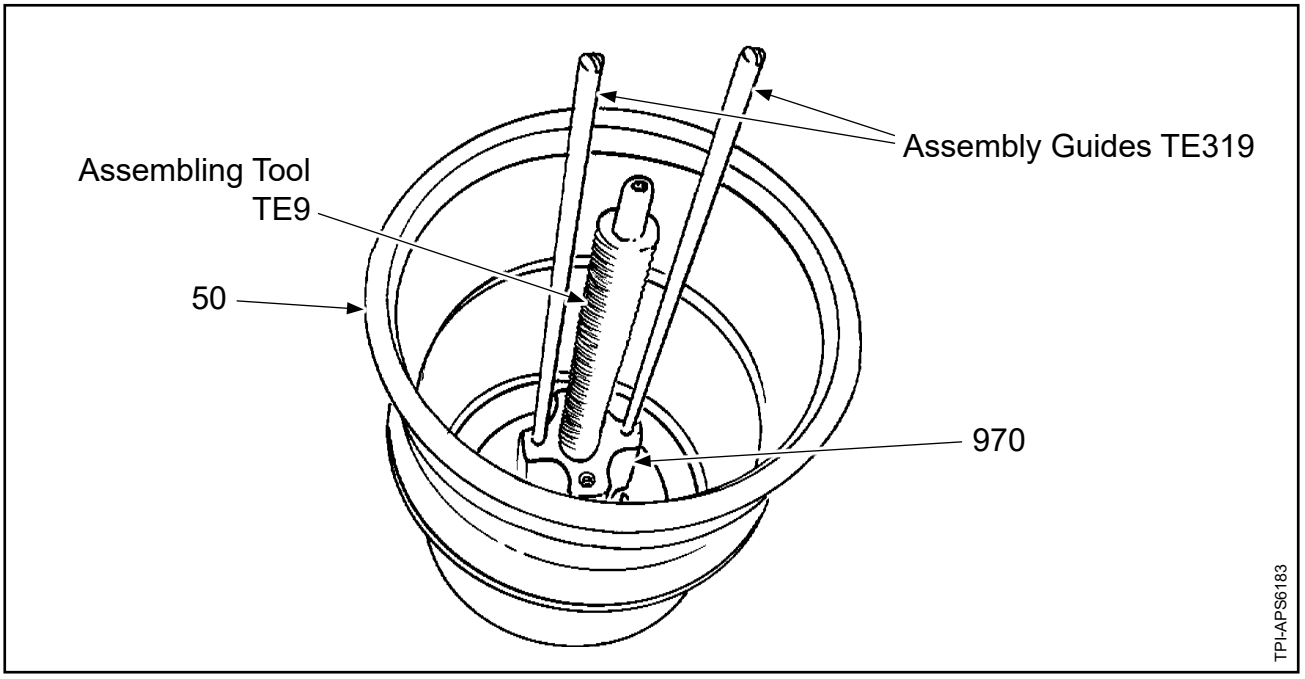
(6) Install the cylinder ID O-ring (160) in the groove inside the cylinder (50).



Start Lock Housing Installation
Figure 7-14



Cylinder on the Assembling Tool TE9
Figure 7-15



Installing the Assembly Guides TE319
Figure 7-16

(7) Put the cylinder (50) on the assembling tool TE9 with the small opening of the cylinder toward the vise as shown in Figure 7-15.

NOTE: The small diameter shoulder of the guide washer will fit in the small opening of the cylinder.

(8) Install the assembly guides TE319 into the screw holes in the start lock housing (970) as shown in Figure 7-16.

NOTE: Make sure the assembly guides are installed 180 degrees apart.

(9) Put the extension spring (960) and spring guide (950) over the assembly guides TE319 in the cylinder (50) as shown in Figure 7-17.

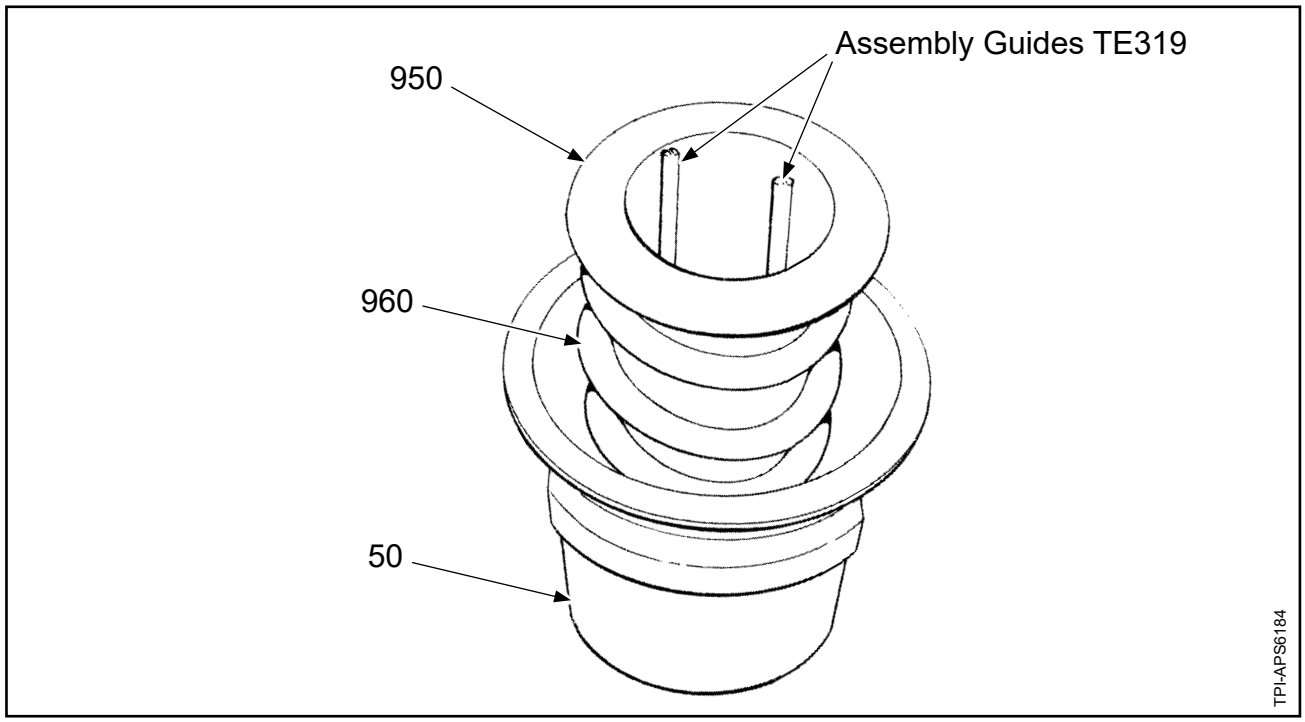
(10) With the raised side of the flyweight plate (940) facing up, line up the holes in the flyweight plate with the assembly guides TE319 as shown in Figure 7-18.

(11) Push the flyweight plate (940) onto the assembly guides TE319 until the flyweight plate is snug against the bottom of the spring guide (950) as shown in Figure 7-18.

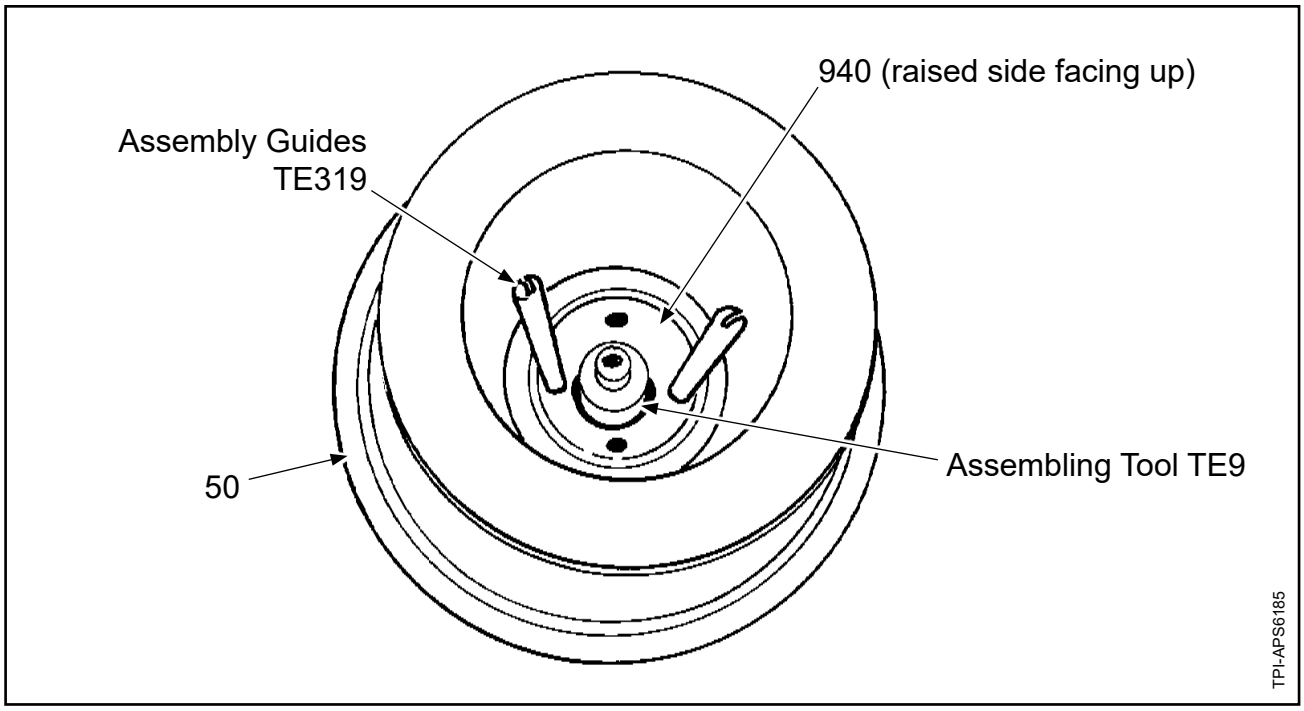
NOTE: The raised side of the flyweight plate (940) should be visible.

(12) Put the extension spring (930) in the groove around both halves of the flyweight (920). Refer to Figure 7-19.

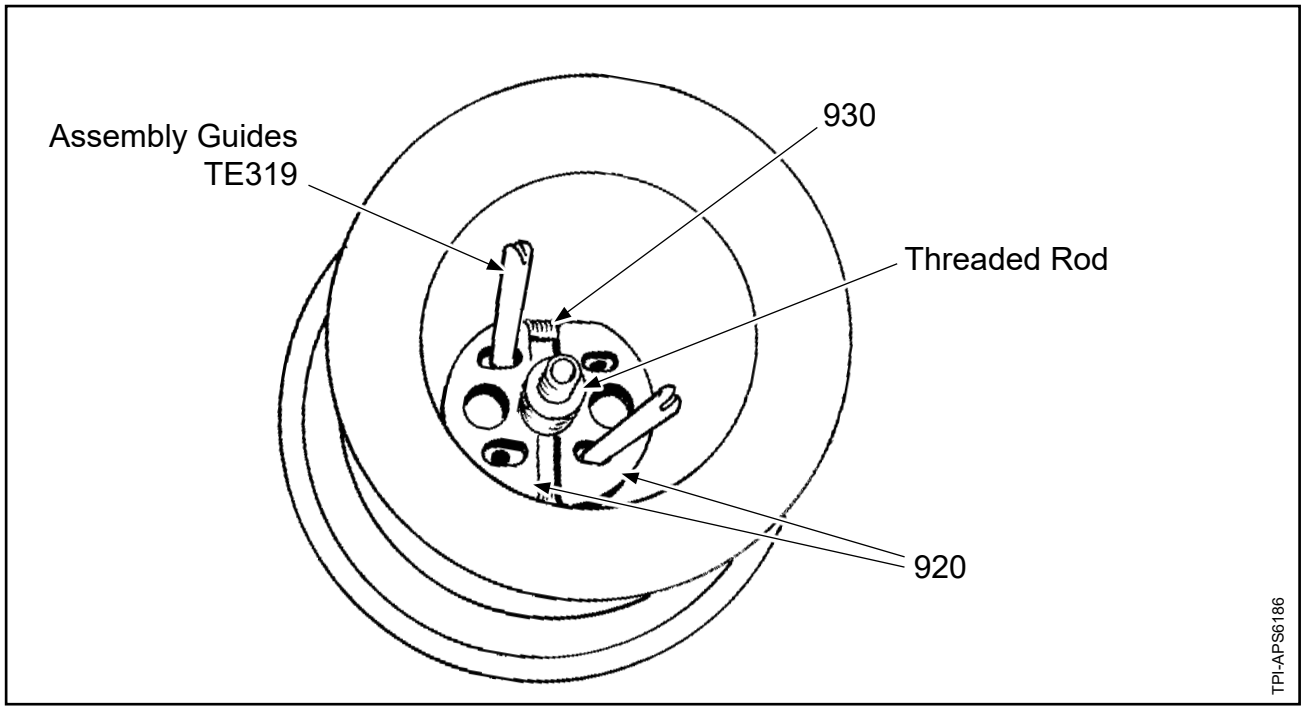
NOTE: Position the connection point of the extension spring (930) 90 degrees from the meeting point of the flyweight halves (920).



