HARTZELL PROPELLER INC.
One Propeller Place
Piqua, Ohio 45356-2634 U.S.A.
Telephone: 937.778.4200
Fax: 937.778.4391

MANUAL REVISION TRANSMITTAL
MANUAL 114C (61-10-14)
-3 and -5 Steel Hub Propeller Maintenance Manual
REVISION 14 dated June 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 pages in this manual.

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

(Blank Page)

Manual 114C
61-10-14
Revision 14
June 2023

-3 and -5
Steel "A" Hub Propeller
Overhaul Manual

Two Blade	Three Blade
BHC-A2VF-3	HC-A3VF-3L
HC-A2V20-3L	HC-A3V20-3L
BHC-A2MVF-3	HC-A3MVF-3L
HC-A2MV20-3L	HC-A3MV20-3L
HC-A2MV20-5L	HC-A3VF-5A
	HC-A3VF-5AL
	HC-A3VF-5R
	PHC-A3VF-5R
	HC-A3MVF-5A
	HC-A3MVF-5AL
	HC-A3MVF-5R
	PHC-A3MVF-5R

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

REVISION 14 HIGHLIGHTS

Revision 14, dated June 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.

- ILLUSTRATED PARTS LIST
  - Revised the parts list for HC-A2(MV,V)20-5L Propeller Assembly

(Blank Page)

REVISION 14 HIGHLIGHTS

1. Introduction

   A. General

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

   B. Components

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

      (2) Issue Date is the date of 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 page revision dates are the same and no change bars are used.

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

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

Revision No.	Issue Date	Comments
Original	Mar/98	New Issue
Revision 1	Jun/99	Minor Revision
Revision 2	Dec/99	Minor Revision
Revision 3	Feb/00	Minor Revision
Revision 4	Jan/01	Minor Revision
Revision 5	Aug/01	Minor Revision
Revision 6	Sep/02	Minor Revision
Revision 7	June/04	Minor Revision
Revision 8	Aug/15	Reissue
Revision 9	Mar/18	Minor Revision
Revision 10	Feb/19	Minor Revision
Revision 11	Feb/21	Major Revision
Revision 12	Apr/22	Minor Revision
Revision 13	Oct/22	Minor Revision
Revision 14	Jun/23	Major Revision

RECORD OF REVISIONS

This is a record of revisions inserted into this manual.
Revision 14 includes all prior revisions.

Revision Number	Issue Date	Date Inserted	Inserted By	Revision Number	Issue Date	Date Inserted	Inserted By
14	Jun/23	Jun/23	HPI				

(Blank Page)

RECORD OF TEMPORARY REVISIONS

Update this page to show all temporary revisions inserted into this manual.
Revision 14 includes all prior temporary revisions, up to and including TR-011.

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 Bulletins:	
HC-SB-61-285	Rev. 8 Aug/15
HS-SB-61-370	Rev. 9 Mar/18
HS-SB-61-374	Rev. 9 Mar/18

Service Document Number	Incorporation Rev./Date
Service Letters:	
HC-SL-61-367	Rev. 11, Feb/21

SERVICE DOCUMENT LIST

Service Document Number	Incorporation Rev./Date

Service Document Number	Incorporation Rev./Date

AIRWORTHINESS LIMITATIONS

1. Airworthiness Limitations (Rev. 1)

   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 Owner's Manual 168 (61-00-68).

(Blank Page)

LIST OF EFFECTIVE PAGES

Chapter	Page	Rev. Level	Date
Cover and Inside Cover	Cover and Inside Cover	Rev. 14	Jun/23
Revision Highlights	1 thru 4	Rev. 14	Jun/23
Record of Revisions	1 thru 2	Rev. 14	Jun/23
Record of Temporary Revisions	1 thru 2	Rev. 14	Jun/23
Service Document List	1 thru 2	Rev. 14	Jun/23
Airworthiness Limitations	1 thru 2	Rev. 14	Jun/23
List of Effective Pages	1 thru 2	Rev. 14	Jun/23
Table of Contents	1 thru 2	Rev. 14	Jun/23
Introduction	1 thru 22	Rev. 14	Jun/23
Description and Operation	1 thru 4	Rev. 14	Jun/23
Testing and Fault Isolation	1-1 thru 1-12	Rev. 14	Jun/23
Automatic Test Requirements	2-1 thru 2-2	Rev. 14	Jun/23
Disassembly	3-1 thru 3-2	Rev. 14	Jun/23
	3-2.1 thru 3-2.2	Rev. 14	Jun/23
	3-3 thru 3-52	Rev. 14	Jun/23
Cleaning	4-1 thru 4-4	Rev. 14	Jun/23
Check	5-1 thru 5-2	Rev. 14	Jun/23
	5-2.1 thru 5-2.2	Rev. 14	Jun/23
	5-3 thru 5-58	Rev. 14	Jun/23
Repair	6-1 thru 6-8	Rev. 14	Jun/23
Assembly	7-1 thru 7-2	Rev. 14	Jun/23
	7-2.1 thru 7-2.4	Rev. 14	Jun/23
	7-3 thru 7-176	Rev. 14	Jun/23
Fits and Clearances	8-1 thru 8-8	Rev. 14	Jun/23
Special Tools, Fixtures and Equipment	9-1 thru 9-4	Rev. 14	Jun/23
Illustrated Parts List	10-1 thru 10-2	Rev. 14	Jun/23
	10-2.1 thru 10-2.2	Rev. 14	Jun/23
	10-3 thru 10-36	Rev. 14	Jun/23
	10A-1 thru 10A-46	Rev. 14	Jun/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 not yet have 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 148 (61-16-48)	Yes	Composite Spinner Maintenance Manual
Manual 133C (61-13-33)	-	Aluminum Blade Overhaul Manual
Manual 159 (61-02-59)	Yes	Application Guide
Manual 165A (61-00-65)	Yes	Illustrated Tool and Equipment Manual
Manual 168 (61-00-68)	Yes	Propeller Owner’s Manual and Logbook for Steel “A” Hub Reciprocating Propeller Models with Aluminum Blades
Manual 171 (61-10-71)	-	-1, -4, -6 Series Steel “A” Hub Propeller Overhaul 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

B. Vendor Publications

(1) 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 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 the 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 are "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.

(6) 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 The TSN and TSO of the remaining propeller components that are required to be tracked as defined above, are not affected by the hub replacement and must be maintained separately.

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 corrode, 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 fiber 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
N	Newtons

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

2. Operation

A. Constant Speed, Feathering, and Reversing Operational Features

(1) All propellers in this manual are constant speed (controlled by a governor to maintain constant RPM) and reversing (to produce reverse thrust). Some of the propellers in this manual will reach a feathering (low drag) blade angle when one of several engines is shut down during flight. The remaining propellers in this manual will reach a high pitch blade angle (lower than feather blade angle) to support single engine operation.

B. Reverse, Feathering, High Pitch and Low Pitch Blade Angles

(1) Reverse blade angle, feathering blade angle, and high pitch blade angle are all selected and set during the propeller build by adjusting hard stops in the propeller.

(2) Low Pitch Blade Angle and Related Mechanisms

(a) On a reversing propeller the low pitch blade angle hydraulically shuts off the flow of oil from the governor to the propeller and is the lowest blade angle the propeller will attain in flight. Low pitch blade angle is selected and set by adjusting when the propeller piston begins movement of the beta ring from a position closest to the engine. The blade angle range between low pitch blade angle and full reverse blade angle is defined as the beta range and is only entered when commanded by a pilot control.

(b) A propeller mounted mechanism moves in beta range to communicate propeller blade angle to an engine mounted unit described as a beta valve. The beta valve will stop governor oil from entering the propeller piston and prevent movement of propeller blade angle below low pitch.

(c) On propeller models HC-A3(MV,V)F-5A, HC-A3(MV,V)F-5AL, and HC-A2(MV,V)20-5L the propeller mounted mechanism that moves in beta range to communicate propeller blade angle to an engine mounted unit described as a beta valve is in the following form. Several concentric tubes in the propeller shaft link linear position of the propeller piston to the engine mounted beta valve. The concentric tubes also serve as an oil passage between the engine and the propeller.

(d) On all other propeller models in this manual the propeller mounted mechanism that moves in beta range to communicate propeller blade angle to an engine mounted unit described as a beta valve is in the following form. An external ring connected to the propeller piston transmits linear position to a carbon block assembly and lever attached to the engine mounted beta valve.

(e) A command by the pilot to move below low pitch blade angle and enter beta range is operated by a lever in the cockpit and communicates through a linkage connected to the engine mounted beta valve.

C. Feathering Propellers vs Non-Feathering Propellers

(1) Propeller models (P)HC-A3(MV,V)(F,20)-5(A,AL,R) installed on reciprocating engines are constant speed, reversing, and feathering.

(2) Propeller models (B)HC-A(2,3) (MV,V)(F,20)-(3,3L) and HC-A2(MV,V)20-5L installed on reciprocating engines are constant speed and reversing only (not feathering). These propellers have a high pitch blade angle capability but do not reach the higher feathering blade angle.

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

TROUBLESHOOTING GUIDE

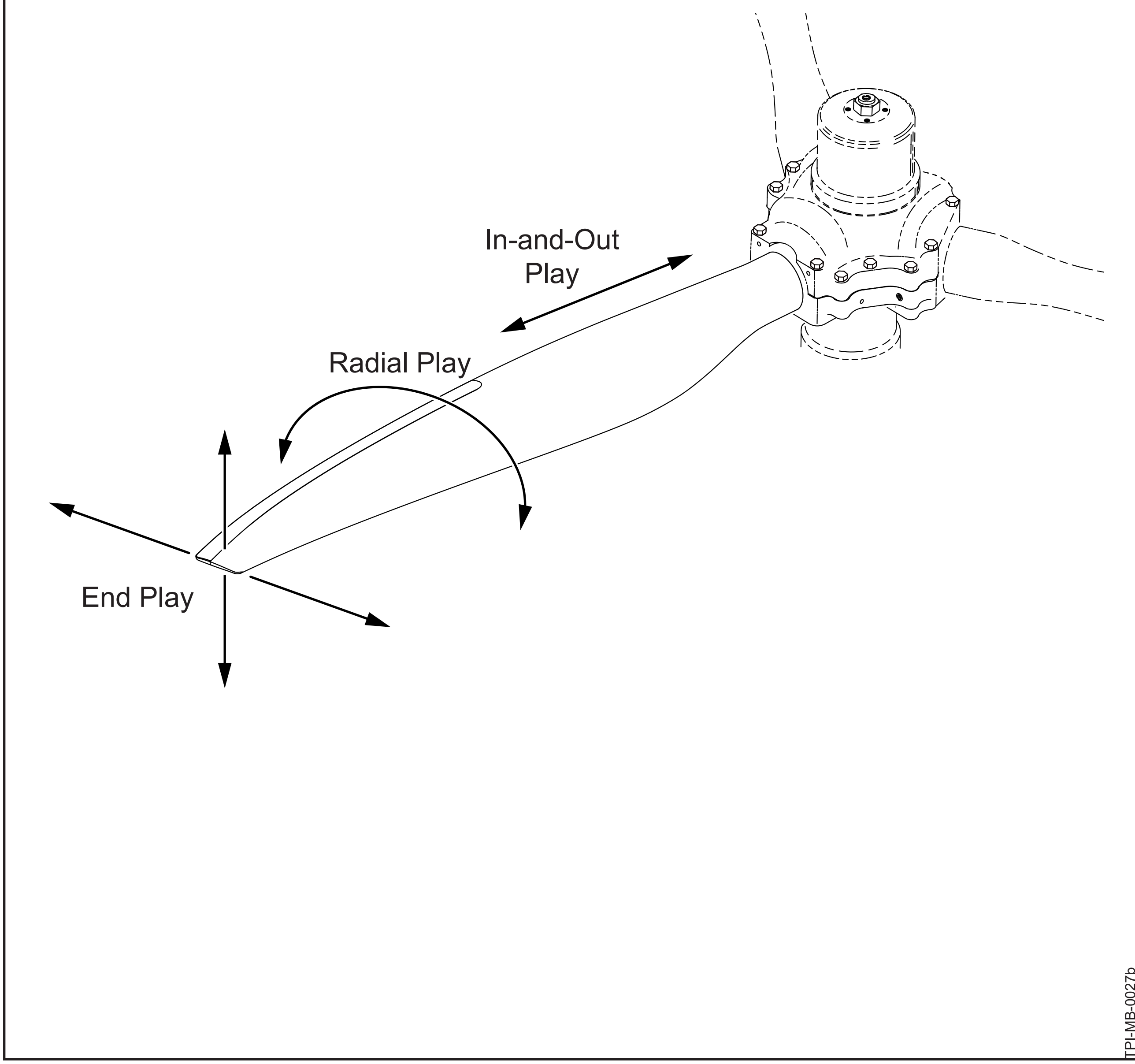
Symptom	Probable Cause	Remedy
A. Propeller Actuates Slowly or Fails to Actuate	Air is trapped in the propeller piston or in the engine shaft.	Before each flight, cycle the propeller three times to purge trapped air in the propeller.
	Lack of blade bearing lubrication.	Add approved lubricant to blade clamp lubrication fittings in accordance with the Propeller Lubrication chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	There is insufficient clearance between various moving parts in the pitch change mechanism.	Examine the moving parts individually for interference and establish the correct clearances in accordance with this manual.
		Isolate the friction in each blade by disconnecting the link arm from the piston and rotating each blade individually before disassembling the propeller.
	There is excessive friction in the piston due to the phenolic bushing scraping against the wall of the cylinder.	Inspect the inside diameter of the phenolic bushing. Refer to the Check chapter of this manual.
		Inspect the roundness of the bushing. Refer to the Check chapter of this manual. If necessary, follow the replacement procedure in the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
		Inspect the outside diameter of the cylinder. Refer to the Check chapter of this manual. Replace the cylinder if necessary.
		For cylinder repair and rechroming procedures, refer to the Hard Chromium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	The bearing balls in the split bearing are unusually rough, corroded, or chipped.	Replace the split bearing assembly in accordance with the Assembly chapter of this manual.
	The wire retention ring is wedged under the inboard race of the blade bearing.	Replace the wire retention ring in accordance with the Assembly chapter of this manual.

TROUBLESHOOTING GUIDE

Symptom	Probable Cause	Remedy
A. Propeller Actuates Slowly or Fails to Actuate (continued)	The pilot tube has slipped out slightly and is rubbing hard against the end of the cavity in the blade.	Inspect each pilot tube for wear and to make sure that the pilot tube extends the correct distance from the hub arm. Inspect in accordance with the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	The feathering compression spring is weak or broken.	Replace the feathering compression spring in accordance with the Assembly chapter of this manual.
	The oil passages are blocked.	Inspect the hydraulic system to make sure that the oil passages are clear.
B. Failure to Feather	Excessive friction in the moving parts.	Refer to Symptom A, "Propeller Actuates Slowly or Fails to Actuate".
	The feathering compression spring is weak or broken.	Replace the feathering compression spring in accordance with the Assembly chapter of this manual.
C. Surging RPM or Torque	Air is trapped in the propeller piston or in the engine shaft.	Before each flight, cycle the propeller three times to purge trapped air from the propeller. The engine should have provision for permitting trapped air to escape from the system during one-half of the pitch cycle.
	Excessive friction in the moving parts.	Refer to Symptom A, "Propeller Actuates Slowly or Fails to Actuate".
D. Oil Leakage	There is a defective propeller mounting O-ring.	Replace the O-ring in accordance with the Assembly chapter of this manual.
	The piston dust seal is displaced.	Replace the piston dust seal in accordance with the Assembly chapter of this manual.
	There is a defective O-ring on the pitch change rod.	Replace the O-ring in accordance with the Assembly chapter of this manual.
	There is a defective O-ring seal between the hub and the cylinder.	Replace the O-ring in accordance with the Assembly chapter of this manual. Replace the cylinder if its surface is scratched or gouged in the area where the O-ring slides.

TROUBLESHOOTING GUIDE

	Symptom	Probable Cause	Remedy
E.	Grease Leakage NOTE: The clamp/split-bearing is the only source for grease leakage.	There is a damaged lubrication fitting cap.	Replace the damaged lubrication fitting cap.
		There is a loose lubrication fitting.	Tighten the lubrication fitting in accordance with the Assembly chapter of this manual.
		There is a defective lubrication fitting.	Replace the defective lubrication fitting.
		The grease leaks past the blade clamp seal gaskets.	Loosen the blade clamp bolts and replace the gaskets, sealant, and gasket compound. Reassemble the blade and the clamp in accordance with the Assembly chapter of this manual.
		The grease leaks from between the blade and the clamp.	Remove and clean the blade and the clamp. Refer to the Cleaning chapter of the Hartzell Standard Practices Manual 202A (61-01-02). Add gasket compound CM46 in the radius of the blade. Reassemble the blade and the clamp in accordance with the Assembly chapter of this manual.
		There is no sealant CM93 on the blade clamp radius of the bearing-to-clamp interface.	Remove the blade and the clamp. Add sealant CM93 in the radius of the clamp. Reassemble the blade and the clamp in accordance with the Assembly chapter of this manual.



Checking Blade Play
Figure 1-1

TROUBLESHOOTING GUIDE

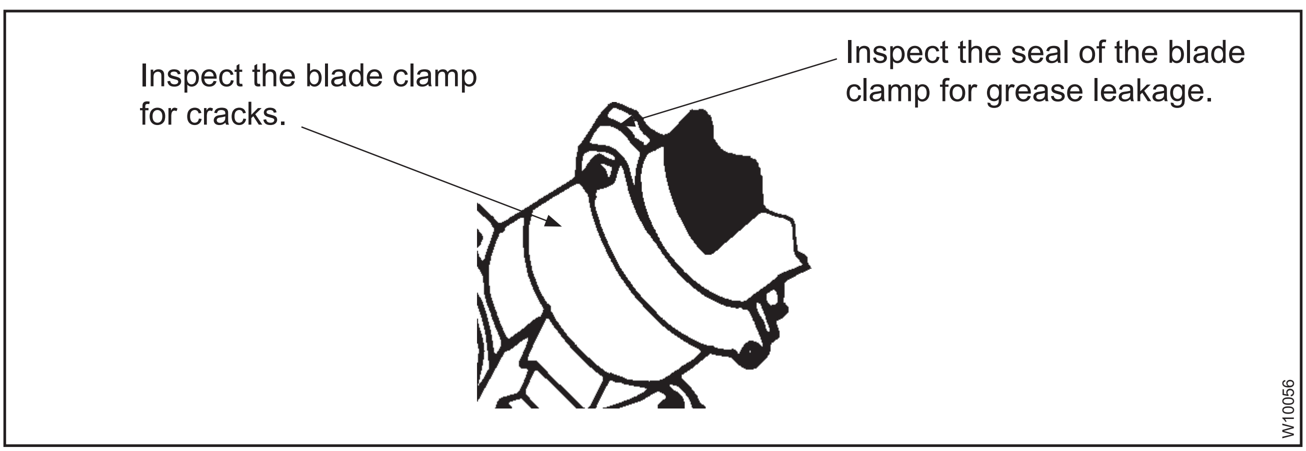
Symptom	Probable Cause	Remedy
F. End Play (Leading Edge to Trailing Edge) of the blade Refer to Figure 1-1.	The hub pilot tube is worn or the blade alignment bearings are worn.	Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual for End Play limits. Inspect the pilot tube and the blade alignment bearings for wear or damage. Replace the parts as necessary.
G. End Play (Fore-and-Aft) of the blade Refer to Figure 1-1.	The hub pilot tube is worn or the blade alignment bearings are worn.	Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual, for End Play limits. Inspect the pilot tube and the blade alignment bearings for wear or damage. Replace the parts as necessary.
H. In-and-Out Play of the blade Refer to Figure 1-1.	There is a buildup of wear or repair tolerances.	Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual for In-and-Out Play limits. Replace the parts as necessary. With grease and split bearings in the blade clamps, in-and-out play in the blades is not permitted.
I. Blades are not Tracking	Foreign object strike damage.	Refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33). Refer to the Special Inspections chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	The hub pilot tube(s) is distorted.	Refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	The blade face(s) is out of alignment.	Refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

TROUBLESHOOTING GUIDE

	Symptom	Probable Cause	Remedy
J.	Radial Play of the Blade	The link arm screw hole or pin hole is worn.	Refer to Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual for Radial Play limits. Inspect the link arm in accordance with the Check chapter of this manual. Replace the link arm if wear if greater than the serviceable limits. Remove the blade and the clamp in accordance with the Disassembly chapter in this manual. Clean the blade and the clamp thoroughly. Reinstall the blade and the clamp in accordance with the Assembly chapter of this manual.
K.	Blade Slippage in the Blade Clamp	The blade clamp does not clamp the blade tight enough.	Make sure that each clamp nut is torqued in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual. Refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
L.	Slight Propeller Vibration	The blades are not tracking.	Refer to Symptom "I", Blades are not Tracking.
		The static balance is incorrect.	Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
		The dynamic balance is incorrect.	Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
		There is blade wear.	Refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).
		There is grease leakage.	Refer to Symptom "E", Grease Leakage.

TROUBLESHOOTING GUIDE

Symptom	Probable Cause	Remedy
M. Excessive Propeller Vibration Refer to Figure 1-2.	Mass propeller imbalance.	Balance the propeller in accordance with the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	Blade aerodynamic imbalance because of excessive differences in blade-to-blade angles.	Perform blade-to-blade angle checks at the setup blade radius, at a blade radius six inches outboard of the setup blade radius, and at a blade radius six inches inboard of the setup blade radius. If a blade is consistently high or low at all three locations, rotate the blade in the clamp to minimize blade angle variance, and recheck the blade-to-blade angles.
	The link arm hole is worn.	Inspect the link arm in accordance with the Check chapter of this manual and replace as necessary.
	The link arm is disconnected from the piston.	Inspect the threaded holes in the piston, the safety screws, and the link pin for damage. Repair damaged threads in accordance with the Standard Repairs and Instructions chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Replace damaged components and install the link arm in accordance with the Assembly chapter of this manual.