Extension Spring Installation
Figure 7-17



Flyweight Plate Installation
Figure 7-18



Flyweight Installation
Figure 7-19

(13) Line up two of the small holes in the flyweight (920) with the assembly guides TE319 as shown in Figure 7-19.

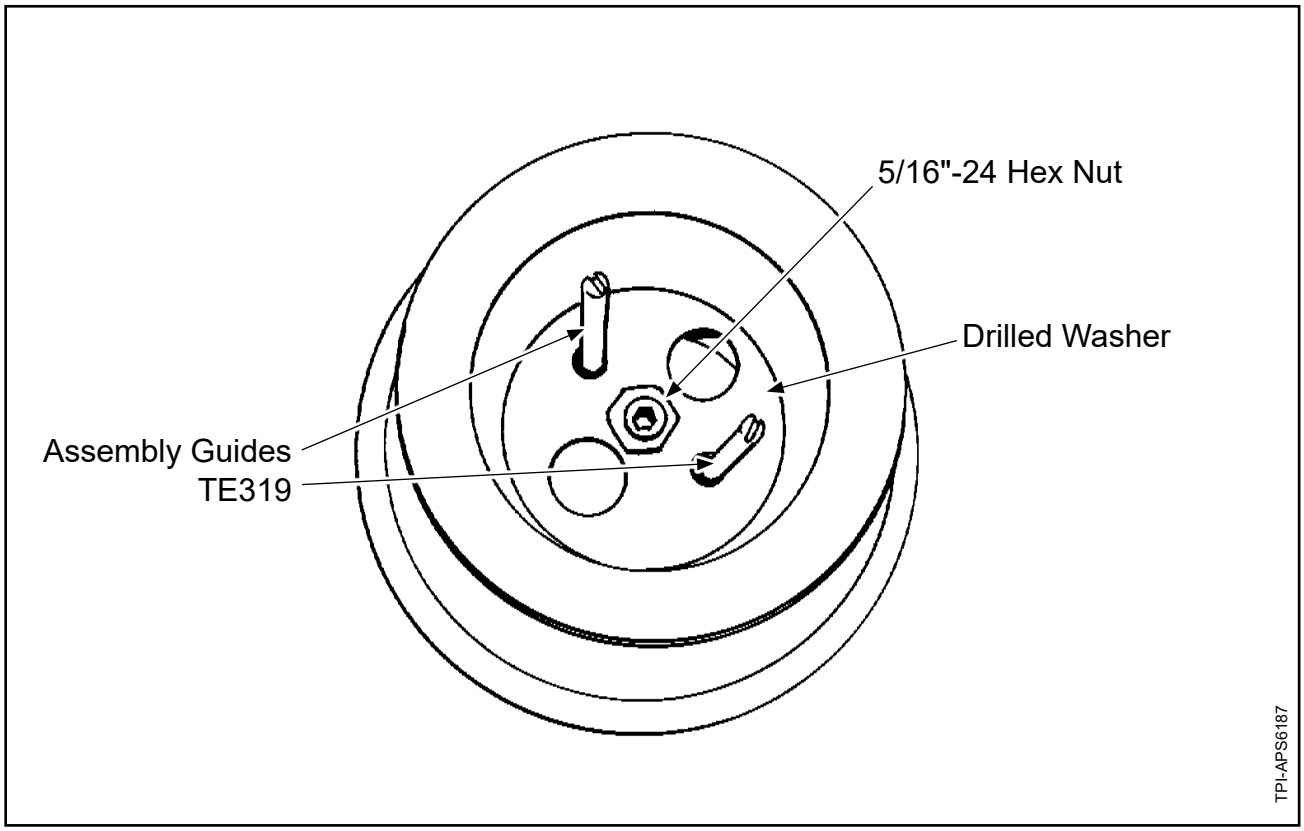
CAUTION: THE FLYWEIGHT (920) MUST REST AROUND THE LARGE DIAMETER OF THE THREADED ROD.

(14) Push the flyweight (920) onto the assembly guides TE319 until the flyweight rests around the large diameter of the threaded rod TE287 and against the flyweight plate (940) at the bottom of the spring guide (950) as shown in Figure 7-19.

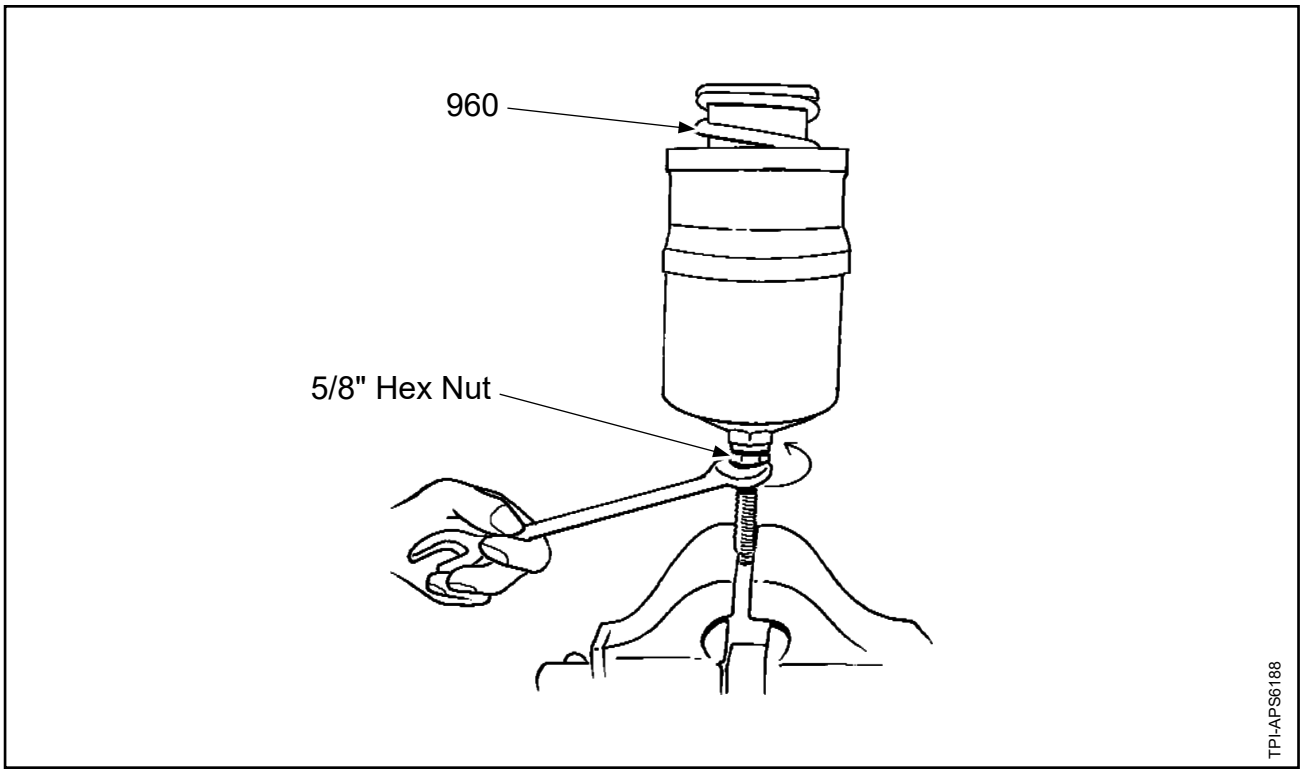
(15) Line up the two small holes in the drilled washer with the assembly guides TE319 as shown in Figure 7-20.

(16) Push the drilled washer onto the assembly guides TE319 and over the end of the 5/16"-24 set screw in the end of the assembling tool TE9.

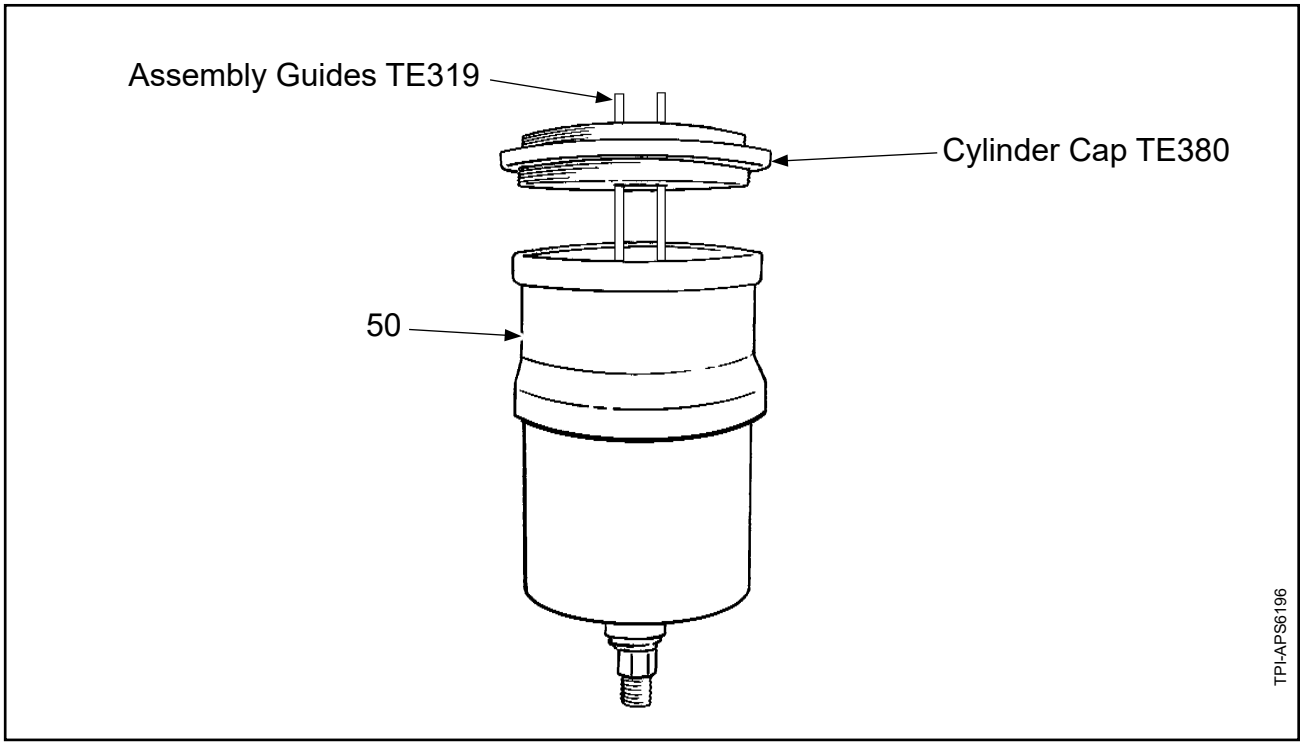
(17) Install the two 5/16"-24 hex nuts on the 5/16"-24 set screw and tighten. Refer to Figure 7-20.



Using the Drilled Washer TE288
Figure 7-20



Compressing the Extension Spring
Figure 7-21



Installing the Cylinder Cap TE380
Figure 7-22

WARNING: WHEN COMPRESSED, THE FEATHERING SPRING ASSEMBLY IS LOADED TO APPROXIMATELY 750 POUNDS (341 KG) FORCE. ENSURE THE SAFETY OF PERSONNEL IN THE VICINITY DURING ASSEMBLY PROCEDURES.

CAUTION: DO NOT EXCEED 10 FT-LB (13 N•M) OF TORQUE WHEN COMPRESSING THE SPRING.

(18) Turn the 5/8" hex nut with the appropriate wrench to fully compress the spring (960). Refer to Figure 7-21.

CAUTION: DO NOT DAMAGE THE THREADS OF THE CYLINDER (50) WHEN INSTALLING THE CYLINDER CAP TE380.

(19) Apply lubricant CM12 to the threads of the cylinder cap TE380.

(20) Install the cylinder cap TE380 until snug. Refer to Figure 7-22.

NOTE: The cylinder cap is designed to accommodate two different size cylinders. Make sure the cylinder cap threads are aligned with the cylinder threads.

CAUTION: DO NOT APPLY SEALANT TO THE SHOULDER OF SCREW (910).

(21) Apply one drop of sealant CM21 to the threads of two screws (910).

NOTE: Excessive sealant may inhibit movement of the flyweight (920).

(22) Install a screw (910) in each of the threaded holes that can be seen through the large holes in the drilled washer. Refer to Figure 7-23.

(23) Torque the screws (910) in accordance with Table 8-1 "Torque Values", in the Fits and Clearances chapter of this manual.

(24) Remove the assembly guides TE319.

(25) Loosen the 5/8" hex nut until the drilled washer can be rotated past the heads of the installed screws (910).

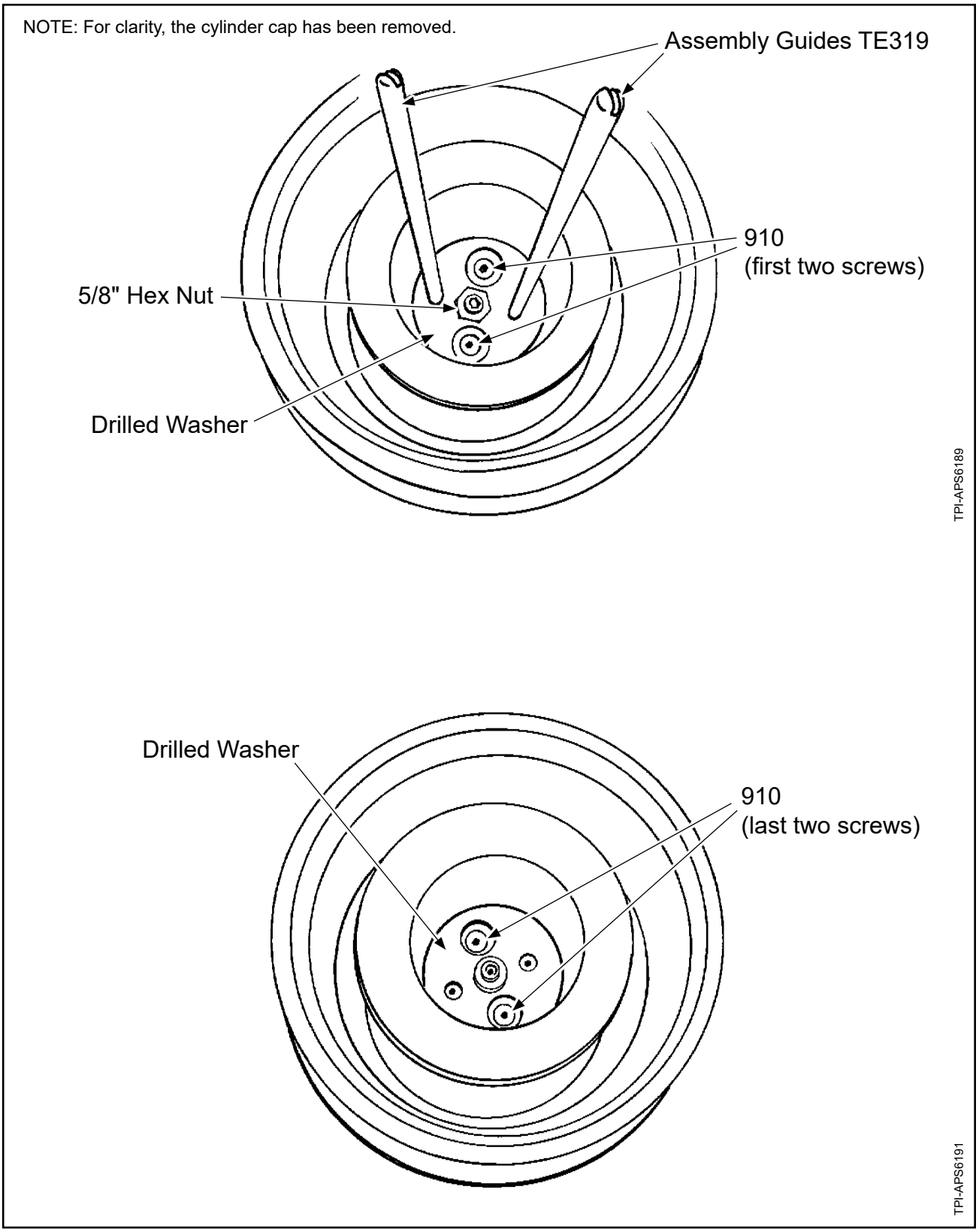
(26) Turn the drilled washer until the threaded holes for the remaining two screws (910) can be seen through the large holes in the drilled washer. Refer to Figure 7-23.

(27) Tighten the 5/8" hex nut to draw the drilled washer tight against the heads of the two screws (910) already installed.

CAUTION: DO NOT APPLY SEALANT TO THE SHOULDER OF SCREW (910).

(28) Apply one drop of sealant CM21 to the threads of the other two screws (910).

NOTE: Excessive sealant may inhibit weight movement.



Installing the Flyweight Screws
Figure 7-23

(29) Install a screw (910) in each of the threaded holes that can be seen through the large holes in the drilled washer. Refer to Figure 7-23.

(30) Torque the screws (910) in accordance with Table 8-1 "Torque Values", in the Fits and Clearances chapter of this manual.

(31) Loosen the 5/8" hex nut until the drilled washer is clear of the cylinder (50) and the cylinder cap TE380.

(32) Remove the two 5/16"-24 hex nuts and the drilled washer.

WARNING: USE CARE WHEN HANDLING THE CYLINDERS (50) WITH THE SPRING ASSEMBLY (110) INSTALLED.

(33) Remove the cylinder (50) from the assembly tool TE9.

(34) Operate the flyweight (920) with a screwdriver to check for proper operation.

CAUTION: DO NOT DAMAGE THE THREADS OF THE CYLINDER (50) WHEN REMOVING THE CYLINDER CAP TE380.

(35) Remove the cylinder cap TE380.

NOTE: If possible, leave the cylinder cap in place on the cylinder (50) until just before installation as an additional safety precaution.

B. Piston and Cylinder Installation

(1) Install a new cylinder O-ring (210) at the base of the cylinder attachment threads on the cylinder-side of the hub (240).

(2) Install a new O-ring (190) in the groove in the small opening of the piston (180).

(3) Install the piston (180) on the pitch change rod (200) with the small opening toward the hub (240).

(4) Install the piston nut (170) on the pitch change rod (200).

(5) Torque the piston nut (170) in accordance with Table 8-1 "Torque Values", in the Fits and Clearances chapter of this manual.

(6) Stack washers (145) (same number as were removed during disassembly) on top of the pitch change rod (200).

NOTE: The number of washers (145) determines the high pitch (start lock) blade angle.

(7) Install the high pitch stop sleeve (150) over the pitch change rod (200) and washers (145).

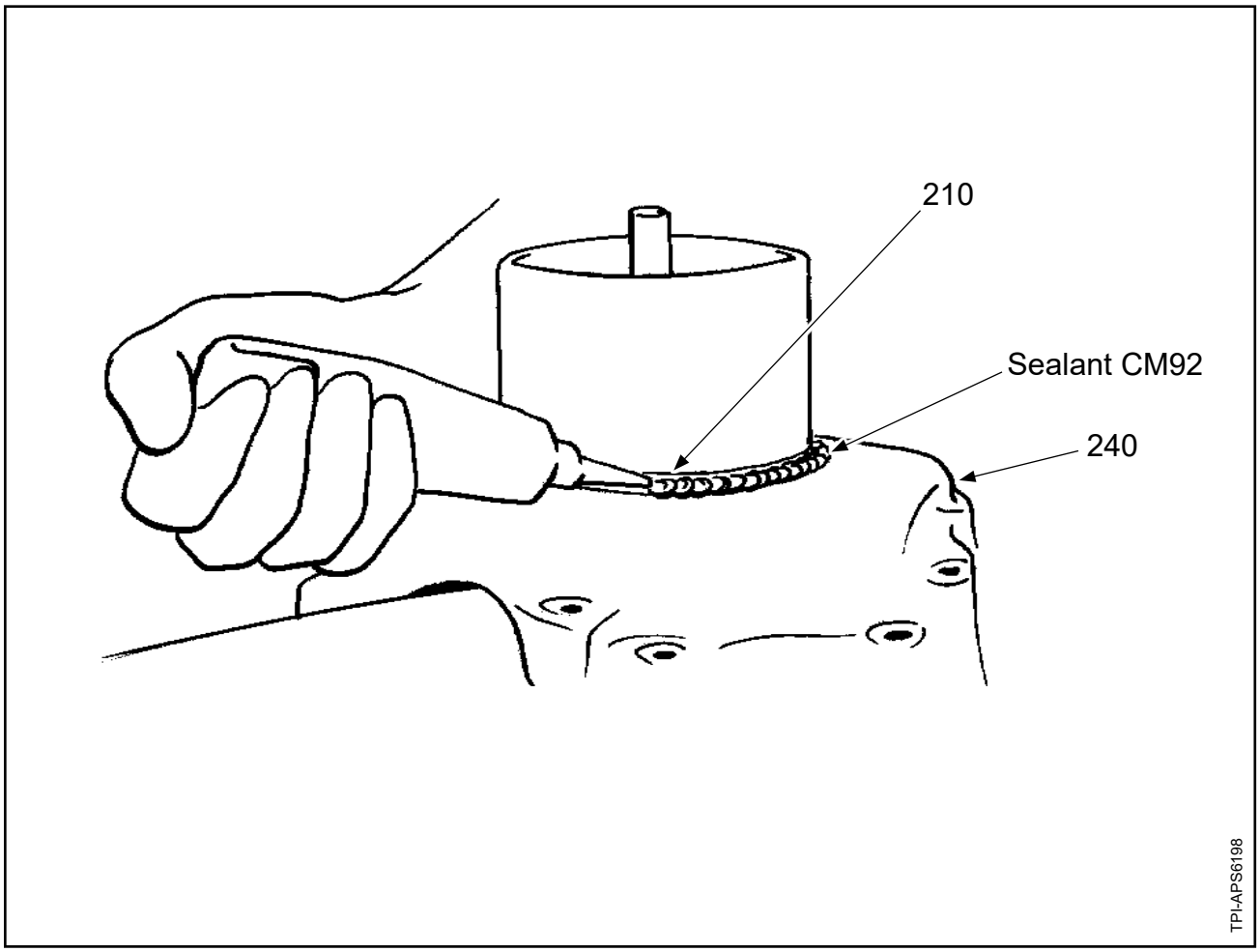
(8) Lubricate the outside of the piston (180) using lubricant CM12.

(9) Pour 2.25 fluid ounces (63.93 ml) of hydraulic oil CM157 into the piston (180).

NOTE: When assembling a propeller that will be disassembled for shipping, it is not necessary to apply sealant CM92 around the shoulder of the cylinder half of the hub (240) next to the O-ring (210).

(10) Apply a bead of sealant CM92 on the cylinder O-ring (210) where the cylinder (50) and the hub (240) will meet at installation. Refer to Figure 7-24.

(12) Apply lubricant CM12 to the threads of the cylinder (50).



Sealing the Cylinder
Figure 7-24

(13) Attach the cylinder torque wrench adapter TE153 to the cylinder (50). Refer to Figure 7-25.

(14) Put the spring guide (900) in the piston (50) with the raised portion of the spring guide away from the hub (240).

(14) Put the cylinder (50) over the piston (180).

(15) Insert the cylinder installation rod TE384 into the cylinder (50) and press down to push the high pitch stops apart, allowing the cylinder to drop into the position to be started on the threads of the hub (240).

CAUTION: DO NOT DAMAGE THE THREADS WHEN INSTALLING THE CYLINDER (50).

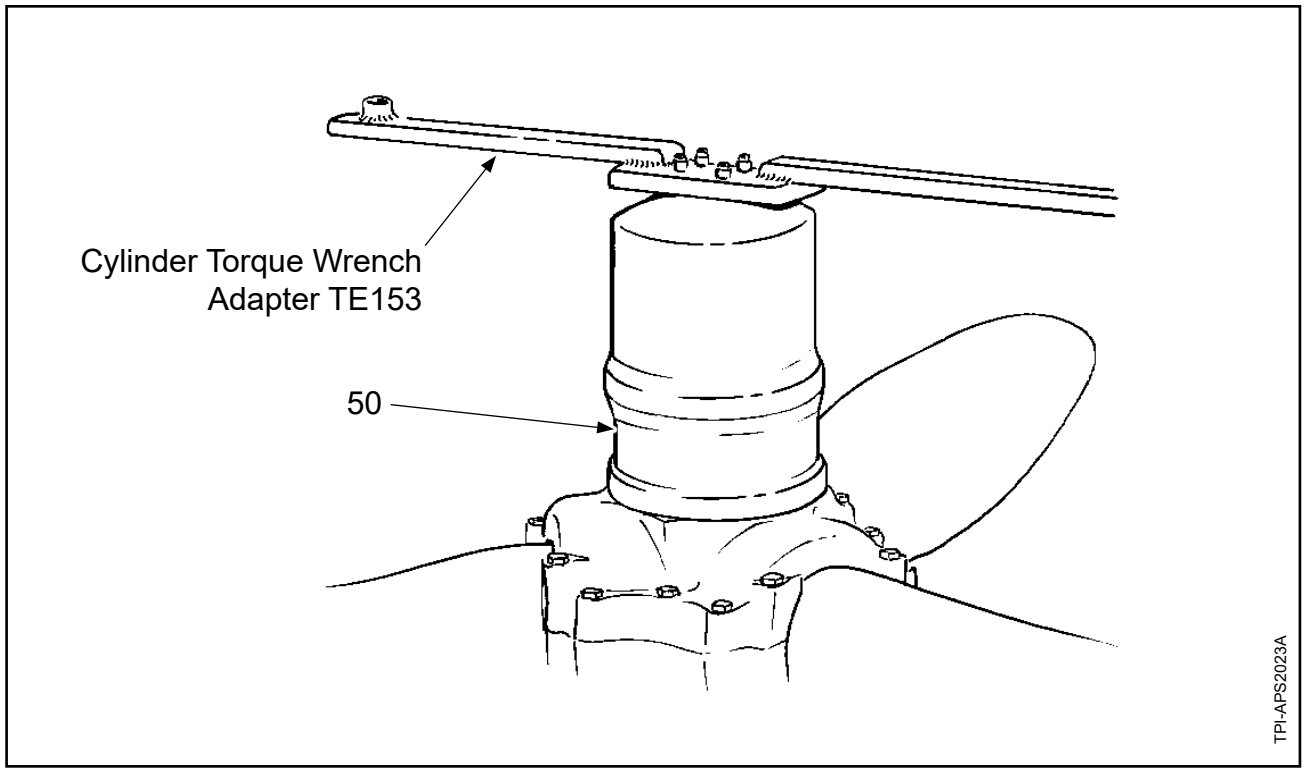
(16) By hand, start the cylinder (50) onto the threads of the hub (240).