Abnormal Vibration
Figure 1-2

TROUBLESHOOTING GUIDE

	Symptom	Probable Cause	Remedy
M.	Excessive Propeller Vibration (continued) Refer to Figure 1-2	Bent, cracked, or damaged blade.	For aluminum blade overhaul procedures, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33) for aluminum blade overhaul procedures. Refer to the Special Inspections chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
		The blade slipped in the clamp.	Inspect the blade-to-blade angles and reset as necessary.
		Cracked blade clamp (grease leaking from a seemingly solid surface).	Inspect the blade clamp in accordance with the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Replace the damaged part.
		Cracked or damaged hub.	Replace the hub in accordance with the Part Retirement Procedure in Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

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

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 hub or blade, as evidence of where it entered or left the propeller.

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

AUTOMATIC TEST REQUIREMENTS (NOT APPLICABLE) (Rev. 1)

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

DISASSEMBLY - CONTENTS, CONTINUED

DISASSEMBLY - CONTENTS, CONTINUED

LIST OF FIGURES

(Blank Page)

WARNING 1: 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.

WARNING 2: THE USE OF BLADE PADDLES TO MOVE 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.

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.

1. Important Information (Rev. 3)

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.

2. Disassembly of Propeller Model (B)HC-A2(MV,V)F-3

A. Piston Disassembly

CAUTION 1: THE PROPELLER MUST BE IN THE FEATHER POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING HEX NUT (110) THAT RETAINS THE PISTON UNIT (1500).

(1) To minimize reassembly problems, measure the distance between the beta ring (50) and the hub flange.

(2) Remove and discard the self-locking hex nut (20) from the end of the beta rod unit (40) at the piston (1500).

(3) Loosen the hex nut (55) from the end of the beta rod unit (40) at the beta ring (50).

CAUTION: TURN THE BETA RODS (40) ALTERNATELY TO PREVENT DAMAGE TO THE BETA RING (50).

(4) Remove the beta rod units (40) from the beta ring (50), two turns at a time.

(5) Lower the beta ring (50) to the assembly table.

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING THIN HEX NUT (110) IS BEING REMOVED.

(6) Remove and discard the self-locking thin hex nut (110) that holds the piston in place. Refer to Figure 3-1.

(7) Rotate the blades by hand from feather to reverse.

(8) Remove the safety wire from the link pin units (120).

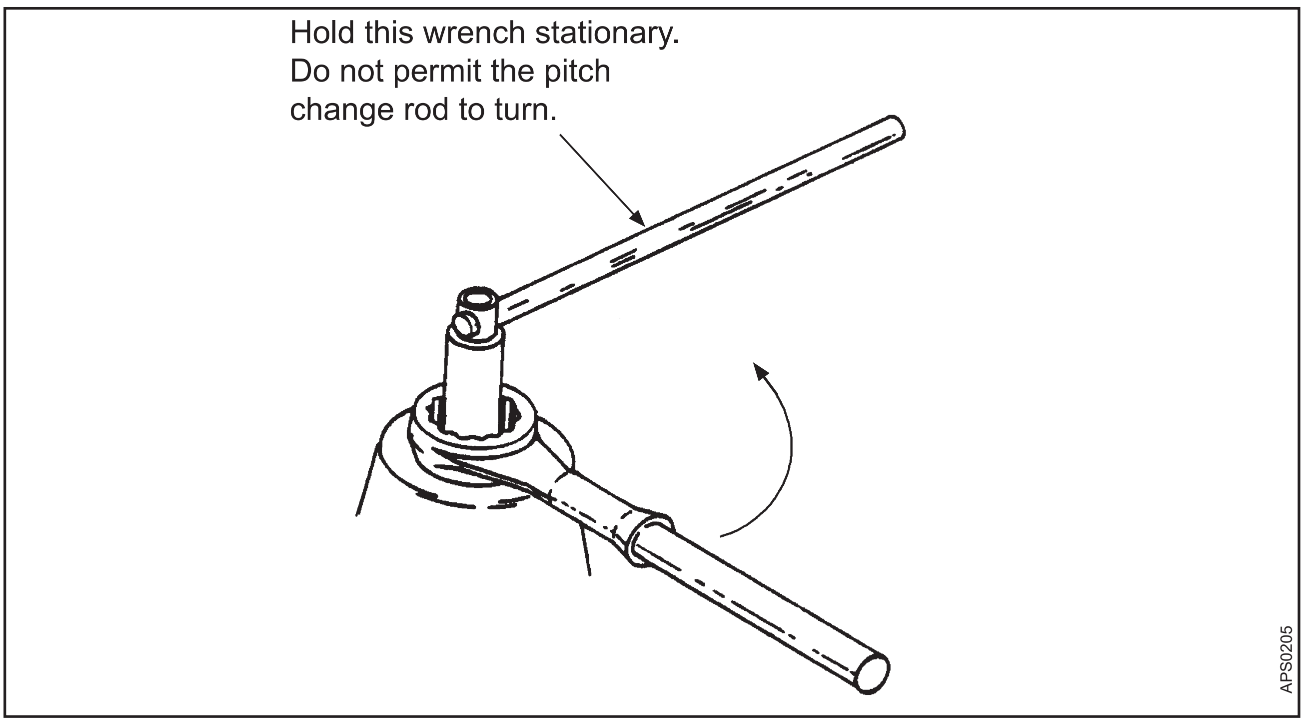
(9) Remove and discard the link pin unit (120) and fillister head screw (130).

(10) Remove the link arm (140) from the piston unit (1500).

(a) Remove and discard the link screw sleeve (145) from the link arm (140).

(11) Remove the piston unit (1500).

(12) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).



Removing the Self-Locking Hex Nut
Figure 3-1

B. Removing the Feathering Spring Assembly from the Cylinder

(1) Remove the O-ring (150) from the pitch change rod.

(2) Remove the pitch stop spacers (160) and the fillister head screws (170).

(3) Discard the fillister head screws (170).

WARNING: DO NOT USE FORCE ON THE FEATHERING SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE FEATHERING SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE FEATHERING SPRING ASSEMBLY.

(4) Push the feathering spring assembly (1300) into the cylinder (190) to permit removal of the split keepers (180).

(5) While the feathering spring assembly (1300) is compressed, remove the front split keeper halves (180) from the groove in the cylinder (190).

(6) Remove the feathering spring assembly (1300) from the cylinder (190).

C. Cylinder and Guide Collar Disassembly

(1) If applicable, use a round bottom stamp and mark the guide collar unit (1550) to indicate blade location.

(2) Loosen the 1/4-28 cap screw (1570) in the side of the guide collar unit (1550).

WARNING: THE CYLINDER (190) IS RETAINING THE BETA COMPRESSION SPRINGS (65) UNDER LOAD. THE CYLINDER AND THE GUIDE COLLAR (1550) WILL RELEASE VERY ABRUPTLY WHEN DISENGAGED FROM THE HUB (2300).

CAUTION: TURN THE CYLINDER (190) SLOWLY AND CAREFULLY TO AVOID DAMAGING THE THREADS OR BENDING THE BETA ROD UNITS (40).

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder from the hub unit (2300).

(4) Remove the cylinder (190) from the hub unit (2300).

(5) Remove the guide collar unit (1550) from the cylinder (190)

(6) Remove the beta rod units (40) from the guide collar unit (1550).

(7) Remove and discard the 1/4-28 cap screws (1570).

(8) Remove and discard the cylinder O-ring (200).

(9) Remove and discard the beta compression spring (65) from the beta rod unit (40).

(10) Remove and discard the bolts (1030) that attach the spinner mounting plate (85) to the hub (2300).

(11) Remove the spinner mounting plate (85).

(12) Remove and discard the snap rings (90) from the guide lugs (100).

(13) Remove the guide lugs (100) from the spinner mounting plate (85).

(a) For information about guide lug bushing (105) replacement, refer to Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

D. Clamp and Counterweight Disassembly

(1) Optionally, using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630).

(2) Remove and discard the outboard clamp bolt (1710), washer (1720), and self-locking nut (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screw (1690).

(4) Remove and discard the inboard clamp socket screw (1690).

(5) Remove the blade clamp halves (1610) from the hub arm.

(6) Remove and discard the clamp gasket (1700).

(7) Remove and discard the fillister head screws (320) that attach the balance weight (310).

(8) Remove and retain the balance weight (310).

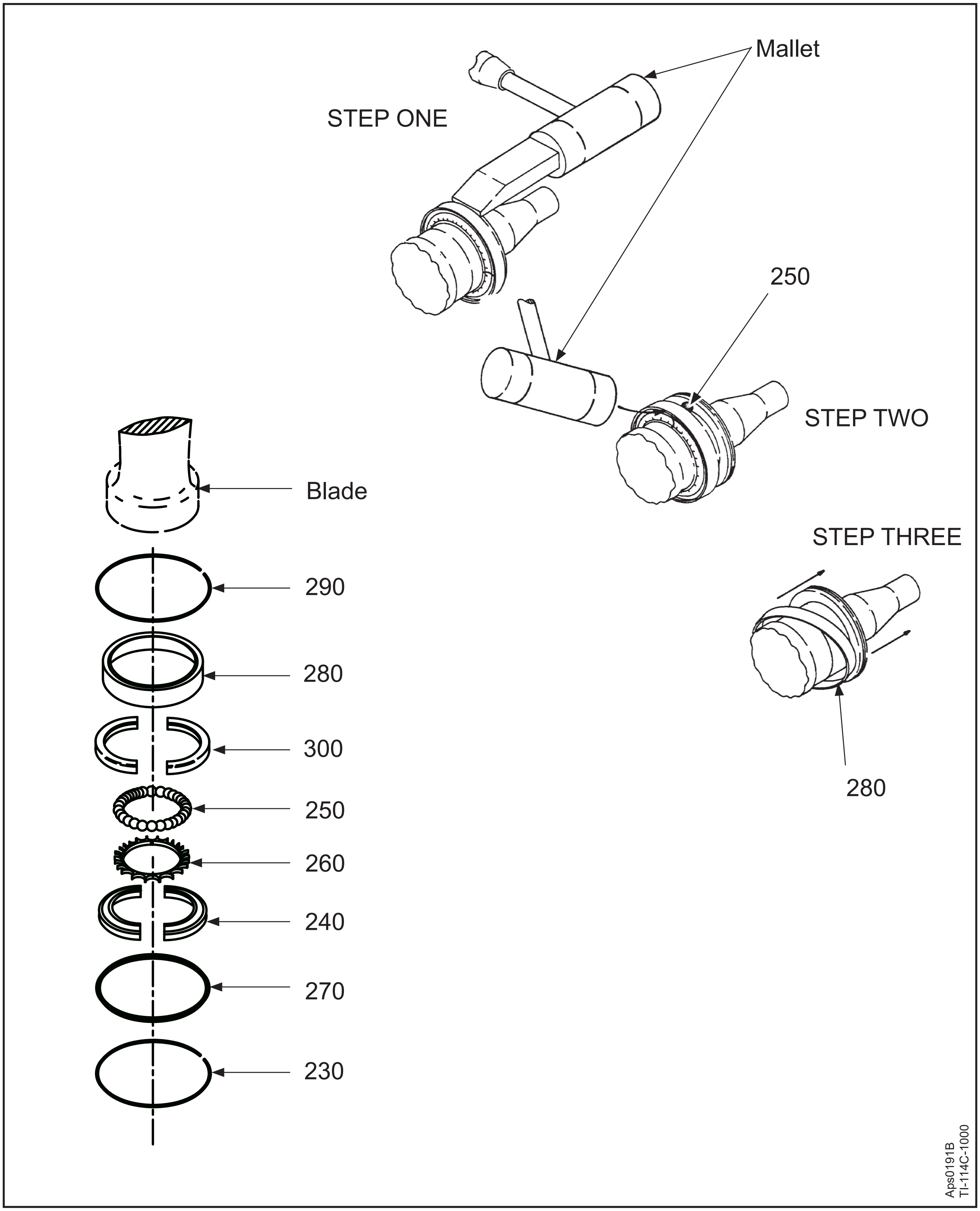
(9) For blade clamp (1600) disassembly and clamp overhaul procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(a) If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Record the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(10) Remove the blade assembly from the hub pilot tube (2310).

(11) For aluminum blade disassembly and overhaul procedures, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).



Removing the Bearing Retaining Ring
Figure 3-2

E. Blade Mounting Parts Disassembly

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the inboard bearing races (240).

(3) Remove and discard the bearing ball (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

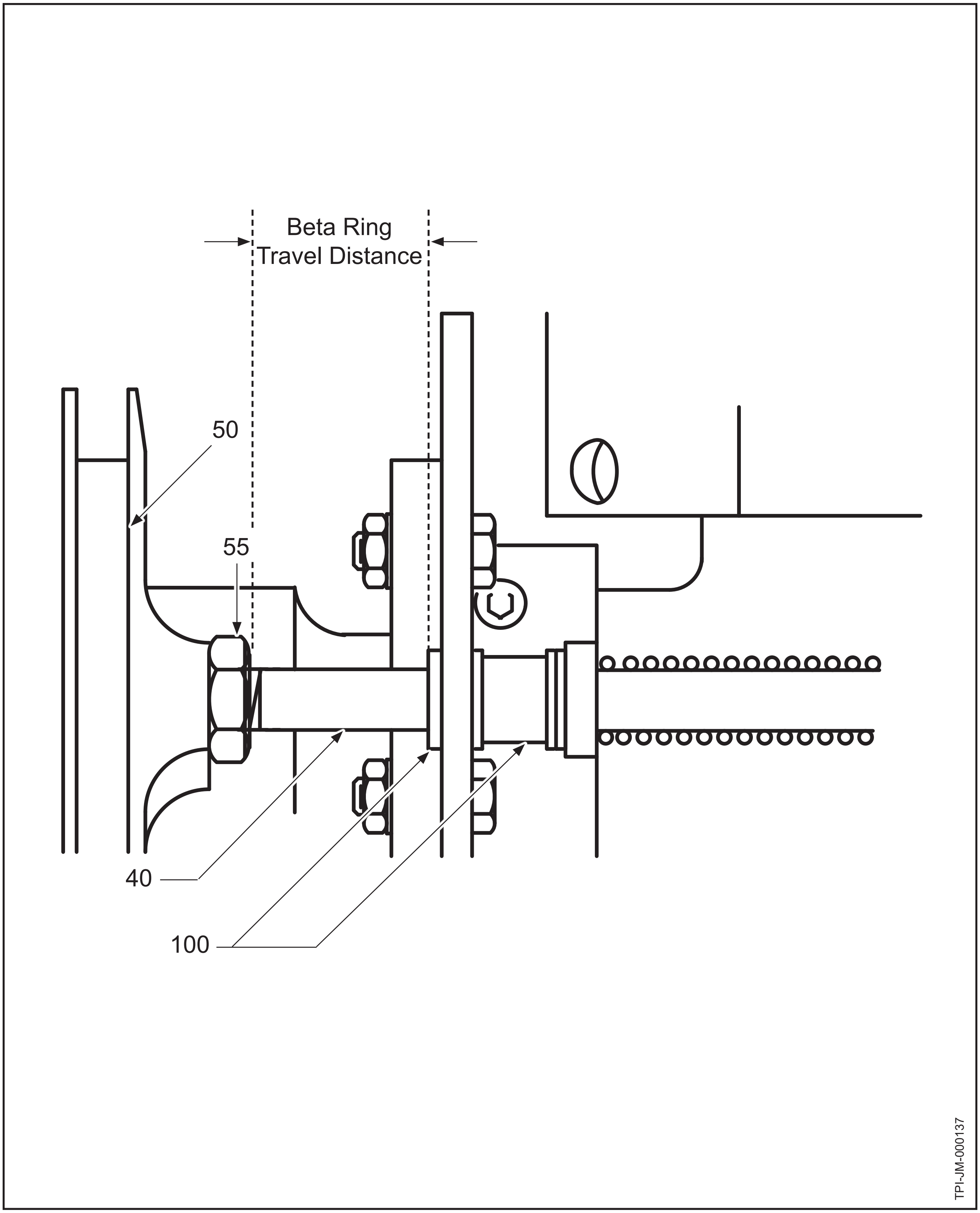
(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

(14) Repeat steps (1) through (13) of this procedure for the remaining blade.

F. Hub Unit Disassembly

(1) Remove and discard all O-rings.

(2) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Beta Ring Travel Distance
Figure 3-3

3. Disassembly of Propeller Model HC-A2(MV,V)20-3L

A. Disassembly Inspection

(1) Mount the propeller on a rotatable fixture and measure the following features:

(a) Position the propeller piston between low pitch blade angle and high pitch blade angle while not engaging the self-locking hex nuts (20) on each beta rod unit (40). Refer to Figure 7-20.

1 Measure beta ring travel distance between the jam nut (55) and the guide lug (100) at each of the four beta rods. Refer to Figure 3-3.

NOTE: This information will be used to reassemble the propeller in the same configuration in which it was received.

(b) Actuate the propeller with air at reverse blade angle stop. Each jam nut (55) must be tight against each guide lug (100). Refer to Figure 3-3.

1 Measure each counterweight angle and record for later use.

NOTE: This information will be used to reassemble the propeller in the same configuration in which it was received.

B. Piston Disassembly

CAUTION 1: THE PROPELLER MUST BE IN THE HIGH PITCH POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING HEX NUT (110) THAT RETAINS THE PISTON UNIT (1500).

(1) Remove and discard the self-locking hex nut (20) from the end of the beta rod unit (40) at the piston (1500).

(2) Remove each spacer (30) from the end of each beta rod unit (40) at the piston (1500).

(3) Loosen the hex nut (55) from the end of the beta rod unit (40) at the beta ring (50).

CAUTION: TURN THE BETA RODS (40) ALTERNATELY TO PREVENT DAMAGE TO THE BETA RING (50).

(4) Remove the beta rod units (40) from the beta ring (50), two turns at a time.

(5) Lower the beta ring (50) to the assembly table.

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING THIN HEX NUT (110) IS BEING REMOVED.

(6) Remove and discard the self-locking thin hex nut (110) that holds the piston in place.

(7) Rotate the blades by hand from high pitch to reverse.

(8) Remove the safety wire from the link pin units (120).

(9) Remove and discard the link pin unit (120) and fillister head screw (130).

(10) Rotate each link arm (140) from the piston unit (1500) slots.

(11) Remove the piston unit (1500).

(12) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).

C. Removing the Spring Assembly from the Cylinder

(1) Remove the O-ring (150) from the pitch change rod (1320).

(2) Remove the pitch stop spacers (160) and the fillister head screws (170).

(3) Discard the fillister head screws (170).

CAUTION: DO NOT USE FORCE ON THE SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE SPRING ASSEMBLY.

(4) Push the spring assembly (1300) into the cylinder (190) and remove the split keepers (180) halves from the groove in the cylinder (190).

(5) Remove the spring assembly (1300) from the cylinder (190).

D. Cylinder and Beta Rod Unit Disassembly

(1) If applicable, use a round bottom stamp and mark the guide collar unit (1550) to indicate blade location.

(2) Loosen the 1/4-28 cap screws (1570) in opposite sides of the guide collar unit (1550).

WARNING: THE CYLINDER (190) IS RETAINING THE BETA COMPRESSION SPRINGS (65) UNDER LOAD. THE CYLINDER AND THE GUIDE COLLAR (1550) WILL RELEASE VERY ABRUPTLY WHEN DISENGAGED FROM THE HUB (2300).

CAUTION: TURN THE CYLINDER (190) SLOWLY AND CAREFULLY TO AVOID DAMAGING THE THREADS OR BENDING THE BETA ROD UNITS (40).

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder (190) from the hub unit (2300).

(4) Remove the cylinder (190) from the guide collar unit (1550).

(5) Remove the guide collar unit (1550) from the beta rod units (40).

(6) Remove and discard the 1/4-28 cap screws (1570).

(7) Remove the beta rod units (40) from the guide lugs (100).

NOTE: One beta compression spring (65) will be loosely encircling each beta rod unit (40).

(8) Remove and discard the cylinder O-ring (200) from the hub (2300).

(9) Remove the washers (70) if present from the beta rod units (40).

(10) Remove and discard the beta compression spring (65) from each beta rod unit (40).

(11) Remove and discard the bolts (1140), washers (1150), and nuts (1160) that attach the guide lug support plate (85) to the guide lug support collar (2470).

(12) Remove and discard the snap rings (90) from the guide lugs (100).

(13) Remove the guide lugs (100) from the guide lug support plate (85).

(a) For information about guide lug bushing (105) replacement, refer to Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(14) Remove and discard the three screws (2490) that secure the guide lug plate collar (2470) to the hub (2300).

(15) Remove the three sections of the guide lug plate collar (2470) from the hub (2300) and lower the guide lug support plate (85) onto the beta ring (50) already on the build table and encircling the rotatable fixture.

E. Clamp Removal

(1) Using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630) (optional).

(2) Remove and discard the outboard clamp bolts (1710), washers (1720), and self-locking nuts (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screws (1690).

(4) Remove and discard the inboard clamp socket screws (1690).

(5) Remove the blade clamp halves (1610) from each hub arm of hub unit (2300).

NOTE: Link arm (140) is still attached to one blade clamp half (1610) from each hub arm.

(6) Remove and discard the clamp gaskets (1700).

(7) Remove cotter pin (330) from each link screw (1640) and slide each link arm (140) and associated link screw sleeve (145) off of the link screw (1640).

(8) Remove and discard the link screw sleeve (145) from each link arm (140).

(9) Remove and discard the fillister head screws (320) that attach the balance weight (310).

(10) Remove and retain the balance weight (310).

(11) For blade clamp (1600) disassembly and clamp overhaul procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(a) If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Record the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(12) Remove the blade assembly from the hub pilot tube (2310).

(13) For aluminum blade disassembly and overhaul procedures, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

F. Blade Mounting Parts Disassembly
Refer to Figure 3-2.

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the inboard bearing races (240).

(3) Remove and discard the bearing balls (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

(14) Repeat steps (1) through (13) of this procedure for the remaining blade.