NOTE: Make sure the cylinder threads are aligned with the hub threads.

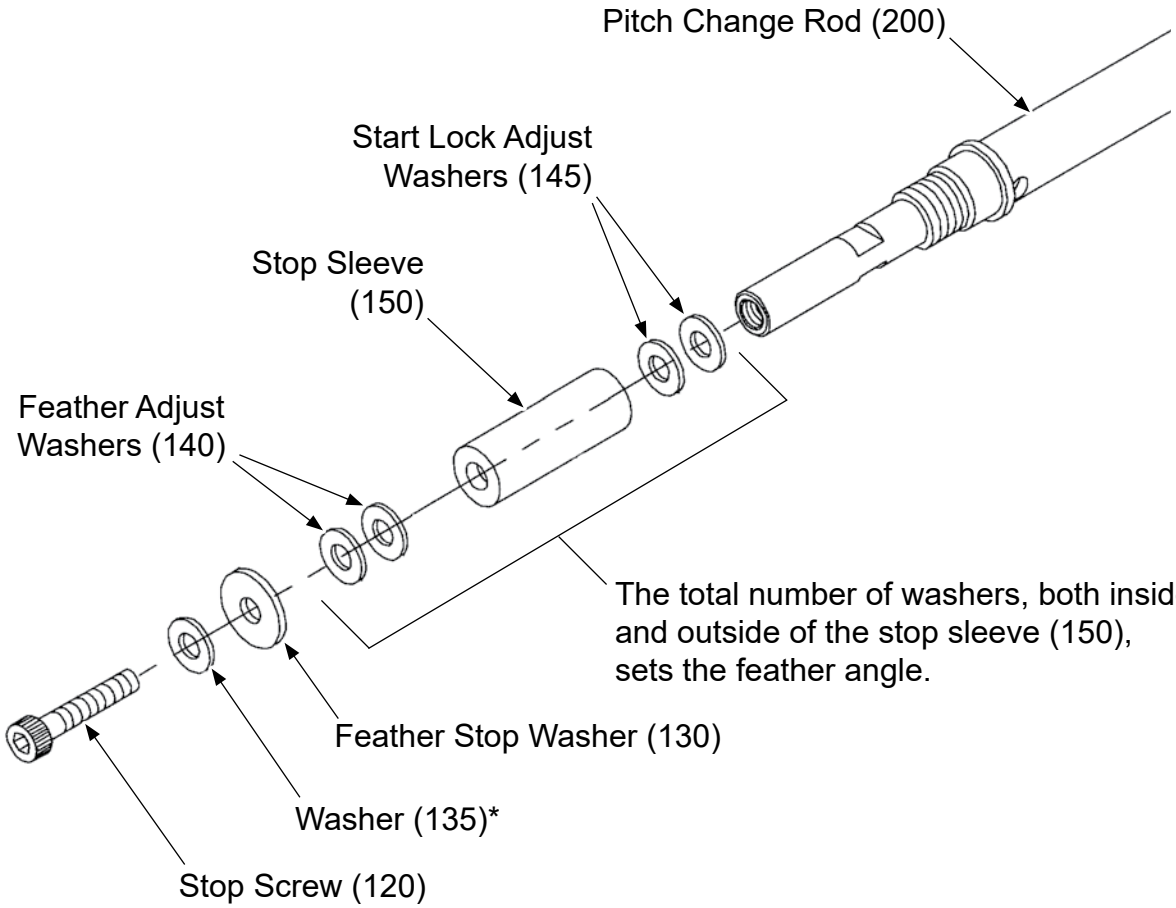
(17) Torque the cylinder (50) in accordance with Table 8-1, "Torque Values".

(18) Remove the cylinder installation rod TE384, as applicable.

(19) Remove the cylinder torque wrench adapter TE153 from the cylinder (50).



Cylinder Installation
Figure 7-25



*NOTE: In some propellers, the proper low pitch blade angle cannot be set even though the stop sleeve and low pitch stop are correctly positioned. This is due to the threaded low pitch stop bottoming in the cylinder. In this situation, add washer(s) (135) as required to reposition the low pitch stop between bottoming in the cylinder and a thread minimum engagement when correct low pitch blade angle is obtained.

Parts for Adjusting the Blade Angle
Figure 7-26

6. Setting the Blade Angles

A. Feather and Start Lock Blade Angles

NOTE 1: Grease may be used between the washers (140) and the feathering stop washer (130) for ease of removal if blade angle adjustment is required. Washers that fall into the propeller may be retrieved with a magnet.

NOTE 2: When setting feather or start lock angles, the approximate degree of movement achieved per washer is:
B-3851-0532 or A-2435-1 washer equals 1.5 degree
B-3851-0563 or A-2435 washer equals 3 degrees

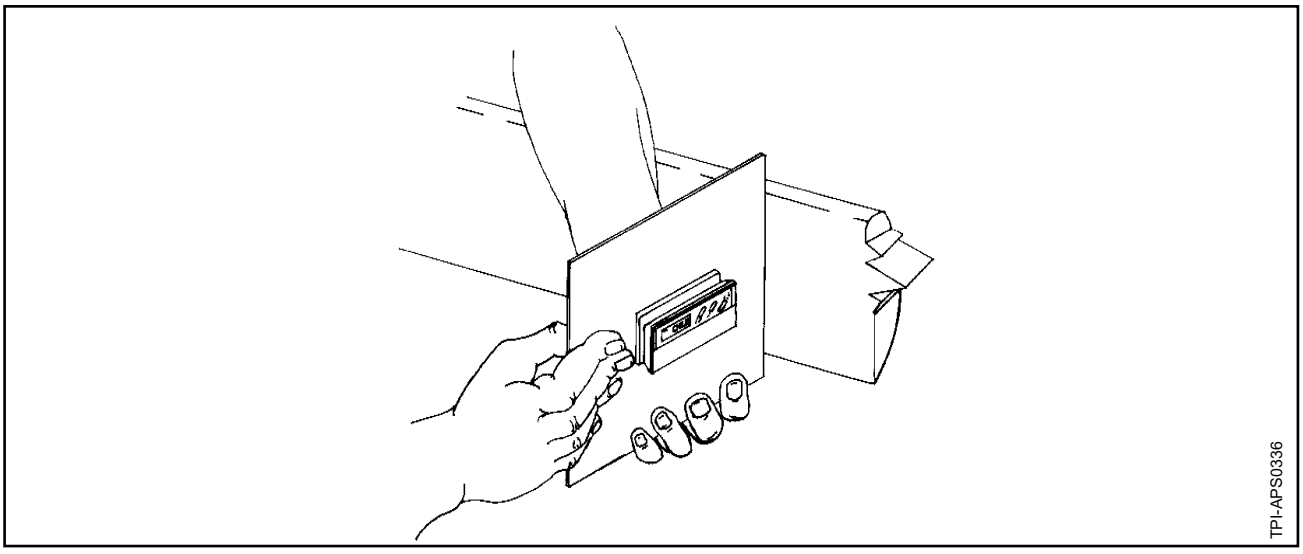
(1) Install washers (140) and the feathering stop washer (130) on top of the stop sleeve (150) using feathering tool TE383.

NOTE: The total number of washers, both inside and outside the stop sleeve (150), sets the feather angle.

(2) Tighten the feathering tool TE383 into the pitch change rod (200) until snug.

(3) Check the feather blade angle at the reference blade radius previously marked. Refer to Figure 7-27.

(a) If feather angle adjustment is required, loosen the feathering tool TE383 and remove the feather stop washer (130) and washer(s) (140) by skewing the tool sideways.



Checking Blade Angles
Figure 7-27

(b) Remove or add washer(s) (140) as needed.

NOTE: Add washers under the feather stop washer (130) to increase the feather angle. Remove washers (130) from under the feather stop washer (130) to decrease the feather angle.

(c) Install the washer(s) (140) and feather stop washer (130) with the feathering tool TE383.

(d) Check the feather blade angle at the reference blade radius previously marked.

(e) Repeat steps (3) thru (4)(d) of this procedure until feather angle is correct.

(4) When the feather angle is correct, apply air pressure to move the propeller into start lock position, with the feathering tool TE383 still installed.

NOTE: The flyweight (920) will click into place when the propeller is moved to start lock position.

(5) Release the air pressure to allow the flyweight (920) to hold the propeller at the start lock angle.

(6) Check the start lock blade angles.

NOTE: Refer to the Type Certificate Data Sheet or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59) for the start lock angle.

CAUTION: IF THE START LOCK ANGLE REQUIRES ADJUSTMENT, CONTROL THE BLADE ANGLE BY ADDING AIR PRESSURE TO THE PROPELLER TO MOVE AND HOLD THE PROPELLER OFF THE START LOCK LATCHES.

(a) If the start lock angle adjustment is required, loosen the feathering tool TE383 and remove the feather stop washer (130), washer(s) (140), stop sleeve (150), and washers (145) from the pitch change rod (200) by skewing the tool sideways.

CAUTION: AFTER THE FEATHER ANGLE HAS BEEN SET, THE TOTAL NUMBER OF WASHERS (140, 145) MUST BE MAINTAINED. CHANGING THE POSITIONS OF THE WASHERS TO ACHIEVE THE START LOCK ANGLE WILL NOT EFFECT THE FEATHER ANGLE. ADDING OR REMOVING ANY WASHERS (140, 145) THAT HAVE ALREADY BEEN INSTALLED WILL CHANGE THE FEATHER AND START LOCK ANGLES.

(b) To decrease the start lock angle, move start lock adjust washer(s) (145) from between the stop sleeve (150) and the pitch change rod (200) to between the stop sleeve (150) and the feather stop washer (130).

(c) To increase the start lock angle, move feather adjust washer(s) (140) from between the stop sleeve (150) and the feather stop washer (130) to between the stop sleeve (150) and the pitch change rod (200).

(d) Using the feathering tool TE383, reinstall the parts stack.

NOTE: The parts stack includes: washers (145), stop sleeve (150), washers (140), feather stop washer (130), and stop screw (120).

(e) Release the air pressure to allow the flyweight (920) to hold the propeller at the start lock angle.

(f) Check the start lock blade angles.

(g) Repeat steps (6) thru (6)(f) of this procedure until angles are correct.

CAUTION: TO AVOID DAMAGE TO THE PROPELLER COMPONENTS, BE SURE THE AIR PRESSURE IS APPLIED BEFORE REMOVING THE FEATHERING TOOL TE383.

(7) When angles are correct, remove the feathering tool TE383.

NOTE: When removing the feathering tool TE383, make sure the washers (140) and the feathering stop washer (130) stay in place on top of the stop sleeve (150).

(8) Using a magnet, remove only the feathering stop washer (130) from the washer stack on top of the stop sleeve (150).

(9) Install the feathering stop washer (130) on the stop screw (120).

NOTE: The self-locking patch on the threads of the stop screw (120) makes it difficult to put the feathering stop washer (130) on the stop screw.

(10) Apply one drop of thread locking compound CM74 to the threaded end of the stop screw (120).

(11) Using the T-handle wrench TE381, install the feathering stop washer (130) and the stop screw (120) through the top of the cylinder (50) into the pitch change rod (200), making sure that the washers (140) are still in position on top of the pitch change rod (200).

NOTE: A small amount of lubricant CM12 on the head of the stop screw (120) will hold the screw to the T-handle wrench long enough to guide the screw and the feathering stop washer (130) into the threaded hole in the pitch change rod (200).

(12) Tighten the stop screw (120) with the T-handle wrench TE381. Maintain a minimum screw engagement of seven threads.

(13) Release the air pressure to allow the flyweight (920) to hold the propeller at the start lock angle.

(14) Re-check the start lock blade angles.

CAUTION: IF THE START LOCK ANGLE REQUIRES ADJUSTMENT, CONTROL THE BLADE ANGLE BY ADDING AIR PRESSURE TO THE PROPELLER TO MOVE AND HOLD THE PROPELLER OFF THE START LOCK LATCHES.

(a) If high pitch angle adjustment is required, remove the stop screw (120), feather stop washer (130), feather adjust washer(s) (140), stop sleeve (150), and start lock adjust washers (145) from the pitch change rod (200).

CAUTION: AFTER THE FEATHER ANGLE HAS BEEN SET, THE TOTAL NUMBER OF WASHERS (140, 145) MUST BE MAINTAINED. CHANGING THE POSITIONS OF THE WASHERS TO ACHIEVE START LOCK ANGLE WILL NOT EFFECT THE FEATHER ANGLE. ADDING OR REMOVING ANY WASHERS (140, 145) THAT HAVE ALREADY BEEN INSTALLED WILL CHANGE THE FEATHER AND START LOCK ANGLES.

(b) To decrease the start lock angle, move start lock adjust washer(s) (145) from between the stop sleeve (150) and the pitch change rod (200) to between the stop sleeve (150) and the feather stop washer (130).

(c) To increase the start lock angle, move feather adjust washer(s) (140) from between the stop sleeve (150) and the feather stop washer (130) to between the stop sleeve (150) and the pitch change rod (200).

(d) Using the T-handle wrench TE381, reinstall the parts stack.

NOTE: The parts stack includes: start lock adjust washer(s) (145), stop sleeve (150), feather adjust washers (140), feather stop washer (130), and stop screw (120).

(15) Tighten the stop screw (120) with the T-handle wrench TE381. Maintain a minimum screw engagement of seven threads.

(16) When the start lock angle is correct, install a new low stop O-ring (40) in the top of the cylinder (50).

B. Low Pitch Blade Angle

CAUTION: THE LOW PITCH STOP (30) MUST BE TURNED A MINIMUM OF FIVE THREADS INTO THE CYLINDER.

(1) Install the low pitch stop (30) in the top of the cylinder (50).

NOTE: If necessary, refer to Figure 5-1, "Pitch Stop Dimensions" in the Check chapter of this manual to determine the appropriate low pitch stop (30) for the blade angle required.

(2) Check the low pitch stop angle.

(a) Rotate the blades to the low pitch position and set the propeller pitch in accordance with the aircraft Type Certificate Data Sheet and/or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) Adjust the low pitch angle with the low pitch stop (30).

1 To increase pitch, turn the low pitch stop (30) clockwise.

2 To decrease pitch, turn the low pitch stop (30) counterclockwise.

CAUTION 1: BE SURE AIR PRESSURE IS APPLIED BEFORE REMOVING THE STOP SCREW (120).

CAUTION 2: ADD WASHERS BETWEEN THE STOP SCREW (120) AND THE FEATHER STOP WASHER (130) ONLY.

3 If low pitch cannot be obtained because the low pitch stop (30) bottoms out or exceeds the five thread engagement minimum, washers (135) may be added or removed between the stop screw (120) and the feather stop washer (130) only.

NOTE: This will not change the feather blade angle.

7. Charging the Propeller with Air

A. 3C2-FP650A1 Propellers

(1) To determine the proper pressure, refer to the Maintenance Practices chapter of Hartzell Propeller Inc. Owner's Manual 480 (61-00-80).

(2) Using proper control, charge the cylinder with dry air or nitrogen.

NOTE: Nitrogen is the preferred charging medium.

(3) Apply solution CM122 to the air valve (10) pin to check for air leaks.

(4) Apply solution CM122 where the air valve (10) and the low pitch stop (30) meet to check for air leaks.

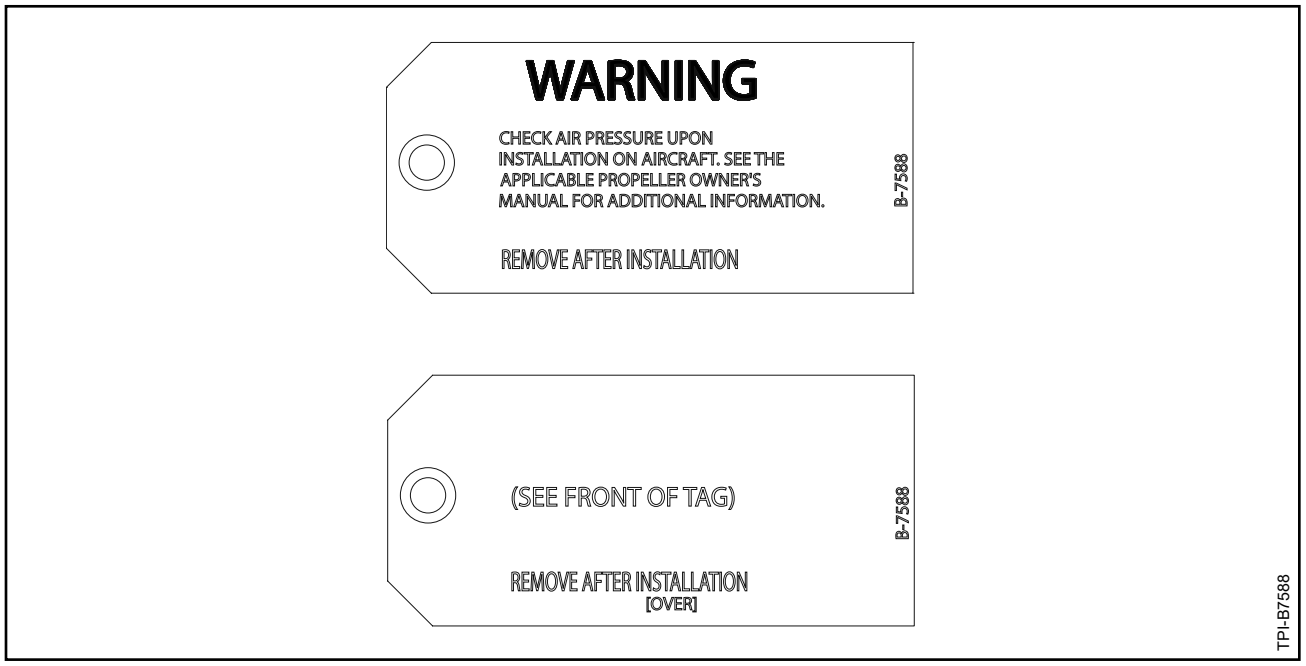
(5) Apply solution CM122 where the low pitch stop (30) and the nut (20) meet to check for air leaks.

(6) Recheck the air charge pressure in the cylinder to make sure that there are no air leaks.

(a) If primer CM127 was not used on the air valve (10), permit twelve hours between pressure checks.

(b) If primer CM127 was used on the air valve (10), permit two hours between pressure checks.

(7) Install tag B-7588 or equivalent on the air valve assembly. Refer to Figure 7-28.



Air Pressure Check Warning Tag
Figure 7-28

8. Leak Test (Rev.3)

A. Leak Test Procedure

NOTE: Refer to the Illustrated Parts List chapter of this manual for the location of the lubrication fittings and lubrication plugs (engine-side/cylinder-side) for the applicable propeller model.

(1) Install the lubrication fittings (280) in the applicable side of the hub.

(a) Tighten each lubrication fitting (280) until finger-tight, then tighten one additional 360 degree turn.

(2) Install the lubrication plugs (270) in the applicable side of the hub.

(a) Leave one lubrication plug hole open for leak testing.

(b) Tighten each lubrication plug (270) until finger-tight, then tighten one additional 360 degree turn.

(3) With the hub installed on the propeller test stand, perform the leak test in accordance with the following steps:

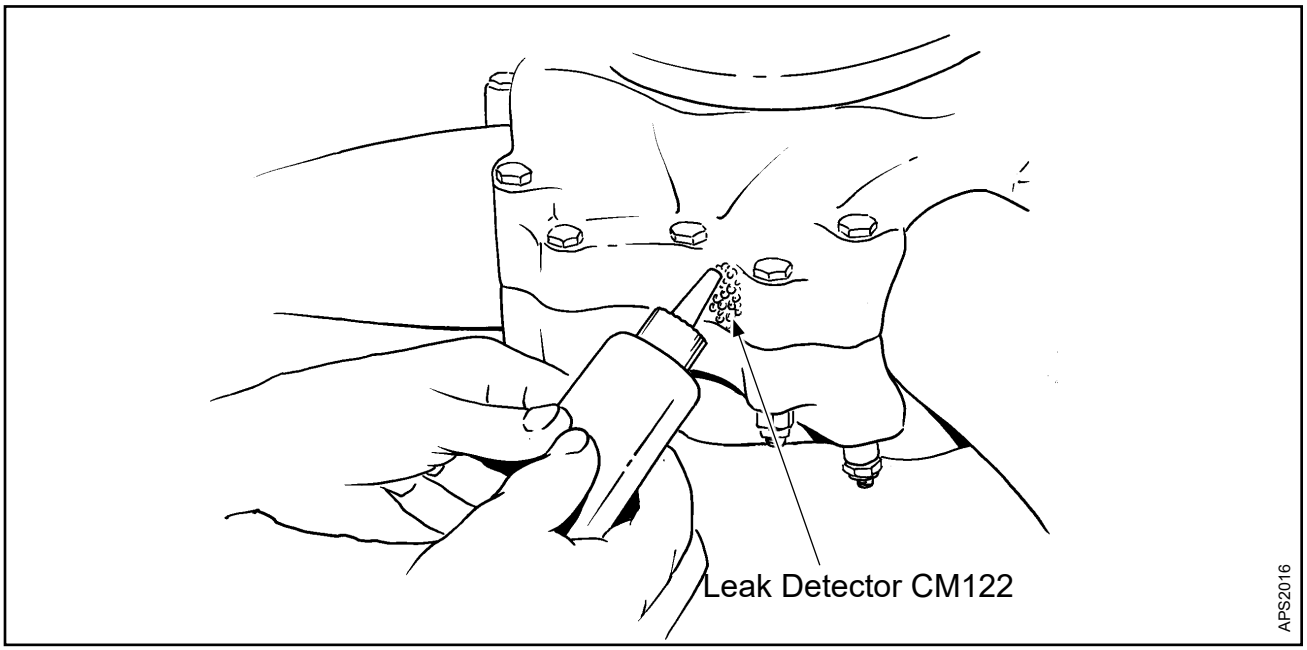
(a) Move the propeller to low pitch.

(b) Apply leak detector CM122 to the open lubrication plug hole. Refer to Figure 7-29.

1 If there is any indication of air exiting the hub, refer to the Testing and Fault Isolation chapter of this manual.

(4) After the leak test is complete, install the remaining lubrication plug (270) in the applicable side of the hub.

(a) Tighten the lubrication plug (270) until finger-tight, then tighten one additional 360 degree turn.



Hub Leak Test
Figure 7-29

9. Post-Assembly Procedures

A. Counterweight Installation

(1) For the correct counterweight (2000) for the propeller, refer to the Hartzell Propeller Inc. Application Guide Manual (61-02-59).

(2) For installation of a counterweight (2000) on a composite blade, refer to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

B. Propeller Lubrication

(1) Lubricate the propeller in accordance with the Propeller Lubrication chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

C. Static Balance

NOTE: When assembling a propeller that will be disassembled for shipping, it is not necessary to install safety wire to the static balance weight drilled screws (800).

(1) Perform static balance of the propeller in accordance with the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

D. Label Placement

(1) For installation of labels, refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) or to Hartzell Propeller Inc. Composite Blade Overhaul Manual 135F (61-13-35).

10. Disassembling a Propeller for Shipping

A. General

(1) A propeller disassembled for shipping has had one or more blades removed from the propeller after assembly. The propeller was fully assembled, tested, inspected, lubricated, and statically balanced before blade removal and shipping.

(2) A propeller disassembled for shipping must be assembled by trained personnel in accordance with Hartzell Propeller Inc. manuals.

(3) For additional general assembly information, refer to the section, "General" at the beginning of this chapter.

B. Preparing the Propeller for Shipping

(1) New hardware was installed during propeller assembly. When disassembling a propeller for shipping, it is not necessary to discard hardware that would require replacement at overhaul.

(2) New O-rings have been installed during propeller assembly. When disassembling a propeller for shipping, it is not necessary to replace O-rings unless they are damaged during component installation or removal.

(3) Before removal, make a mark to indicate alignment of each blade assembly, fork unit, spinner bulkhead, and balance weight location with the hub unit. Refer to the section, "Marking Before Disassembly" in the Disassembly chapter of this manual.

(a) Before removal of the pitch change block (320), make a mark to indicate position and orientation to the pitch change fork unit.

1 The pitch change blocks may be taped in place in the pitch change fork.

(4) Remove all balance weight screws (800) and balance weights (810).

(5) Disconnect the electric de-ice lead wires from the hub and bulkhead, if applicable.

(6) Disassemble the propeller to the point of blade removal in accordance with the Disassembly chapter of this manual.

(7) Propeller Reassembly with Blades Removed for Shipping

(a) Reassemble the propeller without the blade assemblies in accordance with the applicable assembly instructions in this chapter.

1 The pitch change blocks (320) can be taped in position in the fork (300).

(8) Packing the Propeller and Blades for Shipping

(a) Refer to the Packaging and Storage chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02), for packing the propeller and blades for shipping.

(b) Pack the propeller without blades for shipping.

(c) Pack the blades for shipping with the blade seal, blade bearings, and lubricant on each blade shank.

11. Reassembling a Propeller that was Disassembled for Shipping

A. Unpacking the Propeller and Blades

(1) Carefully unpack the propeller and blades from shipping.

(2) Visually examine each propeller component for shipping damage.

(a) If damage is found, refer to the Check chapter of this manual for the inspection, serviceable limits, and corrective action criteria for the specific component.

B. Preparing the Propeller for Reassembly

NOTE 1: Propellers that are properly packaged for shipment are assembled with new hardware. When reassembling a propeller, it is not necessary to discard hardware that would require replacement at overhaul.

NOTE 2: Propellers that are properly packaged for shipment are assembled with new O-rings. When reassembling a propeller, it is not necessary to replace O-rings, unless they are damaged.

(1) Make sure that each blade assembly, the fork unit, and each balance weight (810) has been marked for alignment with the hub unit.

(2) Remove all balance weight screws (800) and balance weights (810), if necessary.

C. Propeller Reassembly

(1) Reassemble the propeller in accordance with the applicable assembly instructions in this chapter.

(2) Reconnect the electric de-ice lead wires to the bulkhead, if applicable.