G. Hub Unit Disassembly

(1) Remove the 20 spline shaft nut (2370) and the hub puller ring (2400).

(2) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

4. Disassembly of Propeller Model HC-A2(MV,V)20-5L

A. Piston Disassembly

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING THIN HEX NUT (110) IS BEING REMOVED.

CAUTION 1: THE PROPELLER MUST BE IN THE FEATHER POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING HEX NUT (110) THAT RETAINS THE PISTON UNIT (1500).

(a) Remove and discard the self-locking thin hex nut (110) that holds the piston in place. Refer to Figure 3-1.

(b) Rotate the blades by hand from feather to reverse.

(c) Remove the safety wire from the link pin units (120).

(d) Remove and discard the link pin unit (120) and fillister head screw (130).

(e) Remove the link arm.

(f) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).

B. Removing the Feathering Spring Assembly from the Cylinder

(a) Remove and discard the pitch change rod O-ring (150).

(b) Remove the pitch stop spacer (155).

(c) Remove the pitch stop spacers (160) and the fillister head screws (170).

(d) Discard the fillister head screws (170).

CAUTION: DO NOT USE FORCE ON THE FEATHERING SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE FEATHERING SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE FEATHERING SPRING ASSEMBLY.

(e) Push the feathering spring assembly (1300) into the cylinder (190) to permit removal of the split keepers (180).

(f) While the spring is compressed, remove the front split keeper halves (180) from the groove in the cylinder.

C. Cylinder and Guide Collar Disassembly

(1) If applicable, use a round bottom stamp and mark the guide collar unit (1550) to indicate blade location.

(2) Loosen the 1/4-28 cap screw (1570) in the side of the guide collar unit (1550).

WARNING: THE CYLINDER IS RETAINING THE BETA SPRINGS UNDER LOAD. THE CYLINDER AND GUIDE COLLAR WILL RELEASE VERY ABRUPTLY WHEN DISENGAGED FROM HUB.

CAUTION: TURN THE CYLINDER SLOWLY AND CAREFULLY TO AVOID DAMAGING THE THREADS OR BENDING THE BETA RODS.

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder from the hub unit (2300).

(4) Remove the cylinder (190) from the hub unit (2300).

(5) Remove the guide collar unit (1550) from the beta rod units (40).

(6) Remove and discard the 1/4-28 cap screws (1570).

(7) Remove and discard the cylinder O-ring (200).

D. Clamp Removal

(1) Using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630) (Optional).

(2) Remove and discard the outboard clamp bolt (1710), washer (1720), and self-locking nut (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screw (1690).

(4) Remove and discard the inboard clamp socket screw (1690).

(5) Remove the blade clamp halves (1610) from the hub arm.

(6) Remove and discard the clamp gasket (1700).

(7) Remove and discard the fillister head screws (320) that attach the balance weight (310).

(8) Remove and retain the balance weight (310).

(9) For blade clamp (1600) disassembly and clamp overhaul procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

NOTE: If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Record the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(10) Remove the blade assembly from the hub pilot tube (2310).

(11) For aluminum blade disassembly and overhaul procedures, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

E. Blade Mounting Parts Disassembly
Refer to Figure 3-2.

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the half of the inboard bearing race (240).

(3) Remove and discard the bearing ball (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

(14) Repeat steps (1) through (13) of this procedure for the remaining blade.

F. Hub Unit Disassembly

(1) Remove the 20 spline shaft nut (2370) and the hub puller ring (2400).

(2) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

5. Disassembly of Propeller Model HC-A3(MV,V)F-3L

A. Piston Disassembly

CAUTION 1: THE PROPELLER MUST BE IN THE FEATHER POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING HEX NUT (110) THAT RETAINS THE PISTON UNIT (1500).

(1) To minimize reassembly problems, measure the distance between the beta ring (50) and the hub flange.

(2) Remove and discard the self-locking hex nut (10) from the end of the beta rod unit (40) at the beta rod support ring (75).

(3) Remove the beta rod support ring (75).

(4) Remove and discard the nuts (20, 60) from the end of the beta rod at the piston (1500).

(5) Remove the spacer (30) from the end of the beta rod at the piston (1500).

(6) Loosen the hex nut (55) from the end of the beta rod unit (40) at the beta ring (50).

CAUTION: TURN THE BETA RODS (40) ALTERNATELY TO PREVENT DAMAGE TO THE BETA RING (50).

(7) Remove the beta rod units (40) from the beta ring (50), two turns at a time.

(8) Lower the beta ring (50) to the assembly table.

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING THIN HEX NUT (110) IS BEING REMOVED.

(9) Remove and discard the self-locking thin hex nut (110) that holds the piston in place.

(10) Rotate the blades by hand from feather to reverse.

(11) Remove the safety wire from the link pin units (120).

(12) Remove and discard the link pin unit (120) and fillister head screw (130).

(13) Remove the link arm (140) from the piston unit (1500).

(a) Remove and discard the link screw sleeve (145) from the link arm (140).

(14) Remove the piston unit (1500).

(15) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).

B. Removing the Feathering Spring Assembly from the Cylinder

(1) Remove the O-ring (150) from the pitch change rod.

(2) Remove the pitch stop spacers (160) and the fillister head screws (170).

(3) Discard the fillister head screws (170).

CAUTION: DO NOT USE FORCE ON THE FEATHERING SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE FEATHERING SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE FEATHERING SPRING ASSEMBLY.

(4) Push the feathering spring assembly (1300) into the cylinder (190) to permit removal of the split keepers (180).

(5) While the spring is compressed, remove the front split keeper halves (180) from the groove in the cylinder (190).

(6) Remove the feathering spring assembly (1300) from the cylinder (190).

C. Cylinder and Guide Collar Disassembly

(1) If applicable, use a round bottom stamp and mark the guide collar unit (1550) to indicate blade location.

(2) Loosen the 1/4-28 cap screw (1570) in the side of the guide collar unit (1550).

WARNING: THE CYLINDER (190) IS RETAINING THE BETA COMPRESSION SPRINGS (65) UNDER LOAD. THE CYLINDER AND THE GUIDE COLLAR (1550) WILL RELEASE VERY ABRUPTLY WHEN DISENGAGED FROM THE HUB (2300).

CAUTION: TURN THE CYLINDER (190) SLOWLY AND CAREFULLY TO AVOID DAMAGING THE THREADS OR BENDING THE BETA ROD UNITS (40).

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder from the hub unit (2300).

(4) Remove the cylinder (190) from the hub unit (2300).

(5) Remove the guide collar unit (1550) from the cylinder (190).

(6) Remove the beta rod units (40) from the guide collar unit (1550).

(7) Remove and discard the 1/4-28 cap screws (1570).

(8) Remove and discard the cylinder O-ring (200).

(9) Remove and discard the beta compression spring (65) from the beta rod unit (40).

(10) Remove and discard the bolts (80) that attach the spinner mounting plate (85) to the hub (2300).

(11) Remove the spinner mounting plate (85).

(12) Remove and discard the snap rings (90) from the guide lugs (100).

(13) Remove the guide lugs (100) from the spinner mounting plate (85).

(a) For information about guide lug bushing (105) replacement, refer to Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

D. Clamp Removal

(1) Using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630) (Optional).

(2) Remove and discard the outboard clamp bolt (1710), washer (1720), and self-locking nut (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screw (1690).

(4) Remove and discard the inboard clamp socket screw (1690).

(5) Remove the blade clamp halves (1610) from the hub arm.

(6) Remove and discard the clamp gasket (1700).

(7) Remove and discard the fillister head screws (320) that attach the balance weight (310).

(8) Remove and retain the balance weight (310).

(9) For blade clamp (1600) disassembly and clamp overhaul procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

NOTE: If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Record the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(10) Remove the blade assembly from the hub pilot tube (2310).

(11) For aluminum blade disassembly and overhaul procedures, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

E. Blade Mounting Parts Disassembly
Refer to Figure 3-2.

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the inboard bearing races (240).

(3) Remove and discard the bearing ball (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

(14) Repeat steps (1) through (13) of this procedure for the remaining blades.

F. Hub Unit Disassembly

(1) Remove the spacer (2460) from the hub.

(2) Remove and discard the O-rings (2390 and 2395).

(3) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

6. Disassembly of Propeller Model HC-A3(MV,V)20-3L

A. Disassembly Inspection

(1) Mount the propeller on a rotatable fixture and measure the following features:

(a) Position the propeller piston between low pitch blade angle and high pitch blade angle while not engaging the self-locking hex nuts (20) on each beta rod unit (40). Refer to Figure 7-20.

1 Measure beta ring travel distance between the jam nut (55) and the guide lug (100) at each of the four beta rods. Refer to Figure 3-3.

NOTE: This information will be used to reassemble the propeller in the same configuration in which it was received.

(b) Actuate the propeller with air at reverse blade angle stop. Each jam nut (55) must be tight against each guide lug (100). Refer to Figure 3-3.

1 Measure each counterweight angle and record for later use.

NOTE: This information will be used to reassemble the propeller in the same configuration in which it was received.

B. Piston Disassembly

CAUTION 1: THE PROPELLER MUST BE IN THE HIGH PITCH POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING HEX NUT (110) THAT RETAINS THE PISTON UNIT (1500).

(1) To minimize reassembly problems, measure the distance between the beta ring (50) and the guide lug (100) as shown in Figure 3-3 at each of the three beta rods.

(2) Remove and discard the three self-locking hex nuts (10) from the end of each beta rod unit (40) at the beta rod support ring (75).

(3) Remove the beta rod support ring (75).

(4) Remove and discard the nuts (60) that were next to the beta rod support ring (75).

(5) Remove and discard the nuts (20) from the end of the beta rod unit (40) at the piston (1500).

(6) Remove each spacer (30) from the end of each beta rod unit (40) at the piston (1500).

(7) Loosen the hex nut (55) from the end of the beta rod unit (40) at the beta ring (50).

CAUTION: TURN THE BETA RODS (40) ALTERNATELY TO PREVENT DAMAGE TO THE BETA RING (50).

(8) Remove the beta rod units (40) from the beta ring (50), two turns at a time.

(9) Lower the beta ring (50) to the assembly table.

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING THIN HEX NUT (110) IS BEING REMOVED.

(10) Remove and discard the self-locking thin hex nut (110) that holds the piston in place.

(11) Rotate the blades by hand from high pitch to reverse.

(12) Remove the safety wire from the link pin units (120).

(13) Remove and discard the link pin unit (120) and fillister head screw (130).

(14) Rotate each link arm (140) from the piston unit (1500) slots.

(15) Remove the piston unit (1500).

(16) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).

C. Removing the Spring Assembly from the Cylinder

(1) Remove the O-ring (150) from the pitch change rod (1320).

(2) Remove the pitch stop spacers (160) and the fillister head screws (170).

(3) Discard the fillister head screws (170).

CAUTION: DO NOT USE FORCE ON THE SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE SPRING ASSEMBLY.

(4) Push the spring assembly (1300) into the cylinder (190) and remove the split keepers (180) halves from the groove in the cylinder (190).

(5) Remove the spring assembly (1300) from the cylinder (190).

D. Cylinder and Beta Rod Unit Disassembly

(1) If applicable, use a round bottom stamp and mark the guide collar unit (1550) to indicate blade location.

(2) Loosen the 1/4-28 cap screw (1570) in the side of the guide collar unit (1550).

WARNING: THE CYLINDER (190) IS RETAINING THE BETA COMPRESSION SPRINGS (65) UNDER LOAD. THE CYLINDER AND THE GUIDE COLLAR (1550) WILL RELEASE VERY ABRUPTLY WHEN DISENGAGED FROM THE HUB (2300).

CAUTION: TURN THE CYLINDER (190) SLOWLY AND CAREFULLY TO AVOID DAMAGING THE THREADS OR BENDING THE BETA ROD UNITS (40).

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder (190) from the hub unit (2300).

(4) Lift the cylinder (190) from the guide collar unit (1550).

(5) Remove the guide collar unit (1550) from the beta rod units (40).

(6) Remove and discard the 1/4-28 cap screw (1570).

(7) Remove the beta rod units (40) from the guide lugs (100).

NOTE: One beta compression spring (65) will be loosely encircling each beta rod unit (40).

(8) Remove and discard the cylinder O-ring (200) from the hub (2300).

(9) Remove the washers (70), if present, from the beta rod units (40).

(10) Remove and discard the beta compression spring (65) from each beta rod unit (40).

(11) Remove and discard the bolts (1140), washers (1150), and nuts (1160) that attach the guide lug support plate (85) to the guide lug support collar (2470).

(12) Remove and discard the snap rings (90) from the guide lugs (100).

(13) Remove the guide lugs (100) from the spinner mounting plate (85).

(a) For information about guide lug bushing (105) replacement, refer to Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(14) Remove and discard the three screws (2490) that secure the guide lug plate collar (2470) to the hub (2300).

(15) Remove the three sections of the guide lug plate collar (2470) from the hub (2300) and lower the guide lug support plate (85) onto the beta ring (50) already on the build table and encircling the rotatable fixture.

E. Clamp Removal

(1) Using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630) (optional).

(2) Remove and discard the outboard clamp bolts (1710), washers (1720), and self-locking nuts (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screws (1690).

(4) Remove and discard the inboard clamp socket screws (1690).

(5) Remove the blade clamp halves (1610) from each hub arm of hub unit (2300).

NOTE: Link arm (140) is still attached to one blade clamp half (1610) from each hub arm.

(6) Remove and discard the clamp gaskets (1700).

(7) Remove cotter pin (330) from each link screw (1640).

(8) Slide each link arm (140) and associated link screw sleeve (145) off of the link screw (1640).

(9) Remove and discard the link screw sleeve (145) from each link arm (140).

(10) Remove and discard the fillister head screws (320) that attach the balance weight (310).

(11) Remove and retain the balance weight (310).

(12) For blade clamp (1600) disassembly and clamp overhaul procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

NOTE: If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Record the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(13) Remove the blade assembly from the hub pilot tube (2310).

(14) For aluminum blade disassembly and overhaul procedures, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

F. Blade Mounting Parts Disassembly
Refer to Figure 3-2.

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the inboard bearing races (240).

(3) Remove and discard the bearing ball (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

(14) Repeat steps F.(1) through F.(13) of this procedure for the remaining blades.

G. Hub Unit Disassembly

(1) Remove the 20 spline shaft nut (2370) and the hub puller ring (2400).

(2) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

7. Disassembly of Propeller Model HC-A3(MV,V)F-5A(L)

A. Spinner Bulkhead Removal

(1) Put the propeller assembly on the rotatable fixture TE125 on the assembly table TE129.

(2) Remove and discard the bolts (1020), washers (1040), and nuts (1090) that attach the spinner bulkhead to the start locks (1200).

(3) Lower the bulkhead to the assembly table.

B Start Lock Unit Removal

(1) If the propeller is in feather position:

(a) Remove and discard the hex head bolts (1080) and washers (1040) that attach the start lock (1200) to the hub (2300).

(b) Remove the start lock (1200).

(2) If the propeller is not in feather position:

(a) Apply air pressure through the rotatable fixture to move the blades to high pitch blade angle.

NOTE: In high pitch, the start lock plate (1100) is not resting on the start lock pin (1240).

(b) Retract the start lock pin (1240).

(c) Secure the retracted start lock pin (1240) in place by inserting a piece of heavy wire in the hole through the start lock bracket (1250).

(d) Remove and discard the hex head bolt (1080) that attaches the start lock (1200) to the hub (2300).

(e) Remove the start lock (1200).

(f) Slowly remove air pressure from the propeller to move the blades to feather angle.

C. Piston Disassembly

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING NUT (110) IS BEING REMOVED.

CAUTION 1: THE PROPELLER MUST BE IN FEATHER POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING NUT (110) THAT RETAINS THE PISTON ASSEMBLY (1500).

(1) Remove and discard the self-locking hex nut (110) that holds the piston in place.

(2) Rotate the blades by hand from feather to reverse.

(3) Remove the safety wire between the link pin units (120) and the safety screws (130).

(4) Remove and discard the link pin units (120) and safety screws (130).

(5) Remove and discard the nuts (1575), bolts (1565), and washers (1555) from the piston guide rods (1520).

(6) Disconnect the link arm (140) from the piston unit (1500).

(7) Remove and discard the link pin sleeve (145).

(8) Remove the piston unit (1500).

(9) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).

(10) Remove and discard the pitch change rod O-ring (150).

D. Feathering Spring Removal

WARNING: THE FEATHERING SPRING ASSEMBLY (1300) IS PRELOADED TO APPROXIMATELY 1000 POUNDS FORCE. USE EXTREME CAUTION WHEN REMOVING IT FROM THE PROPELLER.

(1) Remove and discard the feather stops (1540) and safety wire.

(2) Remove and discard the screws 170) that retain the retaining ring (165).

(3) Remove the retaining ring (165) and the pitch stop spacers (160).

CAUTION: DO NOT USE FORCE ON THE FEATHERING SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE FEATHERING SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE FEATHERING SPRING ASSEMBLY.

(4) Push the feathering spring assembly (1300) into the cylinder (190) to permit removal of the split keepers (180).

(5) While the spring is compressed, remove the split keepers (180) from the groove in the cylinder (190).

(6) Remove the feathering spring assembly (1300) from the cylinder (190).

E. Cylinder and Guide Collar Unit Disassembly

(1) If applicable, use a round bottom stamp to identify the guide collar unit (1550) and piston unit (1500) to the corresponding hub arm.

(2) Loosen the self-locking socket head cap screw (1570) in the side of the guide collar unit (1550).

CAUTION: TURN THE CYLINDER SLOWLY AND CAREFULLY TO PREVENT DAMAGING THE THREADS.

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder from the hub unit (2300).

(4) Remove the cylinder (190).

(5) Remove the guide collar unit (1550) and discard the cap screw (1570).

(6) Remove and discard the cylinder O-ring (200).

F. Clamp Removal

(1) Using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630), if applicable.

(2) Remove and discard the outboard clamp bolt (1710), washer (1720), and self-locking nut (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screw (1690).

(4) Remove and discard the inboard clamp socket screw (1690).

(5) Remove the blade clamp half (1610) from the hub arm.

(6) Remove and discard the clamp gasket (1700).

(7) Remove and discard the fillister head screw (320).

(8) Remove the slug weight (310).

(9) For blade clamp (1600) disassembly and clamp overhaul instructions, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(a) If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Make a record of the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(10) Remove the blade assembly from its hub pilot tube (2310).

(11) For aluminum blade disassembly and overhaul instructions, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

G. Blade Mounting Parts Disassembly
Refer to Figure 3-2.

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the half of the inboard bearing race (240).

(3) Remove and discard the bearing ball (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

(14) Repeat steps (1) through (13) of this procedure for the remaining blades.

H. Hub Unit Disassembly

(1) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

8. Disassembly of Propeller Model (P)HC-A3(MV,V)F-5R

A. Start Lock Unit Removal

(1) Install the propeller assembly on the rotatable fixture TE125 on the assembly table TE129.

(2) If the propeller is in feather position:

(a) Remove the hex head bolts (1020 and 1080) and nuts (1090) that attach the start lock assemblies (1200) to the spinner mounting plate (85).

(b) Remove the start lock assemblies (1200).

(c) If applicable, remove the start lock spacer (1130).

(3) If the propeller is not in feather position:

(a) Apply air pressure through the rotatable fixture to move the blades to high pitch blade angle.

NOTE: In high pitch, the stop plate (1110) is not resting on the start lock pin (1240).

(b) Retract the start lock pin (1240).

(c) Hold the retracted start lock pin (1240) in place by inserting a piece of heavy wire in the hole through the start lock bracket (1250).

(d) Remove the hex head bolt (1020 and 1080) that attach the start lock (1200) to the spinner mounting plate (85).

(e) Remove the start lock (1200).

(f) If applicable, remove the start lock spacer (1130).

(g) Slowly remove air air pressure from the propeller to move the blades to feather angle.

B. Beta Rod and Piston Disassembly

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING NUT (110) IS BEING REMOVED.

CAUTION 1: THE PROPELLER MUST BE IN FEATHER POSITION BEFORE IT IS DISASSEMBLED.

CAUTION 2: THERE MUST BE NO AIR PRESSURE APPLIED TO THE PROPELLER WHEN REMOVING THE SELF-LOCKING NUT (110) THAT RETAINS THE PISTON ASSEMBLY (1500).

(1) To minimize reassembly problems, measure the distance between the beta ring (50) and the hub flange.

(2) Remove and discard the self-locking hex nut (10) from the end of the beta rod unit (40) at the beta rod support ring (75).

(3) Remove the beta rod support ring (75).

(4) Remove and discard the nuts (20 and 60) from the end of the beta rod at the piston (1500).

(5) Loosen the hex nut (55) from the end of the beta rod unit (40) at the beta ring (50).

CAUTION: TURN THE BETA ROD UNITS (40) ALTERNATELY TO PREVENT DAMAGE TO THE BETA RING (50).

(6) Remove the beta rod units (40) from the beta ring (50), two turns at a time.

(7) Lower the beta ring (50) to the assembly table.

WARNING: DO NOT PERMIT THE PITCH CHANGE ROD (1320) TO TURN WHILE THE SELF-LOCKING THIN HEX NUT (110) IS BEING REMOVED.

(8) Remove and discard the self-locking thin hex nut (110) that holds the piston in place.

(9) Rotate the blades by hand from feather to reverse.

(10) Remove the safety wire between the link pin units (120) and the safety screws (130).

(11) Remove and discard the link pin units (120) and safety screws (130).

(12) Disconnect the link arm (140) from the piston unit (1500).

(13) Remove the piston unit (1500).

(14) Remove and discard the piston O-ring (1535) and the piston dust seal (1530).

(15) Remove and discard the pitch change rod O-ring (150).

C. Feathering Spring Removal

WARNING: THE FEATHERING SPRING ASSEMBLY IS PRELOADED TO APPROXIMATELY 1000 POUNDS FORCE. USE EXTREME CAUTION WHEN REMOVING IT FROM THE PROPELLER.

(1) Remove and discard the feather stops (1540) and safety wire.

(2) Remove and discard the screws 170) that retain the retaining ring (165).

(3) Remove the retaining ring (165) and the pitch stop spacers (160).

CAUTION: DO NOT USE FORCE ON THE FEATHERING SPRING ASSEMBLY (1300) TO RELEASE THE FRONT SPLIT KEEPER (180) IN THE CYLINDER (190). APPLYING FORCE TO THE FEATHERING SPRING ASSEMBLY MAY CAUSE THE RELEASE OF THE REAR SPLIT KEEPER (1380) INSIDE THE FEATHERING SPRING ASSEMBLY.

(4) Push the feathering spring assembly (1300) into the cylinder (190) to permit removal of the split keepers (180).

(5) While the spring is compressed, remove the split keepers (180) from the groove in the cylinder (190).

(6) Remove the feathering spring assembly (1300) from the cylinder (190).

D. Cylinder and Guide Collar Unit Disassembly

(1) If applicable, use a round bottom stamp to identify the guide collar unit (1550) and piston unit (1500) to the corresponding hub arm.

(2) Loosen the cap screw (1570) in the side of the guide collar unit (1550).

WARNING: THE CYLINDER (190) IS RETAINING THE BETA COMPRESSION SPRINGS (65) UNDER LOAD. THE CYLINDER AND GUIDE COLLAR (1550) WILL RELEASE VERY ABRUPTLY WHEN DISENGAGED FROM HUB (2300).

CAUTION: TURN THE CYLINDER (190) SLOWLY AND CAREFULLY TO AVOID DAMAGING THE THREADS OR BENDING THE BETA ROD UNITS (40).

(3) Using a bar of appropriate size to fit into the slot in the top of the cylinder (190) as a wrench, slowly turn and remove the cylinder from the hub unit (2300).

(4) Remove the cylinder (190).

(5) Remove the beta rod units (40) from the guide collar unit (1550).

(6) Remove and discard the beta compression springs (65).

(7) Discard the cap screw (1570).

(8) Remove and discard the cylinder O-ring (200).

(9) Remove and discard the bolts (1030) that attach the spinner mounting plate (85) to the hub (2300).

(10) Remove the spinner mounting plate (85).

(11) Remove and discard the snap rings (90) from the guide lugs (100).

(12) Remove the guide lugs (100) from the spinner mounting plate (85).

(a) For information about guide lug bushing (105) replacement, refer to Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

E. Clamp Removal
Refer to Figure 3-2.

(1) Using a round bottom stamp or electric pencil, identify the clamp serial number on the corresponding counterweight (1630), if applicable.

(2) Remove and discard the outboard clamp bolt (1710), washer (1720), and self-locking nut (1730).

(3) Remove and discard the cotter pin (1680) from the inboard clamp socket screw (1690).

(4) Remove and discard the inboard clamp socket screw (1690).

(5) Remove the blade clamp half (1610) from the hub arm.

(6) Remove and discard the clamp gasket (1700).

(7) Remove and discard the fillister head screw (320).

(8) Remove the slug weight (320).

(9) For blade clamp (1600) disassembly and clamp overhaul instructions, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(a) If possible, the blade assembly should be reinstalled on the hub arm from which it was removed. Make a record of the blade serial number and its matching hub arm and clamp.

CAUTION: DO NOT DAMAGE THE BLADES WHEN THEY ARE REMOVED AND STORED.

(10) Remove the blade assembly from its hub pilot tube (2310).

(11) For aluminum blade disassembly and overhaul instructions, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

F. Blade Mounting Parts Disassembly
Refer to Figure 3-2.

(1) Remove and discard the wire bearing retainer (230) from its groove in the inboard bearing race (240).

(2) Remove the half of the inboard bearing race (240).

(3) Remove and discard the bearing ball (250).

(4) Remove and discard the ball spacer (260).

(5) Remove and discard the blade O-ring (270).

(6) Remove the bearing guide ring (280) using Option 1 or Option 2. Refer to Figure 3-2, Step One.

(a) Option 1: Using a rubber mallet and TE309, drive the bearing guide ring (280) inboard over the shoulder of the hub arm.

(b) Option 2: Using a rubber mallet and soft punch, at several positions on the outboard edge of the bearing guide ring (280), drive the ring inboard over the shoulder of the hub arm.

(7) Remove the wire retainer ring (290) that had been covered by the bearing retaining ring (280).

(8) Discard the wire retainer ring (290).

(9) As shown in Step Two, Figure 3-2, turn the halves of the outboard bearing race (300) so the parting line is at the top.

(10) At the parting line, place one bearing ball (250) between the outboard bearing race (300) and the inboard shoulder of the hub arm.

(11) With a soft rubber mallet, lightly tap the inboard top edge of a bearing retaining ring (280) to loosen the outboard bearing race (300).

(12) Remove the halves of the outboard bearing race (300).

(13) Tilt the bearing retaining ring (280) inboard to an angle of approximately 45 degrees, and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 3-2, Step Three.

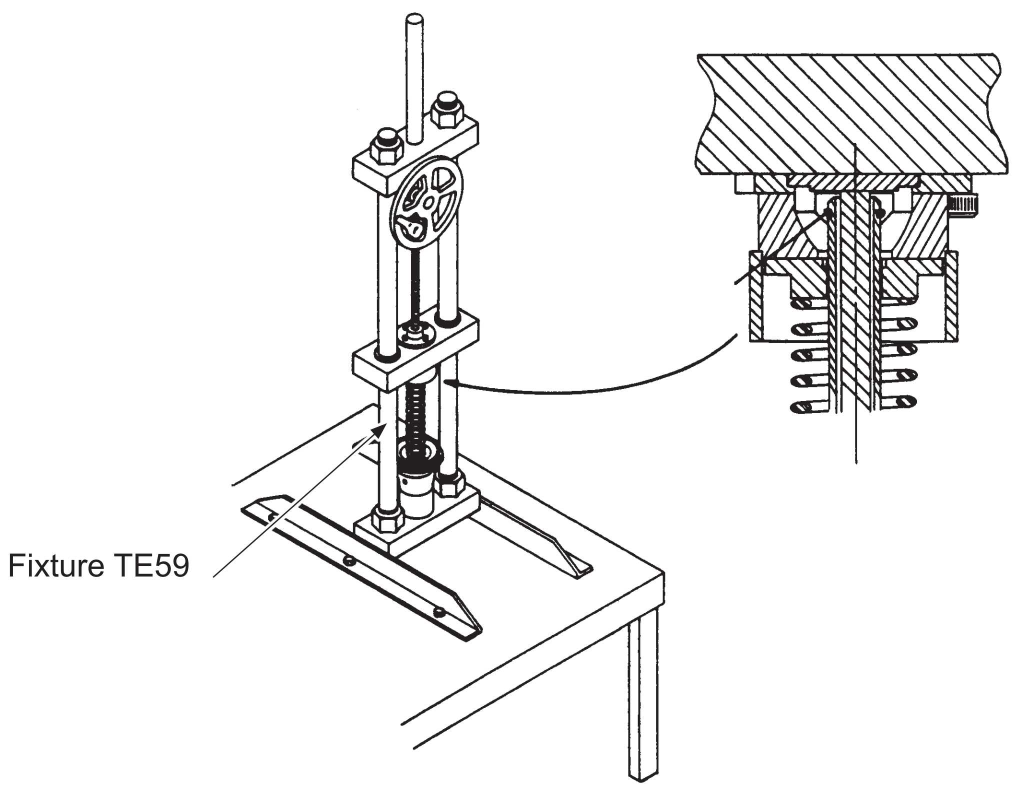
(14) Repeat steps (1) through (13) of this procedure for the remaining blade.

G. Hub Unit Disassembly

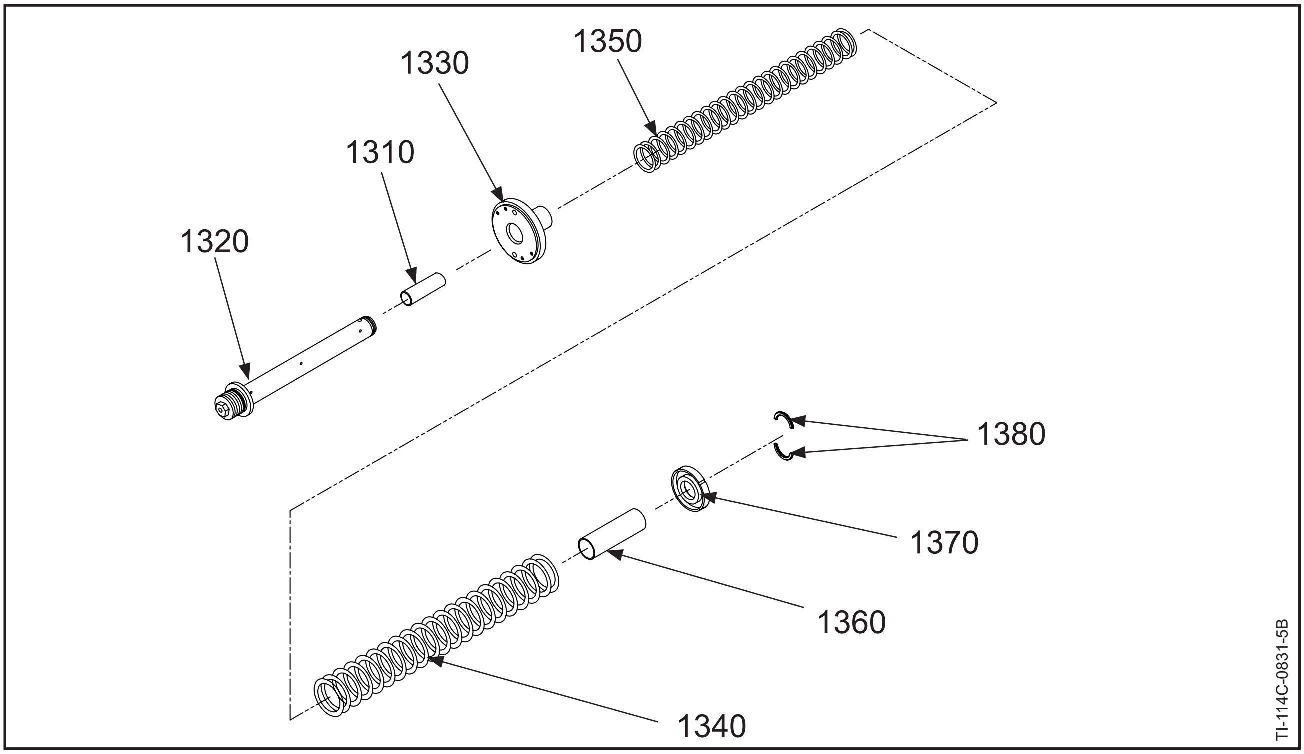
(1) Remove the spacer (2460) from the hub.

(2) Remove and discard the O-rings (2390, 2395).

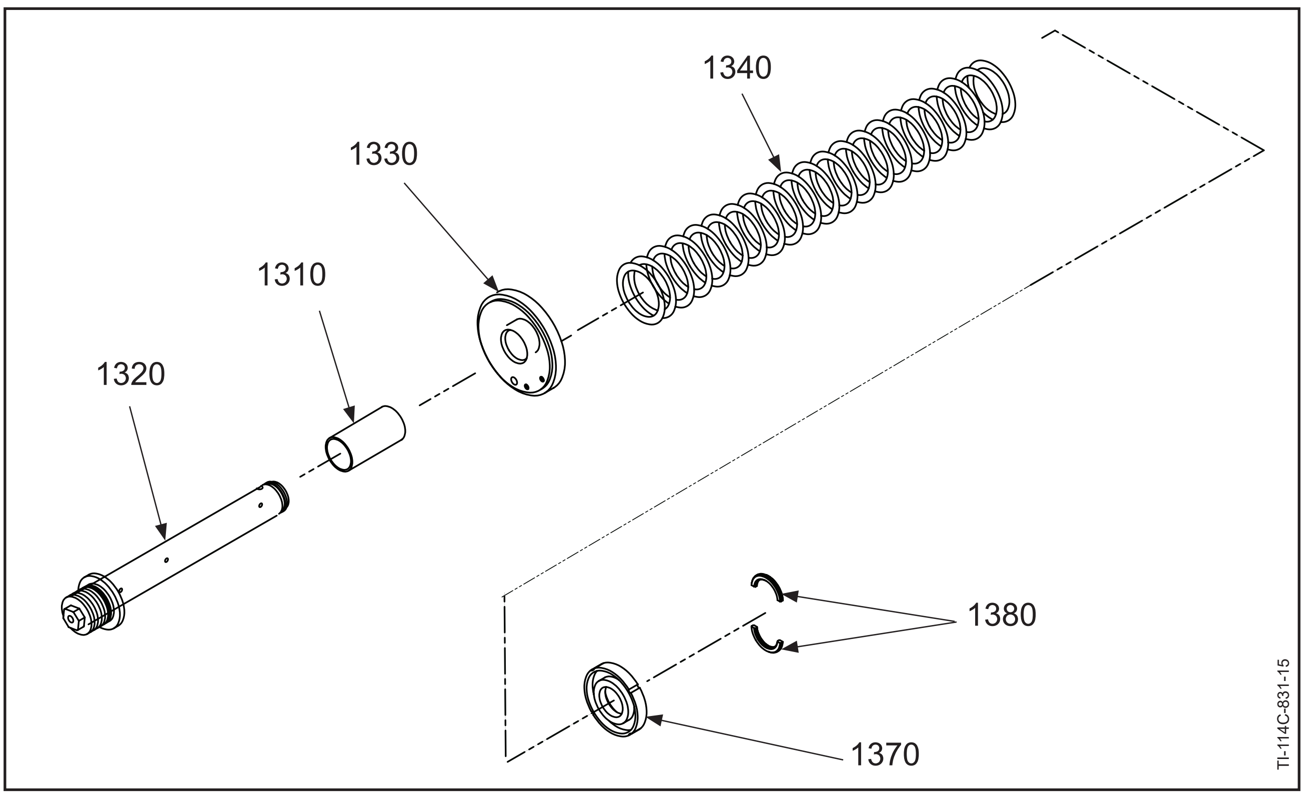
(3) For steel hub disassembly and overhaul procedures refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Placing the Spring Assembly in the Spring Compression Fixture TE59
Figure 3-4



831-5B Feathering Spring Assembly
Figure 3-5



831-15 Spring Assembly
Figure 3-6

WARNING: THE FEATHERING SPRING ASSEMBLY IS PRELOADED TO APPROXIMATELY 1000 POUNDS FORCE. USE EXTREME CAUTION DURING DISASSEMBLY.

9. Disassembly of Spring Assembly/Feathering Spring Assembly

A. 831-5B Feathering Spring Assembly
Refer to Figure 3-4 and Figure 3-5.

(1) Using the spring compression fixture TE59 or equivalent, compress the feathering spring for disassembly.

(2) Remove and discard the split rear split keeper (1380).

(3) Let the feathering spring assembly to expand to its unloaded length, and remove it from the spring compression fixture TE59.

(4) Remove the rear spring retainer (1370).

(5) Remove the feathering springs (1340 and 1350).

(6) Remove the stop sleeve (1360).

(7) Remove the front flanged spring retainer (1330).

(8) Remove the stop sleeve (1310).

(9) Remove the pitch change rod (1320).

B. 831-15 Feathering Spring Assembly
Refer to Figure 3-4 and Figure 3-6.

(1) Using the spring compression fixture TE59 or equivalent, compress the feathering spring for disassembly.

(2) Remove and discard the split keepers (1380).

(3) Let the feathering spring assembly to expand to its unloaded length, and remove it from the spring compression fixture TE59.

(4) Remove the rear spring retainer (1370).

(5) Remove the feathering spring (1340).

(6) Remove the flanged spring retainer (1330).

(7) Remove the spacer tube (1310).

(8) Remove the pitch change rod (1320).

C. 831-35 Feathering Spring Assembly
Refer to Figure 3-4 and Figure 3-7.

(1) Using the spring compression fixture TE59 or equivalent, compress the feathering springs for disassembly.

(2) Remove and discard the split rear retainer (1380).

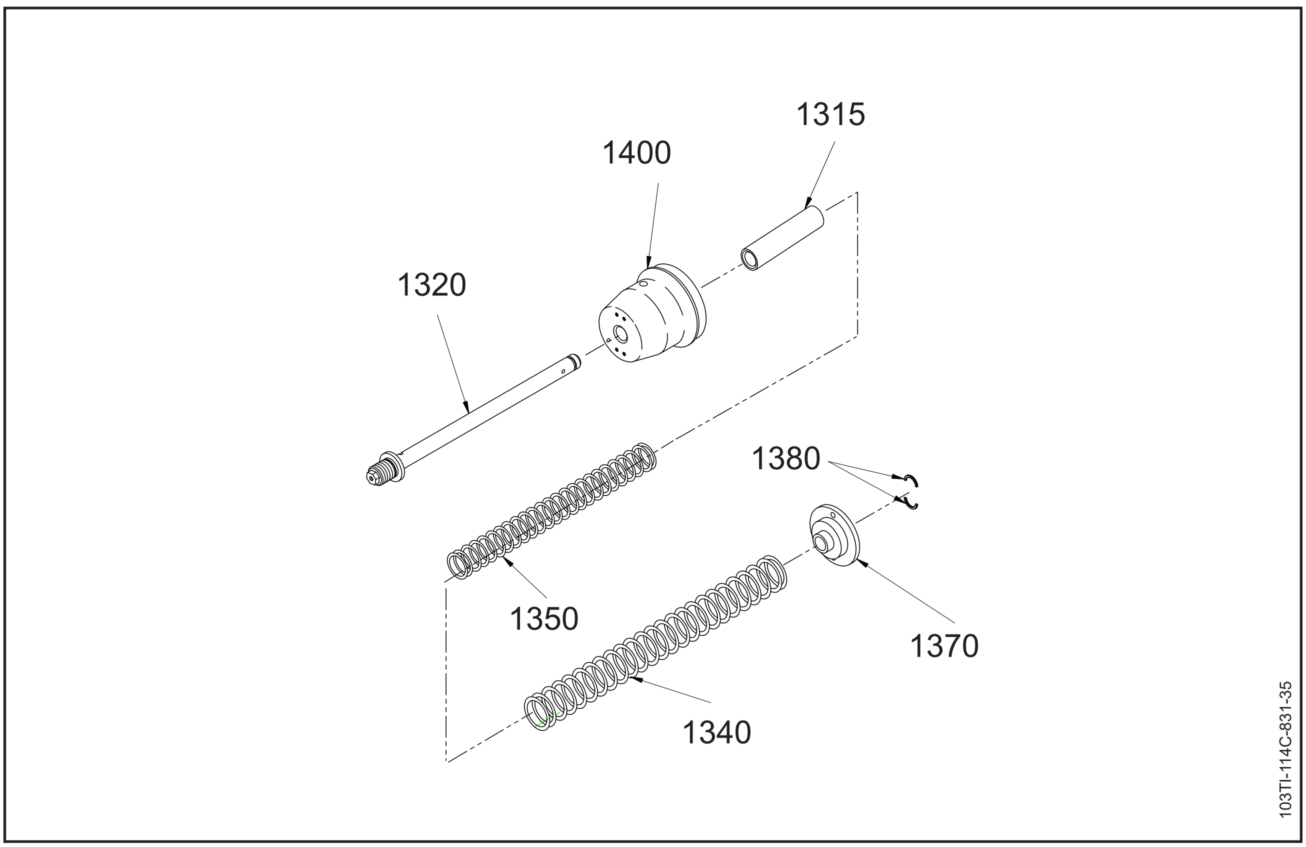
(3) Let the feathering spring assembly to expand to its unloaded length, and remove it from the spring compression fixture TE59.

(4) Remove the rear spring retainer (1370).

(5) Remove the feathering springs (1340) and (1350).

(6) Remove the spacer tube (1315).

(7) Remove the pitch change rod (1320).



831-35 Spring Assembly
Figure 3-7

D. 831-53 Feathering Spring Assembly
Refer to Figure 3-4 and Figure 3-8.

(1) Using the spring compression fixture TE59 or equivalent, compress the feathering springs for disassembly.

(2) Remove and discard the split rear split keeper (1380).

(3) Let the feathering spring assembly to expand to its unloaded length, and remove it from the spring compression fixture TE59.