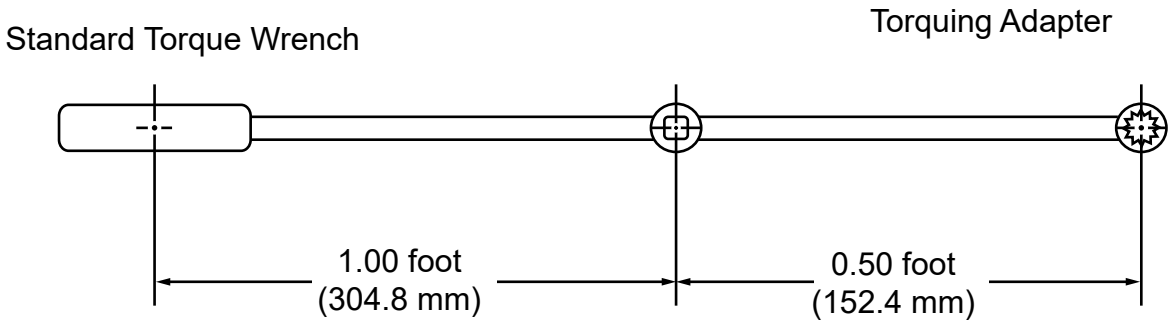
(Blank Page)

FITS AND CLEARANCES - CONTENTS

LIST OF FIGURES

LIST OF TABLES

(Blank Page)



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

EXAMPLE:

$$\frac{\text{100 Ft-Lb (136 N•m) x 1 ft (304.8 mm)}}{\text{1 ft (304.8 mm) + 0.50 ft (152.4 mm)}} = \text{66.7 Ft-Lb (90.1 N•m)}$$

reading on torque wrench with 6-inch (152.4 mm) adapter for actual torque of 100 Ft-Lb (136 N•m)

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

APS212

Calculating Torque When Using a Torque Wrench Adapter
Figure 8-1

1. Torque Values (Rev. 2)

A. Important Information

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

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

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

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

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

(3) For the torque values to use when assembling a Hartzell Propeller Inc. propeller, refer to Table 8-1, "Torque Values" in this chapter.

(4) When an adapter is used with a torque wrench, use the equation in Figure 8-1 to determine the correct torque value.

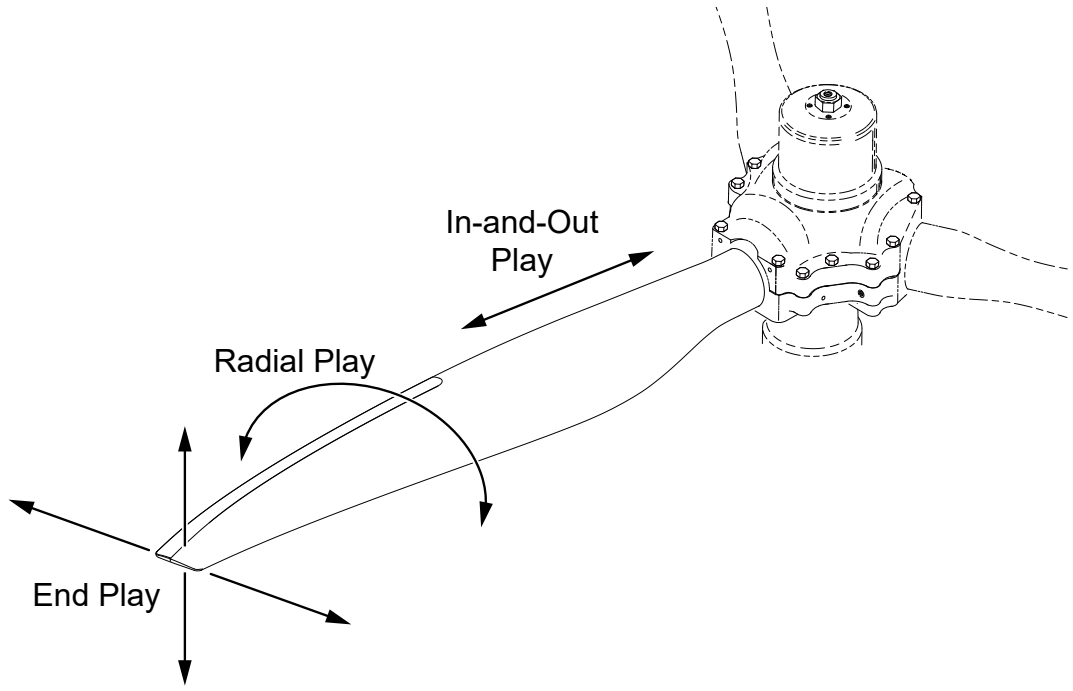
CAUTION 1: TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS, UNLESS SPECIFIED IN TABLE 8-1.

CAUTION 2: FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER, REFER TO FIGURE 8-1.

NOTE: Torque tolerance is ±10% unless otherwise noted.

Item No.	Part Number	Description	Torque		
			Ft-Lb	In-Lb	N•m
10	B-1938	Valve Assembly	Torque until tight and no air leaks from around valve.		
20	A-2405-4	Nut, 15/16-20, Hex	25-30	300-360	34-40
50	B-2423-1	Cylinder	120-150 wet	1440-1800 wet	163-203 wet
100	B-3841-8	Screw, 1/4-28, Fillister Head	-	50	5.7
120	A-3205	Screw, 5/16-24, Cap	10-15	120-180	14-20
170	B-3807	Nut, 5/8-18, Hex, Self-Locking	15-25	180-300	20-34
200	B-2491-5	Pitch Change Rod	40 wet	480 wet	54 wet
350	A-2043-1	Nut, 3/8-24, Hex, Self-Locking	24-26	288-312	33-35
910	A-1595	Screw, Shoulder, 1/4"	-	48	5.5

Torque Values
Table 8-1



Blade Play
Figure 8-2

2. Blade Tolerances

A. Blade Play

(1) Limits for blade play are specified below. Refer to Figure 8-2.

(a)	Radial Play	±0.5 degree (1 degree total) measured at reference station
(b)	In-and-Out Play	0.020 inch (0.50 mm)
(c)	End Play: Leading Edge to Trailing Edge Fore-and-Aft (face to camber)	

NOTE 1: Hartzell Propeller Inc. Raptor-series propellers use specially designed spacers within the propeller to achieve the required blade fit. The blades may feel loose in the hub when compared to Hartzell Compact-series propellers. During propeller rotation, the blade fit within the propeller is the same as other Hartzell propeller models.

NOTE 2: Blade tip play is affected by the fit of the blade within the propeller, and also by movement of components within the engine and the aircraft. The following check will evaluate only the fit of the blade within the propeller.

1 Using one finger and thumb, apply a light load of approximately 5 lbs. (2.2 kg) to the blade in the direction of the check being performed.

a Apply the load at the mid-span of the blade approximately in line with the blade decal.

2 Measure blade play at the tip of the blade.

a The maximum permitted blade play is 0.25 inch (6.3 mm).

(d) If blade play is greater than the permitted limit, contact the Hartzell Propeller Inc. Product Support Department.

B. Blade Track

(1)	Blade Track	0.125 inch (3.17 mm)

C. Blade Pitch Tolerance

(1)	Blade pitch setting tolerance between blades at low pitch	0.2 degree

(Blank Page)

SPECIAL TOOLS, FIXTURES, AND EQUIPMENT - CONTENTS

(Blank Page)

1. Tooling and Facility Requirements (Rev. 1)

   A. Standard Tooling

      (1) Propeller repair stations certified by the FAA or international equivalent to overhaul Hartzell Propeller Inc. propellers are expected to possess precision fixtures, tools, and blade tables for blade inspection and repair.

         (a) Except as specifically required in this manual, locally fabricated tooling is acceptable for most repair and inspection operations.

   B. Special Tooling

      (1) Special tooling may be required for procedures in this manual. For futher tooling information, refer to Hartzell Propeller Inc. 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) It is the responsibility of the repair station or the technician performing the repair or servicing to use these special tools as required.

   C. Facilities

      (1) Grinding, plating, and painting of propeller components can create health and safety hazards beyond that of other areas of a typical workshop.

         (a) Areas where grinding, plating, and painting are performed should comply with governmental regulations for occupational safety and health, industry standards, and environmental regulations.

      (2) Workshop areas need to be segregated to prevent contamination.

         (a) Separate areas should be designated for cleaning, inspection, painting, plating, and assembly.

         (b) Propeller balancing must be performed in a draft free area.

(Blank Page)

ILLUSTRATED PARTS LIST - CONTENTS

PROPELLER PARTS LISTS and FIGURES

SUB-ASSEMBLY PARTS LISTS and FIGURES

1. Introduction (Rev. 1)

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

A. General

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 IN THIS MANUAL FOR IDENTIFICATION OF PROPELLER CRITICAL PARTS.

(1) This chapter includes the parts lists and applicable illustrations for the propeller models included in this manual.

CAUTION: THE ILLUSTRATIONS IN THIS CHAPTER ARE PROVIDED FOR PART IDENTIFICATION AND LOCATION REFERENCE ONLY. THEY SHOULD NOT BE USED FOR ASSEMBLY.

(a) The illustrations in this chapter use some general views of parts that may not exactly depict every propeller part configuration.

B. Counterweights/Slugs/Mounting Hardware

(1) Counterweights, counterweight slugs, and the applicable mounting hardware are application specific. Refer to Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

C. Spinner Assemblies/Mounting Hardware

(1) Spinner assemblies and the applicable mounting hardware are application specific. Refer to Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

D. Ice Protection System Components

(1) Ice protection systems are application specific. Refer to Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(a) For components of ice protection systems supplied by Hartzell, refer to Hartzell Propeller Inc. Ice Protection System Manual 180 (30-61-80).

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

2. Description of Columns (Rev. 1)

A. Fig./Item Number

(1) Figure Number refers to the illustration where items appear.
Item Numbers refer to the specific part callout in the applicable illustration.

(a) Item Numbers that are listed but not shown in the illustration are identified by a dash to the left of the item number. (example: "-800")

(b) Alpha variants will be used to add additional items. There are two reasons for the use of alpha variants:

1 A part may have an alternate, or may be superseded, replaced, or obsoleted by another part.

a For example, the self-locking nut (A-2043) that is item 20 was superseded by the self-locking nut (A-2043-1) that is item 20A.

2 An Illustrated Parts List may contain multiple configurations. Effectivity codes are used to distinguish different part numbers within the same list.

a For example, one propeller configuration may use a mounting bolt (B-3339-1) that is item 30, yet another propeller configuration uses a mounting bolt (B-3347) that is item 30A. Effectivity codes are very important in the determination of parts in a given configuration.

B. Part Number

(1) The Part Number is the Hartzell Propeller Inc. identification number for the part.

(2) Use the Hartzell Propeller Inc. part number when ordering the part from Hartzell or a Hartzell-approved distributor.

C. Description

(1) This column provides the Hartzell Propeller Inc. description of the part.

(2) Bullets and indentations are used to indicate parts that are components of a sub-assembly.

(a) For example, a Fork Assembly that is part of a HC-C2YR-1 propeller assembly will have one bullet (•) before the description. This indicates that the Fork Assembly is part of the propeller assembly.

1 A Fork Bumper that is part of the Fork Assembly will appear directly below the Fork Assembly with two bullets (• •) before the description. This indicates that the Fork Bumper is part of the Fork Assembly - that is part of the Propeller Assembly.

a Example: HC-C2YR-1
• Fork Assembly
• • Fork Bumper

(3) If the description in this column includes a "PCP:" prefix, the part is classified as a Propeller Critical Part.

(4) If applicable, information regarding part alternatives, supersedures, replacements, or obsolescence will appear in the Description column.

(a) Refer to the section, "Description of Terms" in this chapter for definitions and requirements for part "alternates", "supersedures", etc.

(b) When part alternatives, supersedures, replacements, etc. are listed, the service document number related to the change may be included for reference.

(5) If applicable, vendor CAGE codes will be listed in the Description column.

D. Effectivity Code (EFF CODE)

(1) This column is used when additional information about a part is required.

(a) Effectivity codes can be used to identify parts that are only used on a particular model, or to direct the user to additional information in the "Effectivity" box at the bottom of the page.

(b) Whenever an effectivity code is present, refer to the "Effectivity" box at the bottom of the page for the applicable information.

(2) Parts common to all assembly models on the page show no effectivity code.

E. Units Per Assembly (UPA)

(1) Designates the total quantity of an item required for the next higher assembly or subassembly.

F. Overhaul (O/H)

(1) Designates the parts to be replaced at overhaul. A “Y” identifies the parts that must be replaced at overhaul.

NOTE: An overhaul kit may not contain all the parts identified with a "Y" for a particular model propeller. An example of parts that may not be included in the overhaul kit is spinner mounting parts.

G. Propeller Critical Part (PCP)

(1) This column identifies the Propeller Critical Parts (PCP) that are contained in each propeller model.

(a) Refer to the Introduction chapter of this manual for the definition of Propeller Critical Parts (PCP).

3. Description of Terms (Rev. 1)

A. Alternate

(1) Alternate parts are identified by the term "ALTERNATE" in the Description column. Alternate items are considered airworthy for continued flight and existing stock of parts may be used for maintenance and/or repair. The new or alternate part number may be used interchangeably when ordering/stocking new parts.

B. Supersedure

(1) Part changes are identified by the terms “SUPERSEDES ITEM _____” or “SUPERSEDED BY ITEM _____” in the Description column. Superseded items are considered airworthy for continued flight and existing stock of superseded parts may be used for maintenance and/or repair. Once the superseding part has been incorporated/installed into an assembly, the original superseded part may no longer be used. Superseded parts may no longer be available, and the new part number must be used when ordering/stocking new parts.