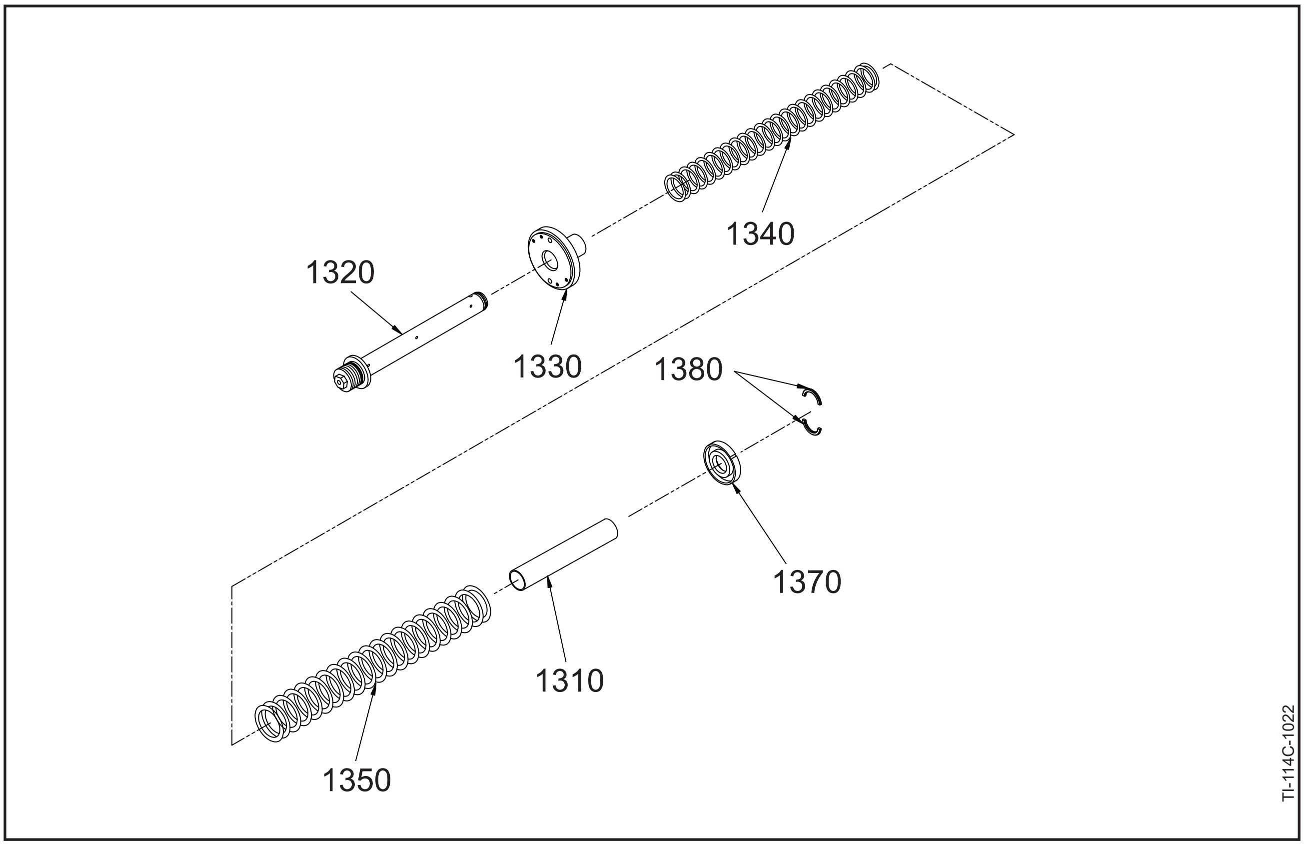
(4) Remove the rear spring retainer (1370).

(5) Remove the feathering springs (1340 and 1350).

(6) Remove the front flanged spring retainer (1330).

(7) Remove the stop sleeve (1310).

(8) Remove the pitch change rod (1320).



831-53 Spring Assembly
Figure 3-8

E. 831-85 Spring Assembly
Refer to Figure 3-4 and Figure 3-9.

(a) Using the spring compression fixture TE59 or equivalent, compress the spring for disassembly.

(b) Remove and discard the split rear split keeper (1380).

(c) Let the spring assembly (1300) to expand to its unloaded length, and remove it from the spring compression fixture TE59.

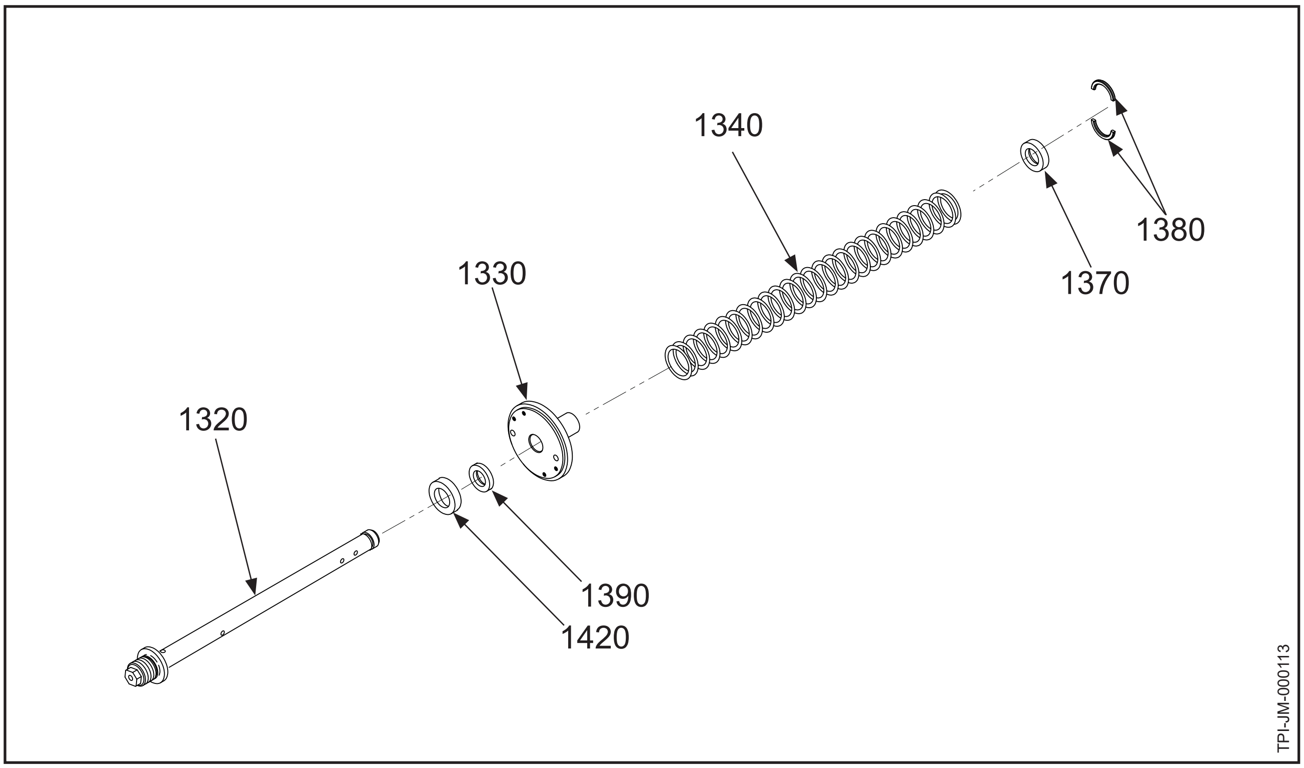
(d) Remove the rear spring retainer (1370).

(e) Remove the springs (1340).

(f) Remove the spring spacer (1420).

(g) Remove the front flanged spring retainer (1330).

(h) Remove the pitch change rod (1320).



831-85 Spring Assembly
Figure 3-9

F. 831-89 Spring Assembly
Refer to Figure 3-4 and Figure 3-10.

(1) Using the spring compression fixture TE59 or equivalent, compress the springs for disassembly.

(2) Remove and discard the split keeper (1380).

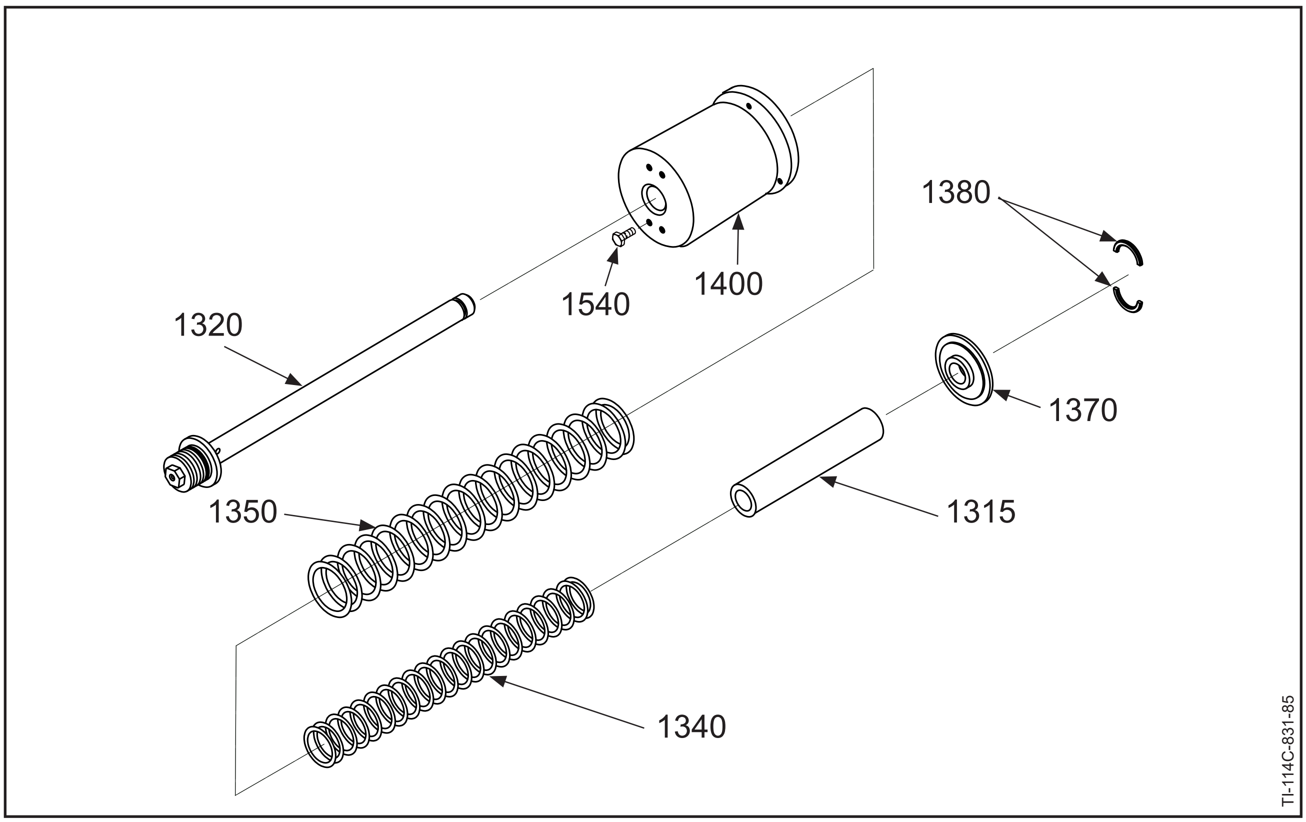
(3) Let the spring assembly (1300) to expand to its unloaded length, and remove it from the spring compression fixture TE59.

(4) Remove the rear spring retainer (1370).

(5) Remove the springs (1340) and (1350).

(6) Remove the spacer tube (1315).

(7) Remove the pitch change rod (1320).



831-89 Spring Assembly
Figure 3-10

10. Disassembly of the Start Lock Unit

A. 830-4(L) Start Lock Assembly
Refer to Figure 3-11.

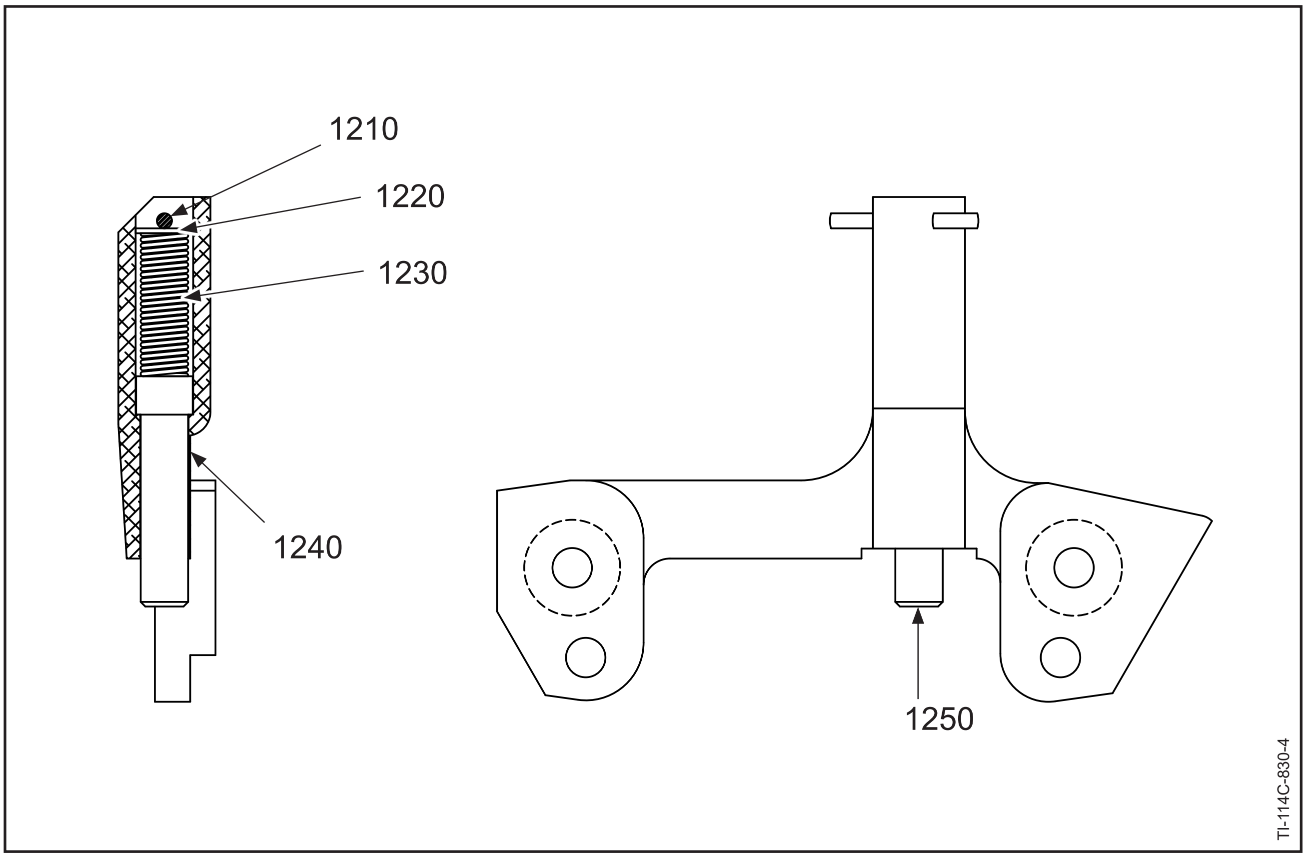
WARNING: THE SPRING (1230) IS COMPRESSED AND WILL BE RELEASED WHEN THE COTTER PIN (1210) IS REMOVED.

(a) Remove and discard the cotter pin (1210) from the bracket (1250).

(b) Remove and discard the washer (1220) from the bracket (1250).

(c) Remove and discard the compression spring (1230) from the bracket (1250).

(d) Remove the pin (1240) from the bracket (1250).



830-4 Start Lock Assembly
Figure 3-11

B. 830-27 Start Lock Assembly
Refer to Figure 3-12

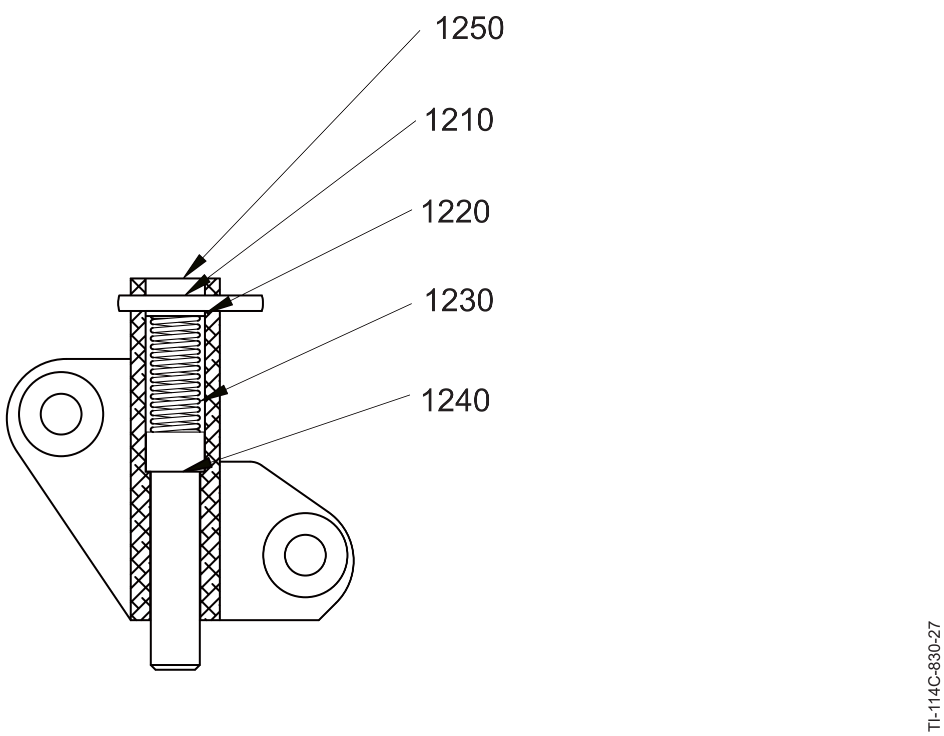
WARNING: THE SPRING (1230) IS COMPRESSED AND WILL BE RELEASED WHEN THE COTTER PIN (1210) IS REMOVED.

(1) Remove and discard the cotter pin (1210) from the bracket (1250).

(2) Remove and discard the washer (1220) from the bracket (1250).

(3) Remove and discard the compression spring (1230) from the bracket (1250).

(4) Remove pin (1240) from the bracket (1250).



830-27 Start Lock Assembly
Figure 3-12

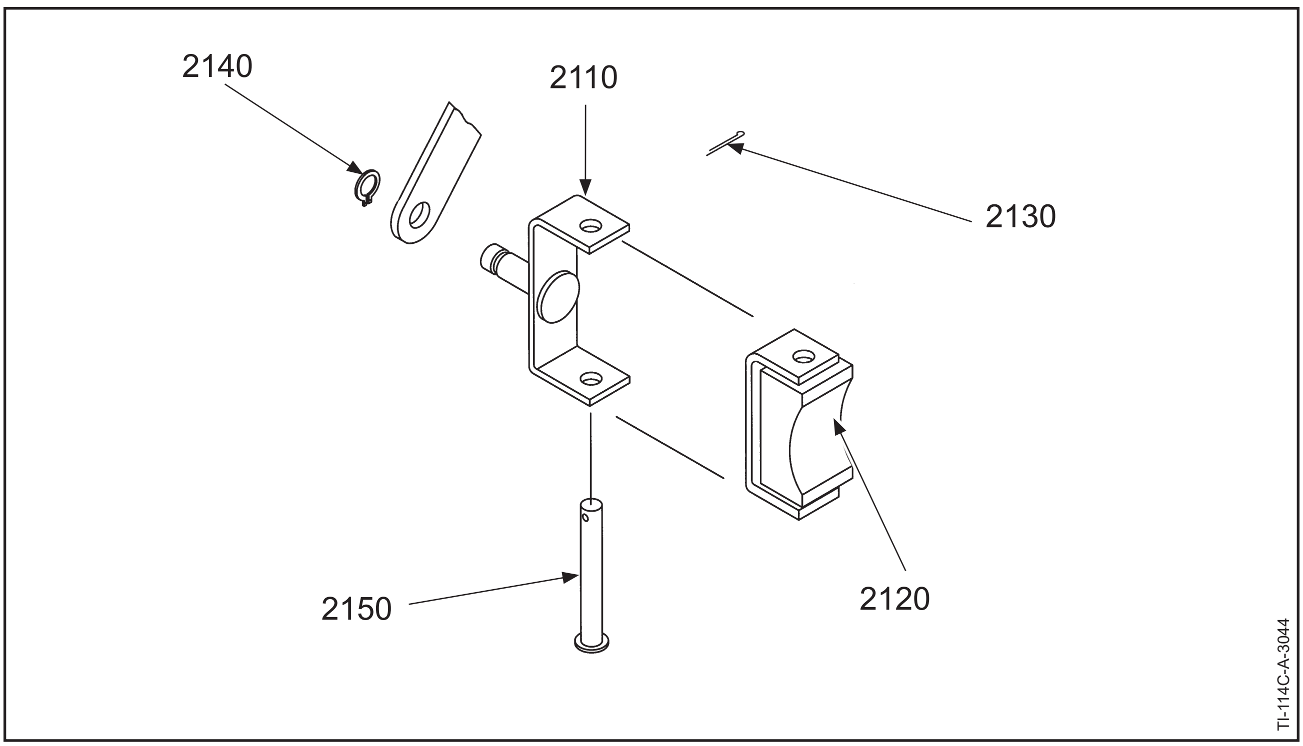
11. Disassembly of the Beta Feedback Block Assembly
Refer to Figure 3-13

A. Procedure

(1) Remove and discard the cotter pin (2130) from the clevis pin (2150).

(2) Remove and discard the clevis pin (2150) from the yoke unit (2110) and the carbon block unit (2120).

(3) Remove and discard the carbon block unit (2120) from the yoke unit (2110).



A-3044 Beta Feedback Block Assembly
Figure 3-13

(Blank Page)

CLEANING - CONTENTS

(Blank Page)

1. Cleaning Procedures (Rev. 4)

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

A. 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 Plating 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).

(Blank Page)

CHECK - CONTENTS

CHECK - CONTENTS, CONTINUED

4. Propeller Component Checks, continued

LIST OF FIGURES

(Blank Page)

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 of 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) Steel Hubs: Refer to the Steel 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).

D. Blade Clamps

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

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).