C. Replacement

(1) Part changes identified by the terms "REPLACES ITEM _____” or “REPLACED BY ITEM _____” in the Description column are considered airworthy for continued flight, but must be replaced with a part with the new part number at overhaul. Existing stock of replaced parts may not be used for maintenance and/or repair of effected assemblies. Replaced parts may no longer be available, and the new part number must be used when ordering/stocking new parts.

D. Obsolete

(1) Obsolete parts are identified by "OBS” in the Units Per Assembly (UPA) column. Obsolete items are considered unairworthy for continued flight.

4. Vendor Supplied Hardware (Rev. 1)

A. Important Information

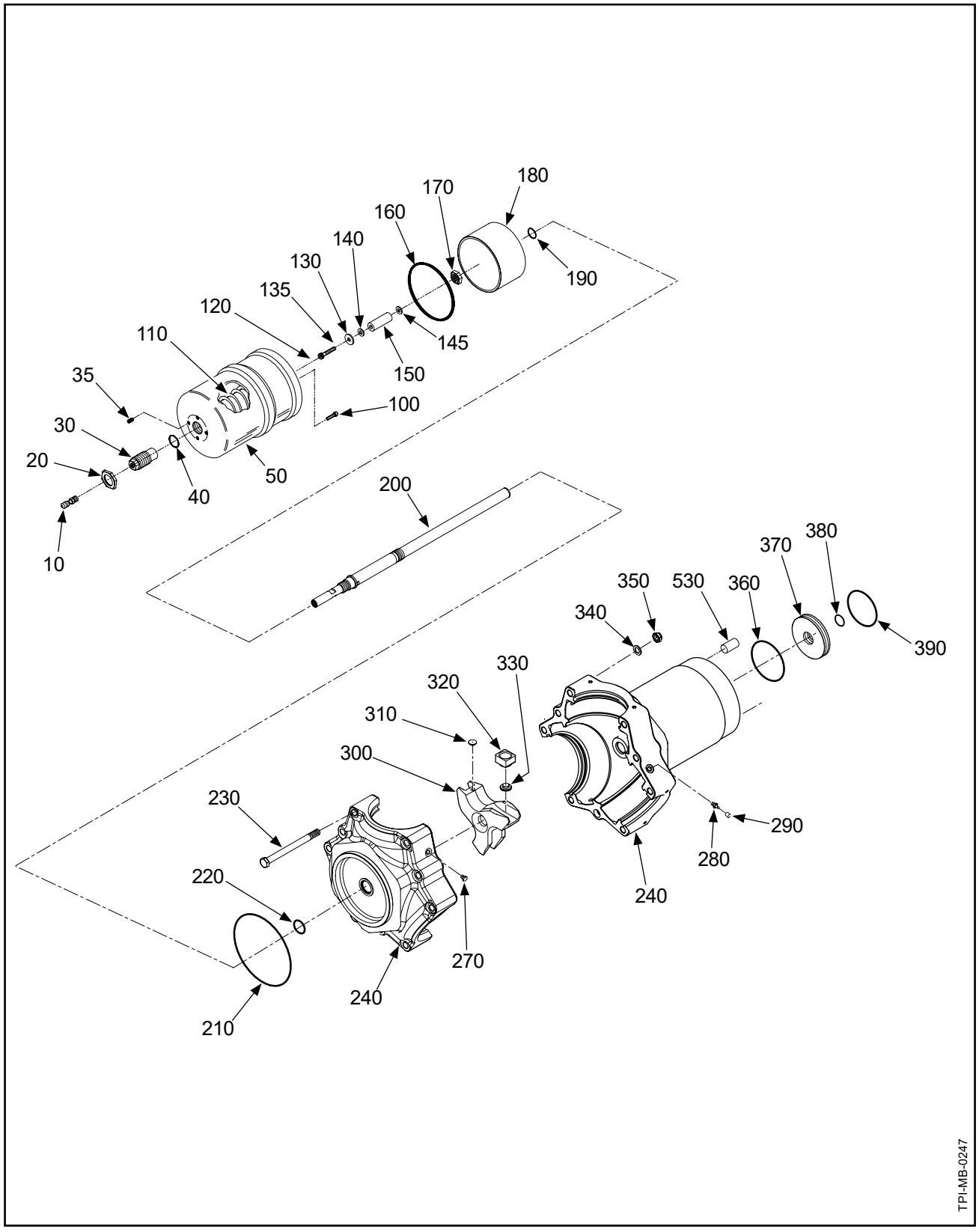
(1) Many O-rings, fasteners, and other vendor supplied hardware listed in Hartzell Propeller Inc. manuals have previously been specified with AN, MS, NAS, or vendor part number. To provide internal controls and procurement flexibility, Hartzell part numbers have been assigned to all O-rings, fasteners, and hardware. Part shipments from Hartzell Propeller Inc. will specify only the Hartzell part numbers.

(2) Some O-rings, fasteners, and hardware manufactured in accordance with established industry specifications (certain AN, MS, NAS items) are acceptable for use in Hartzell Propeller Inc. products without additional standards imposed by Hartzell.

(a) For a listing of part number interchangeability, refer to the Vendor Cross Reference chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(b) Where permitted, both the Hartzell part number item and AN, MS, NAS, and other specified vendor number items can be used interchangeably.

(c) The Hartzell part number must be used when ordering these parts from Hartzell Propeller Inc.



3C2-FP650A1: Propeller Parts
Figure 10-1

FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
		3C2-FP650A1				
10-1		**PROPELLER PARTS**				
10	B-1938	• VALVE ASSEMBLY		1	Y	
20	A-2405-4	• NUT, 15/16-20, HEX		1		
30	A-2404-( )	• STOP, PITCH		1		
35	B-7589	• SCREW, SET, 1/4-28, DRILLED		1	Y	
40	C-3317-117	• O-RING		1	Y	
50	B-2423-1	• CYLINDER UNIT		1		
100	B-3841-8	• SCREW, 1/4-28, FILLISTER HEAD		4	Y	
110	B-1589-2	• SPRING ASSEMBLY (FEATHER ASSIST) (REFER TO "B-1589-2 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
120	A-3205	• SCREW, 5/16-24, CAP		1	Y	
130	A-2411-1	• WASHER		1	Y	
135	B-3837-0563	• WASHER, CORROSION RESISTANT		A/R	Y	
135A	B-3837-0532	• WASHER, CORROSION RESISTANT		A/R	Y	
140	B-3837-0563	• WASHER, CORROSION RESISTANT		A/R	Y	
140A	B-3837-0532	• WASHER, CORROSION RESISTANT		A/R	Y	
145	A-2435	• WASHER, 5/16"		A/R	Y	
145A	A-2435-1	• WASHER, 5/16"				
150	A-2499-( )	• SLEEVE, STOP		1		
160	C-3317-427-1	• O-RING		1	Y	
170	B-3807	• NUT, 5/8-18, HEX, SELF-LOCKING		1	Y	
180	B-3683	• PISTON		1		
190	C-3317-210-1	• O-RING		1	Y	
200	B-2491-5	• ROD, PITCH CHANGE		1		
210	C-3317-247	• O-RING		1	Y	
220	C-3317-210-1	• O-RING		1	Y	
230	A-2432	• BOLT, 3/8-24, HEX HEAD		9		
240	107007	• PCP: HUB UNIT, 3C2-FP( )A1 (REFER TO "107007 HUB UNIT" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		PCP
270	106545	• PLUG, LUBRICATION (CYLINDER-SIDE OF HUB)		3	Y	
280	A-279	• FITTING, LUBRICATION (ENGINE-SIDE OF HUB)		3	Y	
290	B-6544	• CAP, FITTING, LUBRICATION		3	Y	
300	105732	• FORK, THREE BLADE ASSEMBLY		1		
310	A-3256	• BUMPER, FORK		3	Y	
320	105733	• BLOCK, PITCH CHANGE		3		
330	106136	• BUTTON, BLOCK, PITCH CHANGE		3	Y	

EFFECTIVITY MODEL

- ITEM NOT ILLUSTRATED

FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
		3C2-FP650A1, CONTINUED				
10-1		**PROPELLER PARTS, CONTINUED**				
340	B-3834-0632	• WASHER		9	Y	
350	A-2043-1	• NUT, 3/8-24, HEX, SELF-LOCKING		9	Y	
360	A-5839-225	• RING, RETAINING, INTERNAL SPIRAL		1	Y	
370	A-2481	• PLUG, HUB		1		
380	C-3317-115-1	• O-RING		1	Y	
390	C-3317-226	• O-RING		1	Y	
		F-FLANGE MOUNTING PARTS				
		• (REFER TO "F-FLANGE MOUNTING PARTS" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)				
		BLADE RETENTION PARTS				
		• (REFER TO "BLADE RETENTION PARTS" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)				
		BALANCE PARTS				
-800	B-3840-( )	• SCREW		A/R	Y	
-810	A-2424-( )	• BALANCE WEIGHT		A/R		
N/A		**SPINNER PARTS**				
		• APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC.APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY MODEL

- ITEM NOT ILLUSTRATED

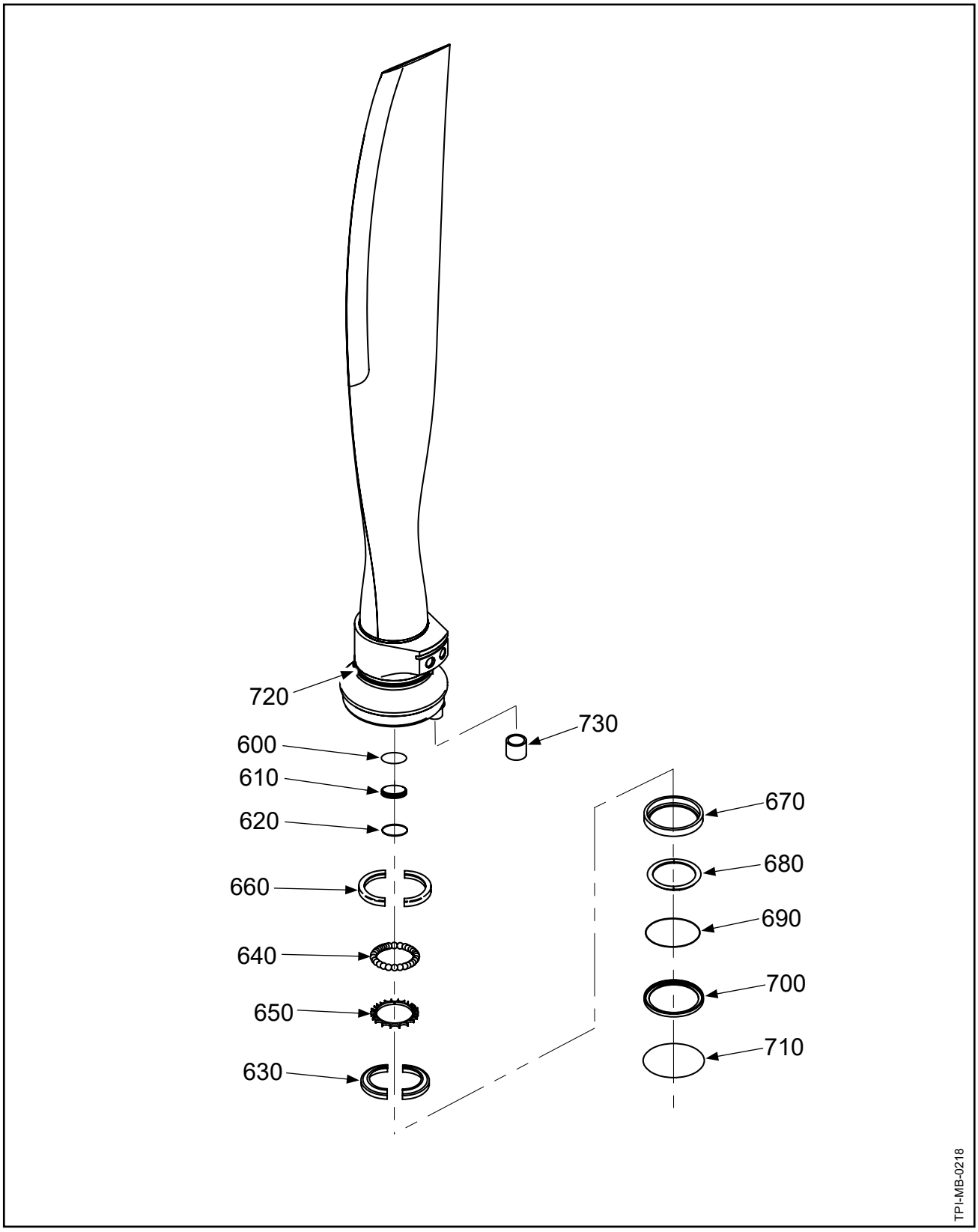
FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
		3C2-FP650A1, CONTINUED				
N/A		**COUNTERWEIGHTS/MOUNTING BOLTS**				
-2000		• COUNTERWEIGHT APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER PART (PCP) IDENTIFICATION				PCP
		• COUNTERWEIGHT MOUNTING BOLTS REFER TO THE APPLICABLE HARTZELL PROPELLER INC. BLADE MAINTENANCE MANUAL: MANUAL 135F (61-13-35) - COMPOSITE BLADES MANUAL 133C (61-13-33) - ALUMINUM BLADES				
N/A		**COUNTERWEIGHT SLUGS/MOUNTING HARDWARE**				
		• COUNTERWEIGHT SLUGS AND SLUG MTG. HARDWARE APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER PART (PCP) IDENTIFICATION				