F. 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)

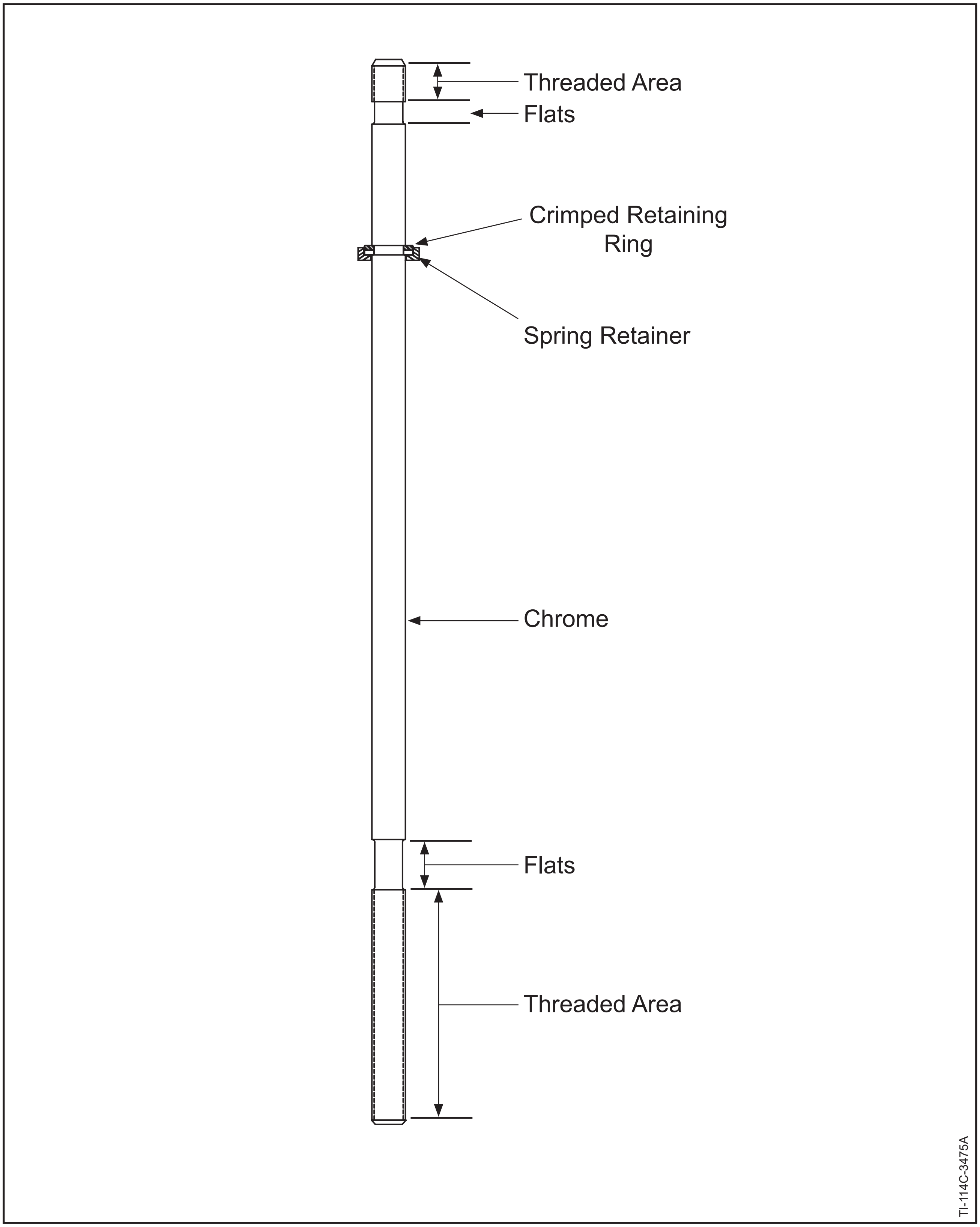
G. Special Inspections (Lightning Strike, Foreign Object Strike, etc.)

(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.

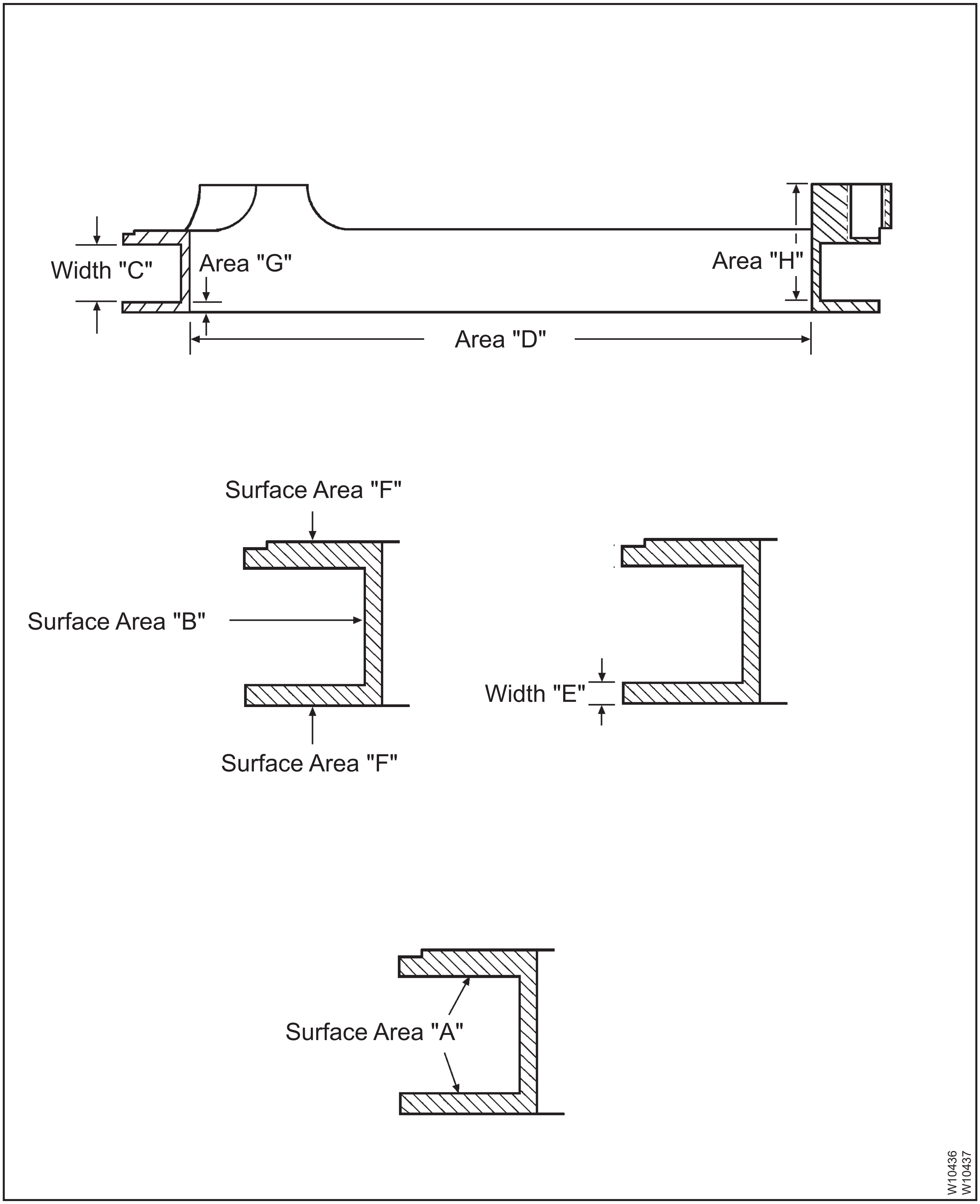
Refer to Table 5-1, "Component Inspection Criteria" in this chapter.



Beta Rod
Figure 5-1

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
A. BETA ROD (40) Refer To Figure 5-1.		
(1) Visually examine each beta rod for bending or distortion.	Bending or distortion is not permitted.	If there is bending or distortion, replace the beta rod.
(2) Visually examine each beta rod for damage that penetrates the chrome surface.	Damage must not penetrate the chrome surface.	If there is damage greater than the permitted serviceable limits, replace the beta rod.
(3) Visually examine the condition of the threaded areas of each beta rod for damage or wear.	Damage or wear must not be more than 10 degrees of the circumference.	If there is damage greater than the permitted serviceable limits, replace the beta rod.
(4) Measure the OD of each beta rod.	The minimum permitted OD of each beta rod is 0.370 inch (9.40 mm).	If the OD is less than the permitted serviceable limits, replace the beta rod.
(5) Visually examine the flats of each beta rod.	Sufficient flat must exist without damage to permit an open-end wrench to engage.	If a wrench will not engage, replace the beta rod.
(6) Perform a magnetic particle inspection of each beta rod 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 beta rod.



Beta Ring Inspection
Figure 5-2

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
B. BETA RING (50) Refer to Figure 5-2.		
(1) Visually examine the beta ring for a crack.	A crack is not permitted.	If there is a crack, replace the beta ring.
(2) Visually examine the bottom of the threaded holes for impressions made by the beta rods.	The maximum permitted height of any bump or the depth of any impression in this area is 0.004 inch (0.10 mm).	If the height of any bump or the depth of any impression is greater than the permitted serviceable limits, replace the beta ring.
(3) Visually examine the sidewalls of the groove for any scratches (Area "A").	The maximum permitted depth of a scratch is 0.004 inch (0.10 mm). Raised material that is caused by a scratch is not permitted.	If there is a scratch that is 0.004 inch (0.10 mm) deep or less, using an abrasive pad CM47 or equivalent, polish to remove pushed-up material adjacent to the scratch only. If the depth of the scratch is greater than the permitted serviceable limits, replace the beta ring.
(4) Visually examine the groove of the beta ring for any scratches or gouges (Area "B").	A scratch or gouge in the groove that is 0.007 inch (0.17 mm) or less must be removed. A scratch or gouge in the groove that is greater than 0.007 inch (0.17 mm) is cause for retirement of the beta ring.	If the scratch or gouge is within the permitted limits, remove the scratch or gouge in accordance with the Repair chapter. If damage or repair is greater than the permitted serviceable limits, replace the beta ring.
(5) Measure the width of the groove in the beta ring (Width "C").	The maximum permitted width of the groove in the beta ring is 0.510 inch (12.95 mm).	If the width of the groove is greater than the permitted serviceable limits, replace the beta ring.
(6) Measure the ID of the beta ring (Area "D").	The maximum permitted ID of the beta ring is 5.4270 inch (137.85 mm).	If the ID of the beta ring is greater than the permitted serviceable limits, replace the beta ring.

Component Inspection Criteria
Table 5-1

Inspect		Serviceable Limits	Corrective Action
B.	BETA RING (50), continued Refer to Figure 5-2.		
	(7) Measure the width of the bottom flange on the beta ring. Inspect a minimum of four separate points on each flange (Width "E").	The minimum permitted width is 0.073 inch (1.85 mm) at any one point on the bottom flange.	If the width is greater than the permitted serviceable limits, replace the beta ring.
	(8) Measure any depression or gouge on the outside surface of the beta ring (Area "F").	A depression or gouge must be removed. The maximum permitted depth for a depression or gouge is 0.007 inch (0.17 mm).	Refer to the Repair chapter of this manual if the damage is within the permitted limits. If damage or repair is greater than the permitted serviceable limits, replace the beta ring.
	(9) Visually examine the area beginning on the side opposite the lugs extending 0.1875 inch (4.763 mm) toward the lug side of the inner surface as shown ("Area G").	A groove or scratch that is 0.007 inch (0.17 mm) deep or less must be removed. A groove or scratch that is deeper than 0.007 inch (0.17 mm) is cause for retirement of the beta ring.	If there is a groove or scratch that is 0.007 inch (0.17 mm) deep or less, using an abrasive pad CM47 or equivalent, polish the inner surface, maintaining a maximum ID of 5.4270 inches (13.785 cm). See step "B.(6)". If damage is greater than the permitted serviceable limits or corrective action, replace the beta ring.
	(10) Visually examine the inner surface, excluding "Area G", above, but including the inner surface of the lug areas, for grooves and scratches ("Area H").	A groove or scratch that is equal to or less than 0.007 inch (0.17 mm) deep does not require repair.	If there is a groove or scratch that is deeper than 0.007 inch (0.17 mm), using an abrasive pad CM47 or equivalent, polish the inner surface, maintaining a maximum ID of 5.4270 inches (137.84 mm). See step "B.(6)". If damage is greater than the permitted serviceable limits or corrective action, replace the beta ring.
	(11) Penetrant inspect the beta ring in accordance with the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Pre-penetrant etch is not required.	A relevant indication is not permitted.	If there is a relevant indication, replace the beta ring.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
C. <u>SPACER (30, 70, 95)</u>		
(1) Visually examine the spacer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Standard Practices Manual 202A (61-01-02).
(2) Visually examine the spacer for pitting.	The maximum permitted depth of pitting is 0.005 inch (0.12 mm).	If the depth of pitting is greater than the permitted serviceable limits, replace the spacer.
(3) Visually examine the spacer for anodize coverage.	A maximum of 0.5 square inch (322.5 square mm) missing anodize is permitted on external surfaces.	If the amount of missing anodize is greater than the permitted serviceable limits, replace the spacer.

Component Inspection Criteria
Table 5-1

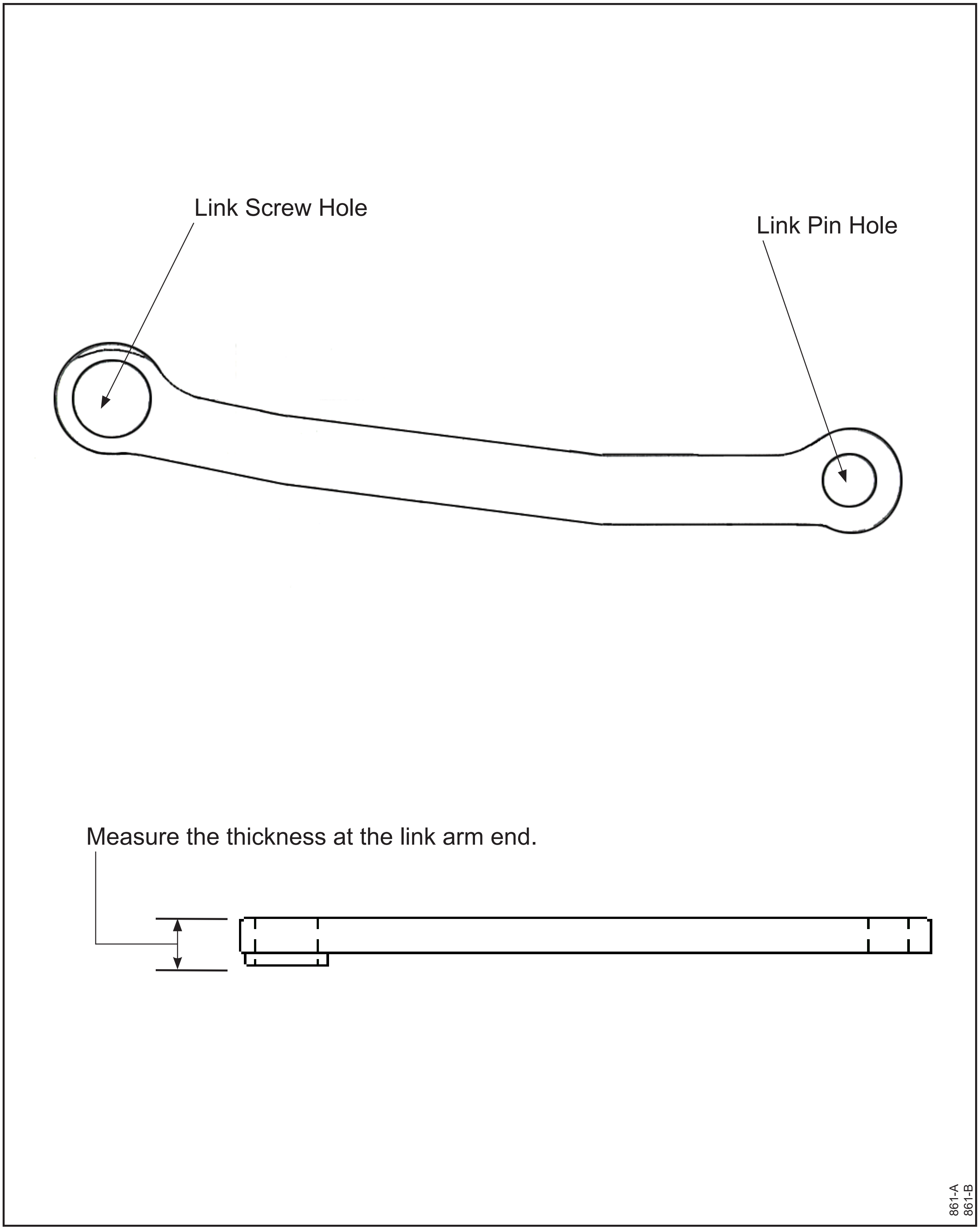
Inspect	Serviceable Limits	Corrective Action
D. <u>BETA ROD SUPPORT RING (75)</u>		
(1) Visually examine the beta rod support ring for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Standard Practices Manual 202A (61-01-02).
(2) Visually examine the beta rod support ring for pitting.	The maximum permitted depth of pitting is 0.005 inch (0.12 mm). Pitting may not cover more than 10% of the beta rod support ring surface.	If the depth of pitting is greater than the permitted serviceable limits or if pitting coverage is more than the permitted serviceable limits, replace the beta rod support ring.
(3) Visually examine the beta rod support ring for anodize coverage.	Loss of anodize that is caused by the clamping nuts around each of the three holes is permitted. Sparse and light, random scratches are permitted. In all other areas, complete coverage of the anodize is required.	If the anodize coating is less than the permitted serviceable limits, replate the beta rod support ring in accordance with the anodize chapter in Hartzell Standard Practices Manual 202A (61-01-02).
(4) Visually examine the beta rod support ring for wear.	If there is wear, measure. The maximum permitted depth of material loss is 0.005 inch (0.12 mm).	If the wear is greater than the permitted serviceable limits, replace the beta rod support ring.
(5) Visually examine the beta rod support ring for flatness.	The beta rod support ring must be flat in accordance with a visual examination. Dimensional measurement of flatness is not required.	If the flatness of the beta support ring is not within the serviceable limits, replace the beta rod support ring.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
E. GUIDE LUG PLATE/SPINNER MOUNTING PLATE (85)		
(1) Visually examine the guide lug plate/spinner mounting plate for corrosion product and pitting.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits. The maximum permitted depth of pitting is 0.005 inch (0.13 mm).	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed or if the pitting is greater than the permitted serviceable limits, replace the guide lug plate/ spinner mounting plate.
(2) Visually examine the guide lug plate/spinner mounting plate for scratches.	The maximum permitted depth of a scratch is 0.005 inch (0.12 mm).	If the depth of a scratch is greater than the permitted serviceable limits, replace the guide lug plate/ spinner mounting plate.
(3) Magnetic particle inspect the guide lug plate/spinner mounting plate at each overhaul in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Cadmium plating does not need to be removed.	A relevant indication is not permitted.	If there is a relevant indication,replace the guide lug plate/spinner mounting plate.
(4) Visually examine each half of the guide lug plate/spinner mounting plate for a serial number.	Guide lug plate/spinner mounting plates are not interchangeable and must have the same serial number on each half.	If the guide lug plate/spinner mounting plate does not have the same serial number on each half, retire the guide lug plate/spinner mounting plate in accordance with the Part Retirement Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(5) Visually examine the guide lug plate/spinner mounting plate for cadmium plating coverage.	A few random scratches and corners with cadmium plate missing is permitted; otherwise complete coverage is required.	If cadmium plate coverage is less than the permitted serviceable limits, replate the guide lug plate/spinner mounting plate in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
F. GUIDE LUG (100) and GUIDE LUG BUSHING (105)		
(1) Guide Lug (100) ONLY: Visually examine the cadmium plating coverage on the guide lug.	A few random scratches are permitted; otherwise, cadmium plating must completely cover the guide lug.	Remove the guide lug bushing (105) from the guide lug (100). Remove cadmium plating from the guide lug (100), mask the ID of the guide lug, and replate in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Install a guide lug bushing (105) into the guide lug (100) in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(2) Guide Lug Bushing (105) ONLY: Examine the guide lug bushing for movement within the guide lug.	Movement is not permitted.	If there is movement, replace the guide lug bushing (105) in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(3) Guide Lug Bushing (105) ONLY: Measure the ID of the guide lug bushing.	The maximum permitted ID of the guide lug bushing is 0.383 inch (9.72 mm).	If the ID of the guide lug bushing (105) is greater than maximum permitted serviceable limits, replace the guide lug bushing in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	The minimum permitted ID of the guide lug bushing is 0.379 inch (9.62 mm).	If the ID of the guide lug bushing (105) is less than the minimum permitted serviceable limits, machine the guide lug bushing ID in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the guide lug bushing cannot be machined, replace the guide lug bushing in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



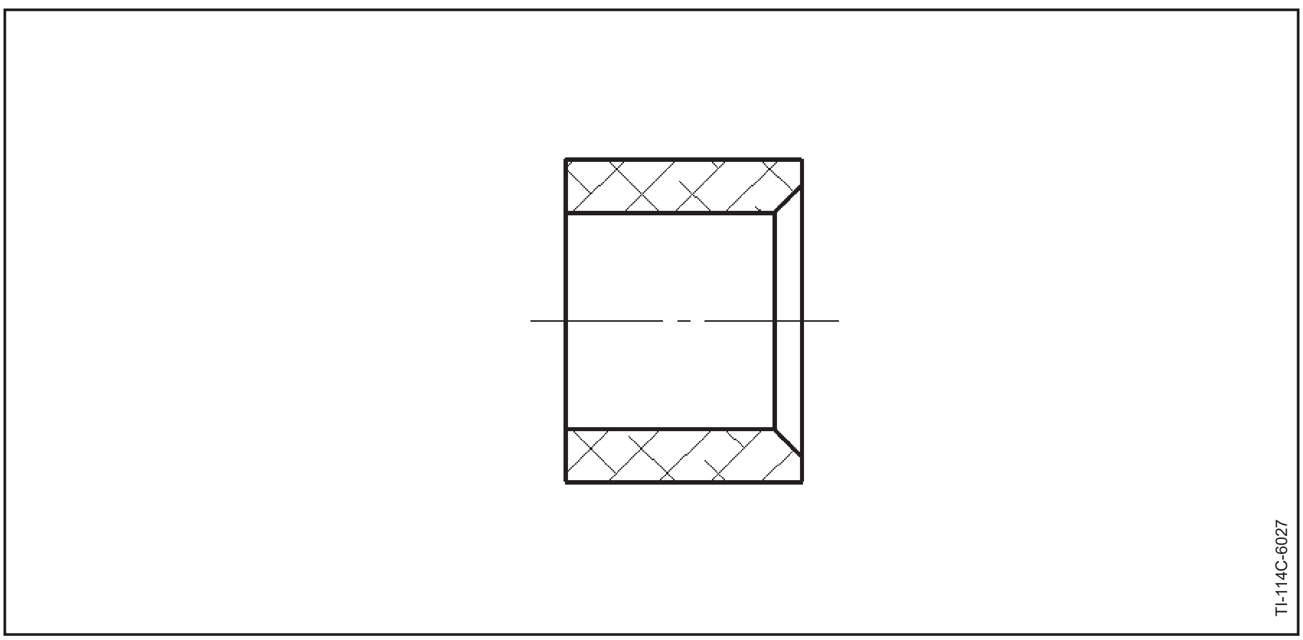
Link Arm Inspection
Figure 5-3

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
G. LINK ARM (140) Refer to Figure 5-3.		
(1) Visually examine each link arm for indications of twisting or distortion.	Twisting or distortion are not permitted. The maximum permitted flatness is 0.015 inch (0.38 mm).	If there are indications of twisting or distortion, replace the link arm. If the flatness is greater than the permitted serviceable limit, replace the link arm.
(2) Visually examine the link pin hole of each link arm.	An oval shaped link pin hole is not permitted.	If the link pin hole is worn to an oval shape, replace the link arm.
(3) Measure the ID of the link pin hole of each link arm.	The maximum permitted ID of the link pin hole is 0.3775 inch (9.588 mm).	If the ID of the link pin hole is greater than the permitted serviceable limit, replace the link arm.
(4) Measure the ID of the link screw hole of each link arm.	The maximum permitted ID of the link screw hole is 0.5645 inch (14.338 mm).	If the ID of the link screw hole is greater than the permitted serviceable limit, replace the link arm.
(5) Measure the thickness of the link arm end next to the link screw hole.	The minimum permitted thickness of the link arm is 0.400 inch (10.16 mm).	If the minimum thickness of the link arm is less than the permitted serviceable limit, replace the link arm.
(6) Visually examine the link arm for wear to the cadmium plating.	A few random scratches and cadmium plating missing from the corners are permitted; otherwise cadmium plate must completely cover the link arm.	If the cadmium plating does not meet the permitted serviceable limit, replate and bake the link arm in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(7) Perform a magnetic particle inspection of each link arm in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Cadmium plating does not need to be removed.	A relevant indication is not permitted.	If there is a relevant indication, replace the link arm.