EFFECTIVITY MODEL

- ITEM NOT ILLUSTRATED

(Blank Page)

SUB-ASSEMBLY
PARTS LISTS and FIGURES



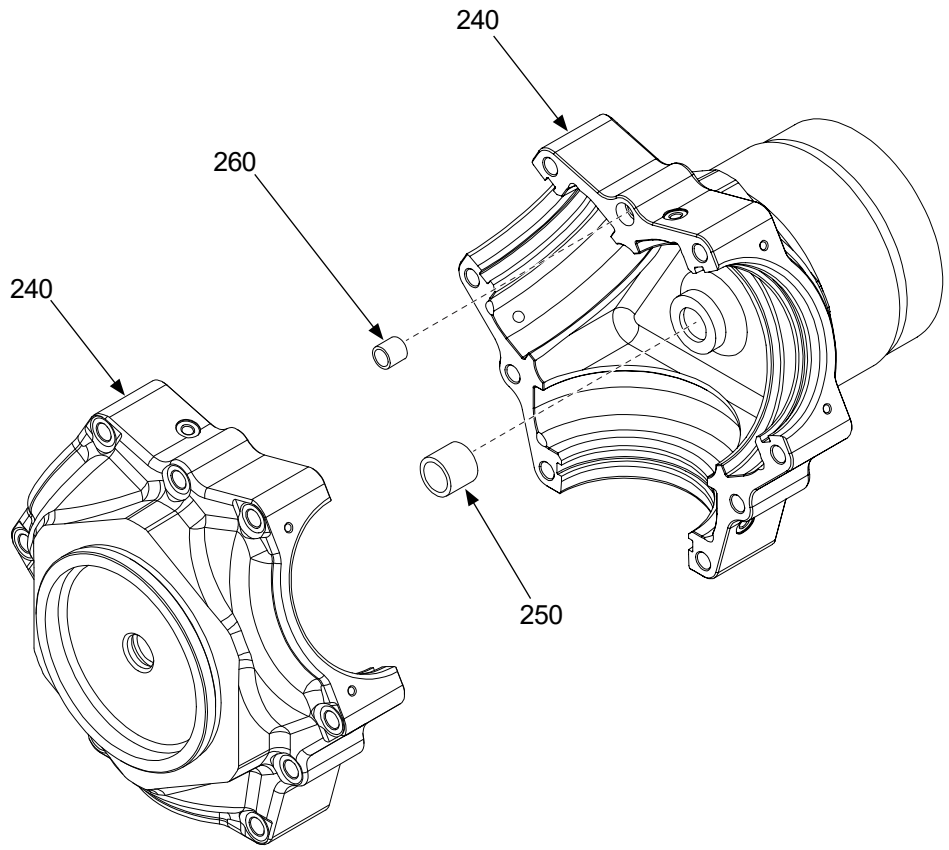
Blade Retention Parts
Figure 10A-1

FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-1		**BLADE RETENTION PARTS** **All quantities (UPA) in this parts list are per blade assembly.**				
600	C-3317-028	O-RING (BLADE PLUG)		1	Y	
610	106048	PLUG, BLADE		1		
620	A-5839-156	RING, RETAINING, INTERNAL SPIRAL (BLADE PLUG)		1	Y	
630	C-792-B	RACE, BLADE SIDE		1		
640	B-6144-1	BALL, BEARING, 3/8" DIA		33	Y	
650	B-793	BALL SPACER		1	Y	
660	C-792-A	RACE, HUB SIDE		1		
670	101512	RING, RETAINING, BEARING		1		
680	105758-( )	SHIM, BLADE		1		
690	C-3317-246	O-RING (BLADE SEAL ID)		1	Y	
700	106117	SEAL, BLADE	A	1		
700A	107223	SEAL, BLADE (ALTERNATE FOR ITEM 700)		1		
710	C-3317-158	O-RING (BLADE SEAL OD)		1	Y	
720	C-3317-341-8	O-RING		1	Y	
730	105731	BUSHING, KNOB, PITCH CHANGE		1	Y	

EFFECTIVITY	MODEL
A	106117 BLADE SEALS IDENTIFIED AS "REV. C" OR LATER

- ITEM NOT ILLUSTRATED

Blade Retention Parts



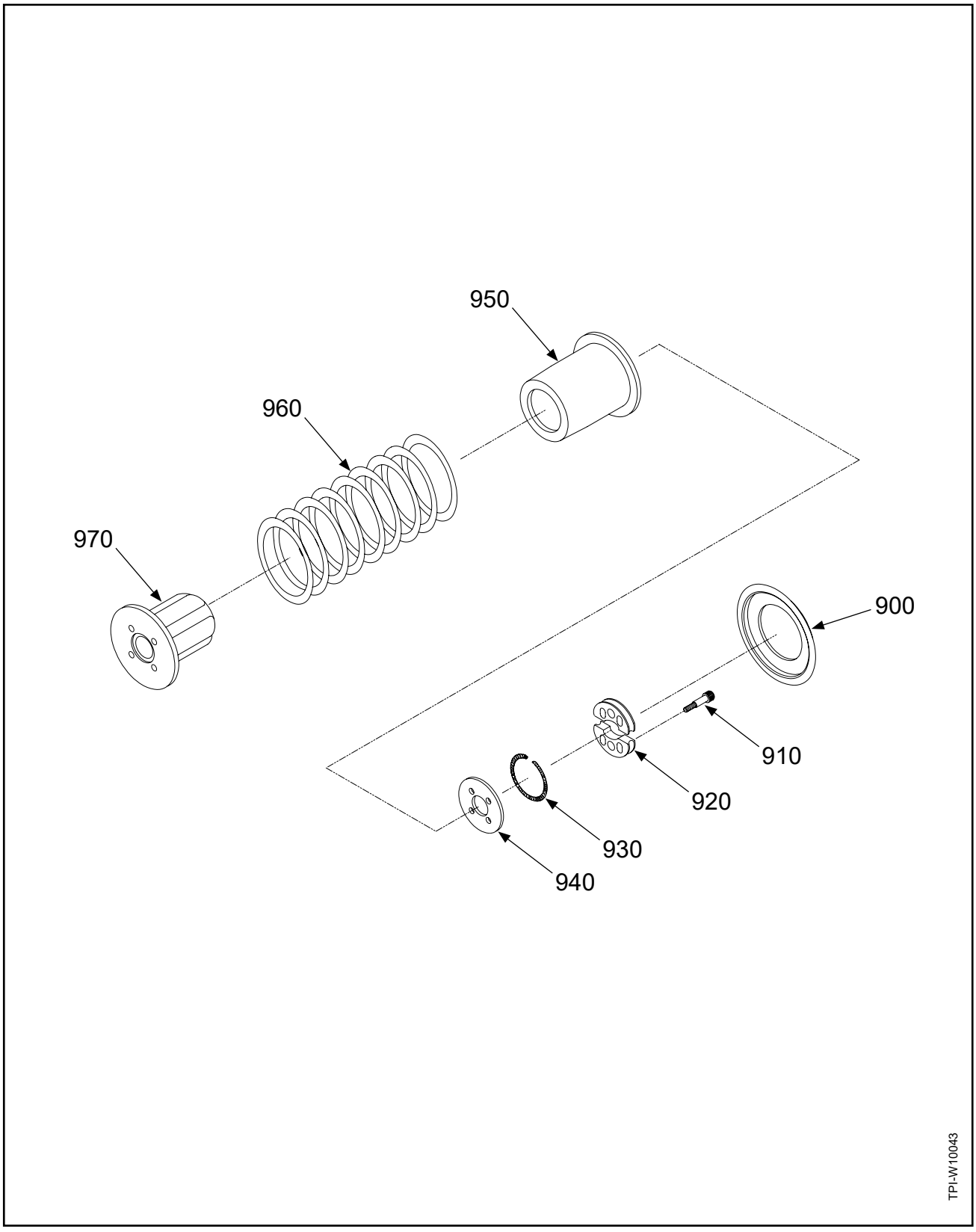
107007 Hub Unit
Figure 10A-2

FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-2		**107007 HUB UNIT PARTS**				
240	107007	PCP: HUB UNIT, 3C2-FP( )A1( )		1		PCP
250	A-2245-8	• HUB BUSHING, ROD (ENGINE-SIDE)		1	Y	
260	A-2249	• HUB BUSHING, GUIDE		1	Y	

EFF CODE	INFORMATION

- ITEM NOT ILLUSTRATED

107007 Hub Unit



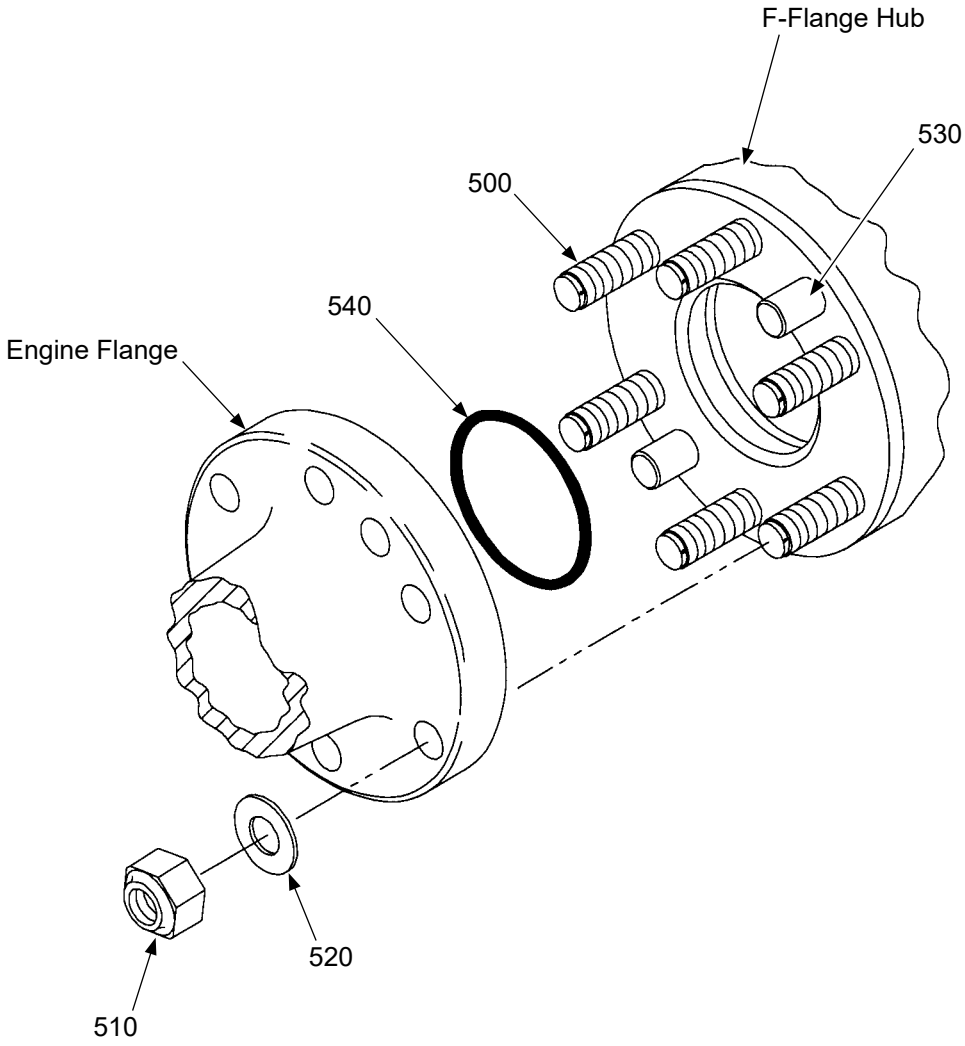
B-1589-2 Spring Assembly
Figure 10A-3

FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-3		**B-1589-2 SPRING ASSEMBLY PARTS**				
900	A-1591	SPRING GUIDE		1		
910	A-1595	SCREW, SHOULDER, 1/4"		4	Y	
920	B-318	FLYWEIGHT, START LOCK		1		
930	A-1596	SPRING, EXTENSION		1	Y	
940	A-3744	PLATE, FLYWEIGHT		1		
950	B-1592-1	GUIDE, SPRING, PLASTIC		1	Y	
960	B-1594-1	SPRING, COMPRESSION		1		
970	B-1593	HOUSING, START LOCK		1		

EFFECTIVITY MODEL

- ITEM NOT ILLUSTRATED

B-1589-2 Spring Assembly



F-flange Mounting Parts
Figure 10A-4

FIG/ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-4		**F-FLANGE MOUNTING PARTS**				
500	A-2429-( )	STUD, MOUNTING, 1/2-20	A	6	Y	
510	A-2044	NUT, 1/2-20, HEX, SELF-LOCKING		6	Y	
520	A-1381	WASHER, 1/2" CRES		6	Y	
530	B-6138-8-9	DOWEL PIN		2	Y	
540	C-3317-228	O-RING		1	Y	

EFFECTIVITY	MODEL
A	MOUNTING STUDS ARE APPLICATION SPECIFIC. REFER TO THE HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).

- ITEM NOT ILLUSTRATED

F-flange Mounting Parts

(Blank Page)