Component Inspection Criteria
Table 5-1

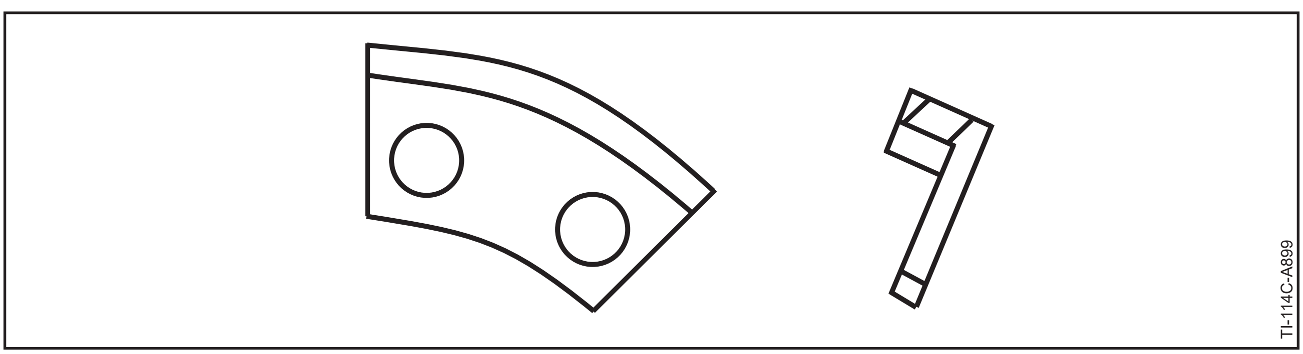
Inspect	Serviceable Limits	Corrective Action
H. PITCH STOP SPACER (155) Refer to Figure 5-4.		
(1) Visually examine the pitch stop spacer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Use glass bead cleaning to remove corrosion product. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the pitch stop spacer.
(2) Visually examine the pitch stop spacer for pitting.	The maximum permitted depth of pitting is 0.005 inch (0.13 mm).	If pitting is deeper than the permitted serviceable limits, replace the pitch stop spacer.
(3) Visually examine the pitch stop spacer for hard anodize coverage.	A maximum of 0.5 square inch (322.5 square mm) missing is permitted on external surfaces.	If the amount of missing Hard Anodize is greater than the permitted serviceable limits, replace the spacer.



Pitch Stop Spacer (155)
Figure 5-4

Component Inspection Criteria
Table 5-1

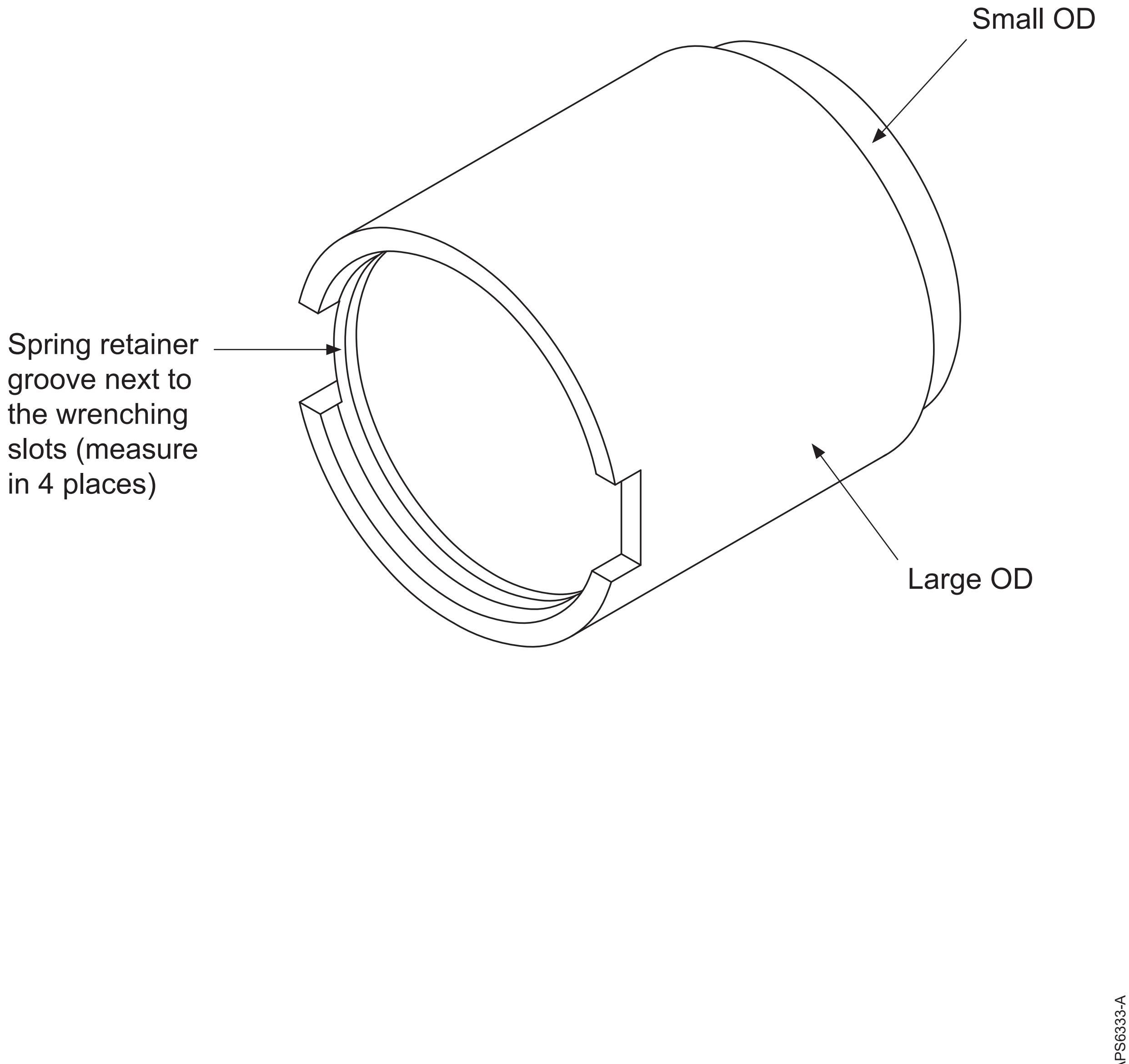
Inspect	Serviceable Limits	Corrective Action
I. PITCH STOP SPACER (160) Refer to Figure 5-5.		
(1) Visually examine the pitch stop spacer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Use glass bead cleaning to remove corrosion product. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the pitch stop spacer.
(2) Visually examine the pitch stop spacer for pitting.	The maximum permitted depth of pitting is 0.005 inch (0.13 mm).	If pitting is deeper than the permitted serviceable limits, replace the pitch stop spacer.
(3) Visually examine the pitch stop spacer for cadmium plating coverage.	A few random scratches are permitted; otherwise, cadmium plating must completely cover the pitch stop spacer.	If the cadmium plating does not meet the permitted serviceable limit, replate and bake the pitch stop spacer in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(4) Perform a magnetic particle inspection of the pitch stop spacer in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Cadmium plating does not need to be removed.	A relevant indication is not permitted.	If there is a relevant indication, replace pitch stop spacer.



Pitch Stop Spacer (160)
Figure 5-5

Component Inspection Criteria
Table 5-1

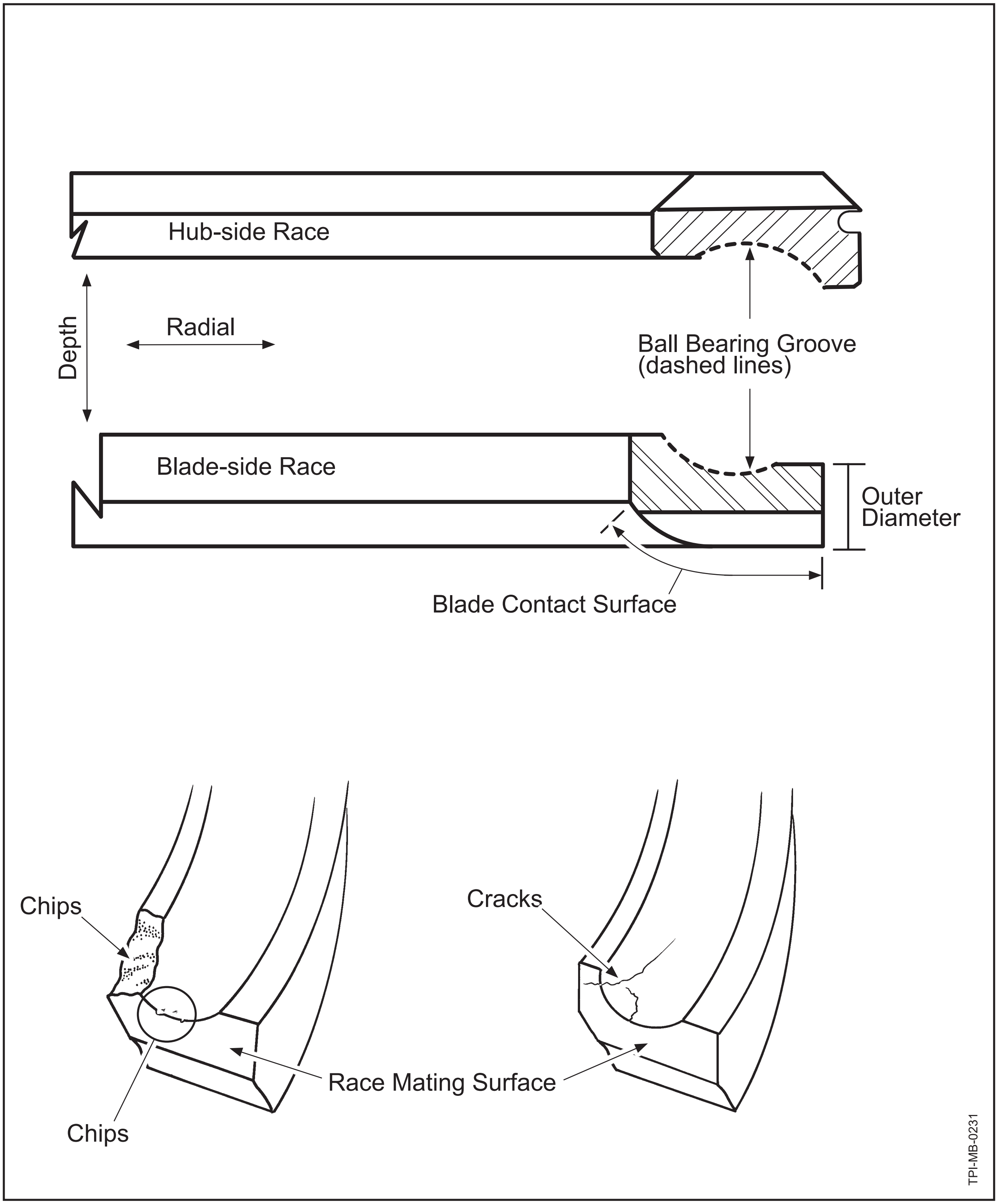
Inspect	Serviceable Limits	Corrective Action
J. <u>SPLIT KEEPER (180)</u>		
(1) Visually examine the split keeper for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Use glass bead cleaning to remove corrosion product. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the split keeper.
(2) Visually examine the split keeper for pitting and damage.	The maximum permitted depth of pitting, wear, or damage is 0.002 inch (0.050 mm).	Visually examine the split keeper for pitting, and damage. If the pitting or damage is greater than the permitted serviceable limits, replace the split keeper.
(3) Visually examine the split keeper for cadmium plating coverage.	A few random scratches are permitted; otherwise, cadmium plating must completely cover the split keeper.	If the cadmium plating does not meet the permitted serviceable limit, replate and bake the split keeper in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Cylinder Inspection
Figure 5-6

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
K. <u>CYLINDER (190)</u> Refer to Figure 5-6.		
(1) Visually examine the front spring retainer groove, adjacent to the wrenching slots, for raised material.	Raised material must not interfere with installation of the split keeper (380).	Using a file, carefully remove raised material.
(2) Visually examine all threaded surfaces on the cylinder.	One damaged thread is permitted.	If the damage is greater than the permitted serviceable limits, replace the cylinder.
(3) Visually examine the cylinder for chrome plate coverage.	Flaking of the chrome finish is not permitted. Minor wear that is within the permitted serviceable limits and random, light scratches that are not greater than the chrome depth and do not interfere with the seal of the O-ring are permitted. Otherwise, complete chrome coverage is required.	If the wear or damage is greater than the permitted serviceable limits, repair or replace the cylinder. For cylinder repair and rechroming procedures, refer to the Hard Chromium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(4) Visually examine the normal operating area of the cylinder for scratches, wear, or gouges.	The maximum permitted depth of a scratch, wear, or gouge is 0.001 inch (0.025 mm).	For cylinder repair and rechroming procedures, refer to the Hard Chromium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(5) Measure the large OD and the small OD of the cylinder.	The minimum permitted large OD is 3.773 inches (95.83 mm). The minimum permitted small OD is 3.496 inches (88.79 mm).	If the large OD or small OD of the cylinder is smaller than the permitted serviceable limits, repair or replace the cylinder. For cylinder repair and rechroming procedures, refer to the Hard Chromium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(6) Magnetic particle inspect the cylinder at overhaul in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Removal of hard the chrome plating before doing Magnetic Particle Inspection is not required.	A relevant indication is not permitted.	If there is a relevant indication, replace the cylinder.



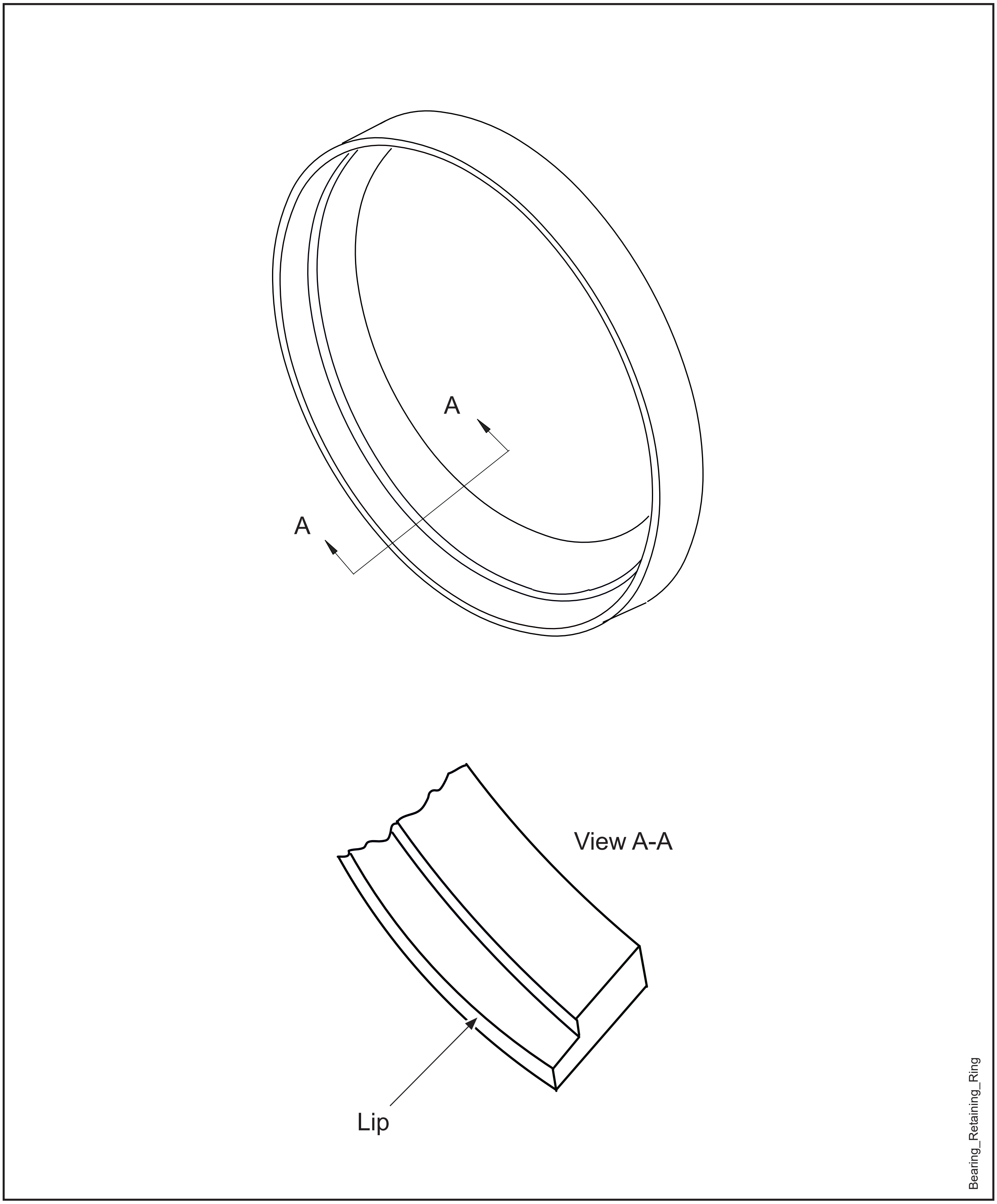
Race (240 and 300)
Figure 5-7

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
L. RACE (240 AND 300) Refer to Figure 5-7.		
(1) Visually examine the ball bearing groove in each race for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If 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 ball bearing 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 ball bearing 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 (240 AND 300), continued Refer to Figure 5-7.		
(3) Except for the ball bearing groove, visually examine all other surfaces of each race for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If 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. Fretting must not loosen the tight fit with the bearing retaining ring.	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 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 or fretting, 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.
(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 (280)
Figure 5-8

Component Inspection Criteria
Table 5-1

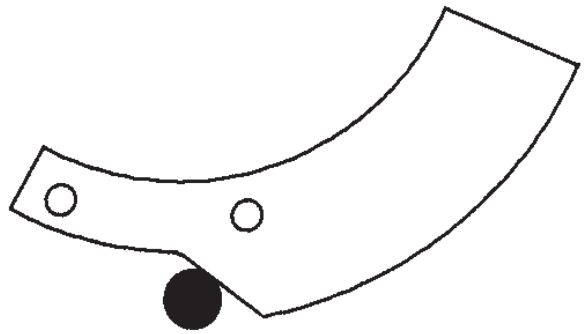
Inspect	Serviceable Limits	Corrective Action
M. BEARING RETAINING RING (280) Refer to Figure 5-8.		
(1) Visually examine the bearing retaining ring for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the bearing retaining ring.
(2) Visually examine the bearing retaining ring for pitting.	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 tight to the blade and the bearing race.	If the pitting is greater than the permitted serviceable limits, replace the bearing retaining ring.
(3) 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 bearing retaining ring retention lip for damage.	Displaced material must not interfere with the wire ring retainer in the hub arm or rise above the normal OD of the bearing retaining ring.	Displaced material may be removed with a file or a rotary grinder (a sufficient amount of the lip must remain). Polish the repaired area to a smooth finish with an abrasive pad CM47, or equivalent.
(5) Verify an interference fit with the hub blade arm.	The bearing retaining ring must fit tightly on the hub blade arm. A loose fit is not permitted.	If the bearing retaining ring is loose, replace the bearing retaining ring.
(6) Visually examine the entire bearing retaining ring for cadmium plating coverage.	A few random scratches and corners with cadmium coating missing is permitted; otherwise, complete coverage is required.	If cadmium plating is less than the serviceable limits, replate the bearing retaining ring in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
M. BEARING RETAINING RING (280), continued Refer to Figure 5-8		
(7) Perform a magnetic particle inspection of the bearing retaining ring in accordance with the Magnetic Particle Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Cadmium plating removal is not required.	A relevant indication is not permitted.	If there is a relevant indication, replace the bearing retaining ring.

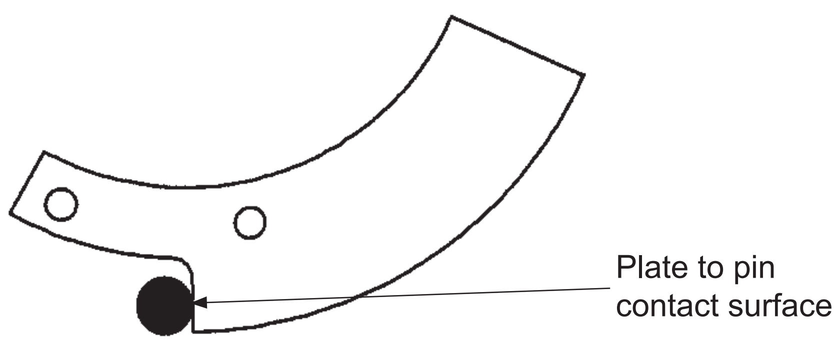
Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
N. BALANCE WEIGHT (310)		
(1) 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).	Polish to a maximum depth of 0.005 inch (0.12 mm). If depth of pitting, wear, or damage is deeper than the permitted serviceable limits after repair, replace the balance weight.
(2) Visually examine the balance weight for corrosion product.	Corrosion product is not permitted.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(3) Visually examine for cadmium plating coverage.	Except for a few scratches and corners with cadmium plating missing, complete coverage is required.	If the cadmium plating coverage is less than the permitted serviceable limits, replate the balance weight in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



NOT PERMITTED

This is an example of a modified start lock plate that is not permitted. If the start lock pin does not squarely contact the start lock plate, the start lock plate must be replaced.



PERMITTED

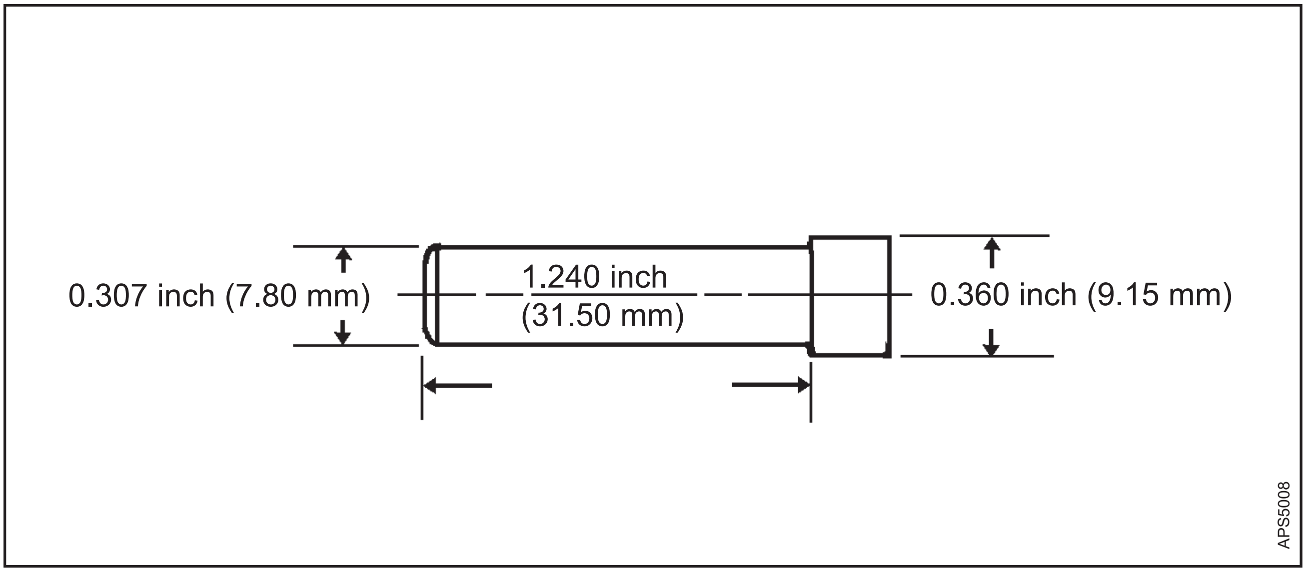
This is an example of a modified start lock plate that is permitted. The contact area of this start lock plate has been modified to permit the start lock pin to squarely contact the start lock plate.

W10498-01-Acceptable
W10498-02-Unacceptable

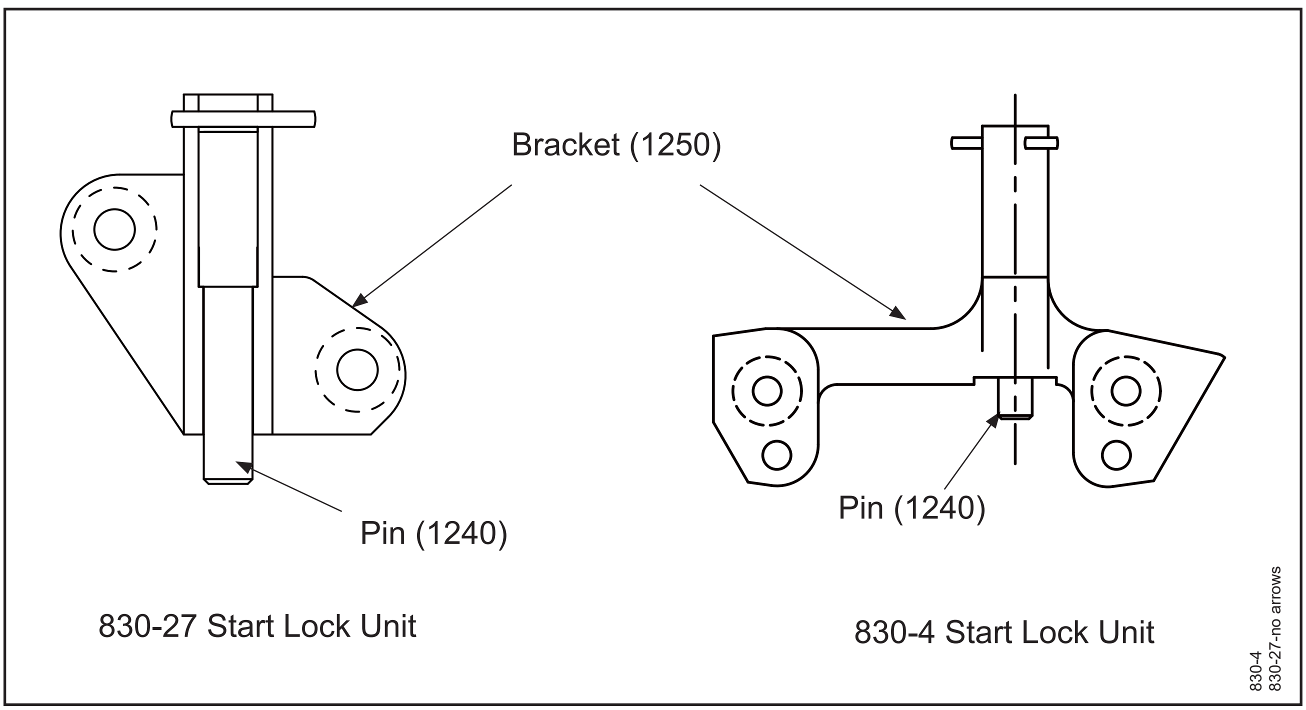
Start Lock Plate Inspection
Figure 5-9

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
O. START LOCK PLATE (1100) Refer to Figure 5-9.		
(1) Visually examine the start lock plate for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the start lock plate.
(2) Visually examine the start lock plate for indications of pitting.	The maximum permitted depth of pitting is 0.005 inch (0.12 mm).	If the pitting is deeper than the permitted serviceable limits, replace the start lock plate.
(3) Visually examine the start lock plate for scratches.	The maximum permitted depth of a scratch is 0.005 inch (0.12 mm).	If a scratch is deeper than the permitted serviceable limits, replace the start lock plate.
(4) Visually examine the start lock plate for wear on the surface that contacts the start lock pin.	The maximum permitted depth of wear is 0.020 inch (0.50 mm).	If the wear is deeper than the permitted serviceable limits, replace the start lock plate.
(5) Visually examine the start lock plate for modification.	Modifying the start lock plate to get high pitch is permitted. If modification is performed, the notched area must contact the pin squarely. Refer to Figure 5-15 for permitted limits when modified.	If the start lock plate has been modified and does not permit square contact with the pin, replace the start lock plate.
(6) Visually examine the start lock plate for cadmium plating coverage.	A few random scratches are permitted; otherwise, cadmium plating must completely cover the start lock plate.	If the cadmium plating coverage does not meet the permitted serviceable limits, replate and bake the start lock plate in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Start Lock Pin Inspection
Figure 5-10



Start Lock Bracket Inspection
Figure 5-11

Component Inspection Criteria
Table 5-1

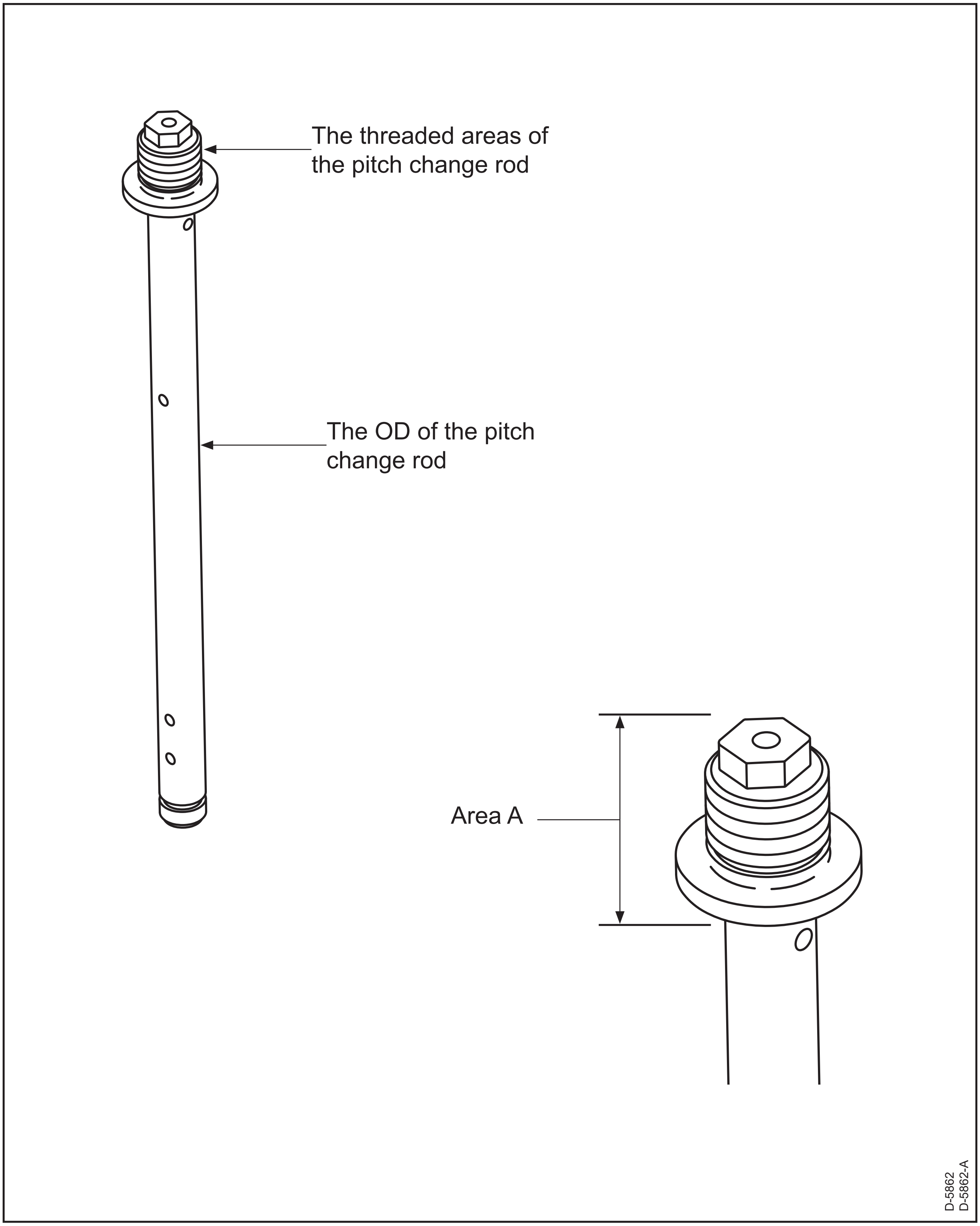
Inspect	Serviceable Limits	Corrective Action
P. START LOCK PIN (1100) Refer to Figure 5-10.		
(1) Measure the start lock pin in accordance with Figure 5-10.	Refer to Figure 5-10 for the minimum permitted dimensional limits.	If the start lock pin measures less than the permitted serviceable limits, replace the start lock pin.
(2) Visually examine the start lock pin for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the start lock pin.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
Q. START LOCK BRACKET (1250) Refer to Figure 5-11.		
(1) Visually examine the start lock bracket surface area (excluding the bore area) for nicks, gouges, or other damage.	The maximum permitted depth of damage is 0.005 inch (0.12 mm).	If the damage is greater than the permitted serviceable limits, using an abrasive pad CM47 or equivalent, polish the damaged area and chemical conversion coat in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(2) Visually examine the start lock bracket (excluding the bore area) for corrosion product.	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. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Chemical conversion coat in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the start lock bracket.
(3) Visually examine the bore area of the start lock bracket for corrosion product.	Corrosion product is not permitted.	If there is corrosion product, replace the start lock bracket.
(4) Perform a Penetrant Inspection of the start lock bracket in accordance with the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). It is not necessary to remove the anodized coating before the penetrant inspection.	A relevant indication is not permitted.	If there is a relevant indication, replace the start lock bracket.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
R. STOP SLEEVE (1310)		
(1) Visually examine the stop sleeve for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the stop sleeve.
(2) Visually examine the stop sleeve for indications of wear or pitting.	The maximum permitted depth of wear or pitting is 0.005 inch (0.12 mm).	If the wear or pitting is greater than the permitted serviceable limits, replace the stop sleeve.
S. SPRING SPACER TUBE (1315)		
(1) Visually examine the spring spacer tube for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the spring spacer tube.
(2) Visually examine the spring spacer tube for wear and pitting.	The maximum permitted depth of wear or pitting is 0.005 inch (0.12 mm).	If wear or pitting is greater than the permitted serviceable limits, replace the spring spacer tube.
(3) Visually examine the spring spacer tube for hard anodize coverage.	A maximum of 0.5 square inch (322.5 square mm) hard anodize missing is permitted on an external surfaces.	If the amount of missing hard anodize is greater than the permitted serviceable limits, replace the spring spacer tube.



Pitch Change Rod Inspection
Figure 5-12

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
T. PITCH CHANGE ROD (1320) Refer to Figure 5-12.		
(1) Visually examine the threaded areas of the pitch change rod for damage.	A maximum of 1/4 of one thread total accumulated damage is permitted.	If the damage is greater than the permitted serviceable limits, replace the pitch change rod.
(2) Measure the OD of the pitch change rod.	The minimum permitted OD of the pitch change rod is: B-855-A pitch change rod is 0.981 inch (24.92 mm). B-1465-( ) pitch change rod is 0.732 inch (18.59 mm). D-5862-( ) pitch change rod is 0.726 inch (18.44 mm)	If the OD of the pitch change rod is less than the permitted serviceable limits, replace the pitch change rod.
(3) Perform a magnetic particle inspection of the pitch change rod 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 pitch change rod.
(4) Visually examine the pitch change rod for cadmium plate coverage in Area "A".	A maximum of 10% of the base metal visible is permitted.	If the cadmium plating coverage is less than the permitted serviceable limits, replate and bake the end of the pitch change rod Area "A" in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
U. FLANGED SPRING RETAINER (1330)		
(1) Visually examine the flanged spring retainer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the flanged spring retainer.
(2) Visually examine the flanged spring retainer for wear, pitting, nicks, gouges, or damage.	The maximum permitted depth of wear, pitting, nicks, or gouges damage is 0.005 inch (0.12 mm).	If the wear, pitting, nicks, or gouges are deeper than the permitted serviceable limits, replace the flanged spring retainer.
(3) Visually examine the 10-32 threaded holes for damage.	A maximum of 1/2 of one thread total accumulated damage is permitted in each threaded hole.	If the damage is greater than the permitted serviceable limits, replace the flanged spring retainer.
(4) Measure the ID of the pitch change rod hole.	The maximum permitted ID of the pitch change rod hole is: A-856 flanged spring retainer is 0.991 inch (25.17 mm). A-871 spring retainer is 0.741 inch (18.82 mm).	If the ID of the pitch change rod hole is greater than the permitted serviceable limits, replace the flanged spring retainer.
(5) Perform a Penetrant Inspection of the flanged spring retainer in accordance with the Penetrant 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 flanged spring retainer.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
V. COMPRESSION FEATHERING SPRING (1340 AND 1350)		
(1) Visually examine the feathering compression spring for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the feathering compression spring.
(2) Visually examine the feathering compression spring for pitting.	The maximum permitted depth of pitting is 0.005 inch (0.12 mm).	If the pitting is greater than the permitted serviceable limits, replace the feathering compression spring.
(3) Visually examine the feathering compression spring for wear, nicks, or other damage.	The maximum permitted depth of damage is 0.005 inch (0.12 mm).	If damage is greater than the permitted serviceable limits, replace the feathering compression spring.
(4) Perform a magnetic particle inspection of the feathering compression spring 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 feathering compression spring.
W. STOP SLEEVE (1360)		
(1) Visually examine the stop sleeve for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the stop sleeve.
(2) Visually examine the stop sleeve for wear and pitting.	The maximum permitted depth of wear or pitting is 0.005 inch (0.12 mm).	If wear or pitting is greater than the permitted serviceable limits, replace the stop sleeve.

Component Inspection Criteria
Table 5-1

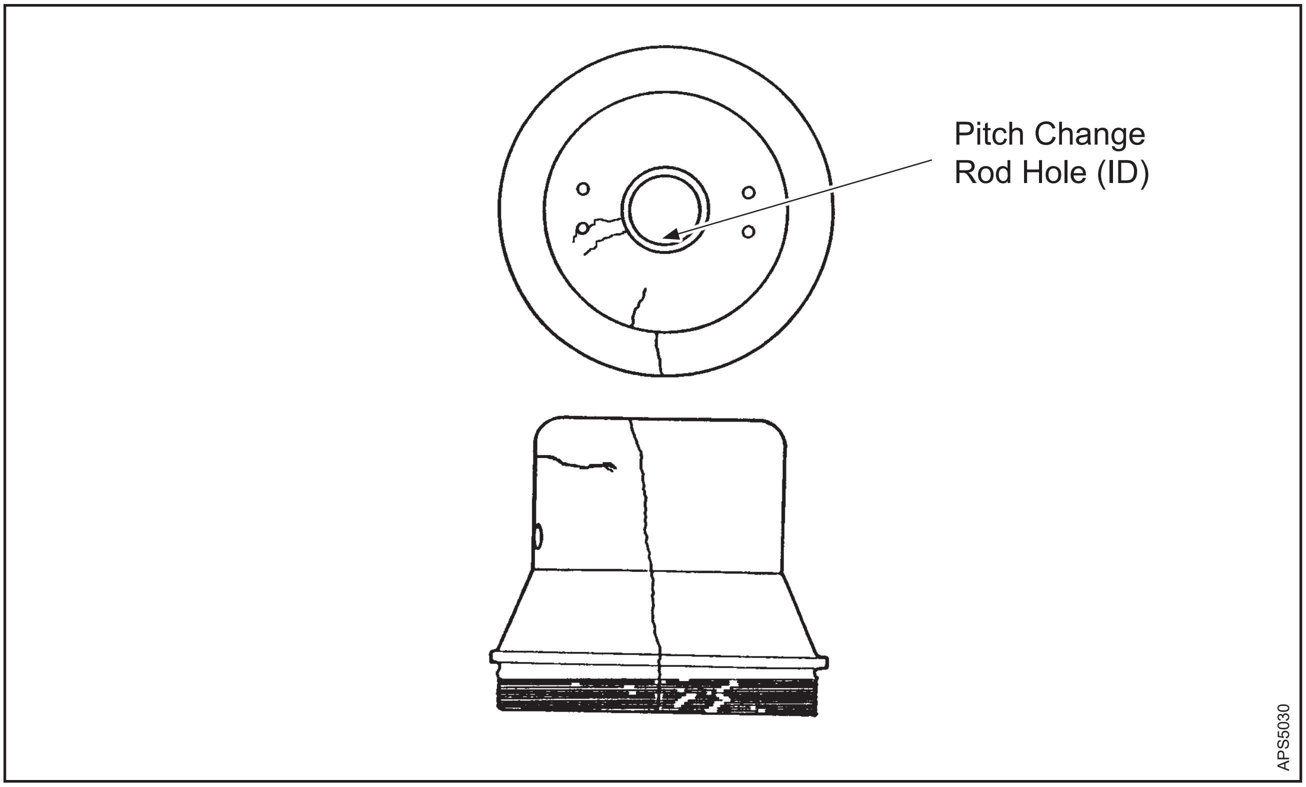
Inspect	Serviceable Limits	Corrective Action
X. A-857-1 REARSPRING RETAINER (1370)		
(1) Visually examine the rear spring retainer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the rear spring retainer.
(2) Visually examine the rear spring retainer for indications of wear or pitting.	The maximum permitted depth of wear or pitting is 0.005 inch (0.12 mm).	If the wear or pitting is deeper than the serviceable limits, replace the rear spring retainer.
(3) Visually examine the rear spring retainer for damage caused by the feathering compression spring.	The maximum permitted depth of damage is 0.005 inch (0.12 mm).	Remove material that is raised above the surface in areas where the depth of damage is less than the permitted serviceable limits. If damage is deeper than the permitted serviceable limits, replace the rear spring retainer.
(4) Visually examine the OD surface of the rear spring retainer that contacts the hub/engine shaft bore for wear.	If there is wear, Measure the OD. The minimum permitted OD of the rear spring retainer is 2.227 inches (56.57 mm).	If the OD is less than the permitted serviceable limits, replace the rear spring retainer.

Component Inspection Criteria
Table 5-1

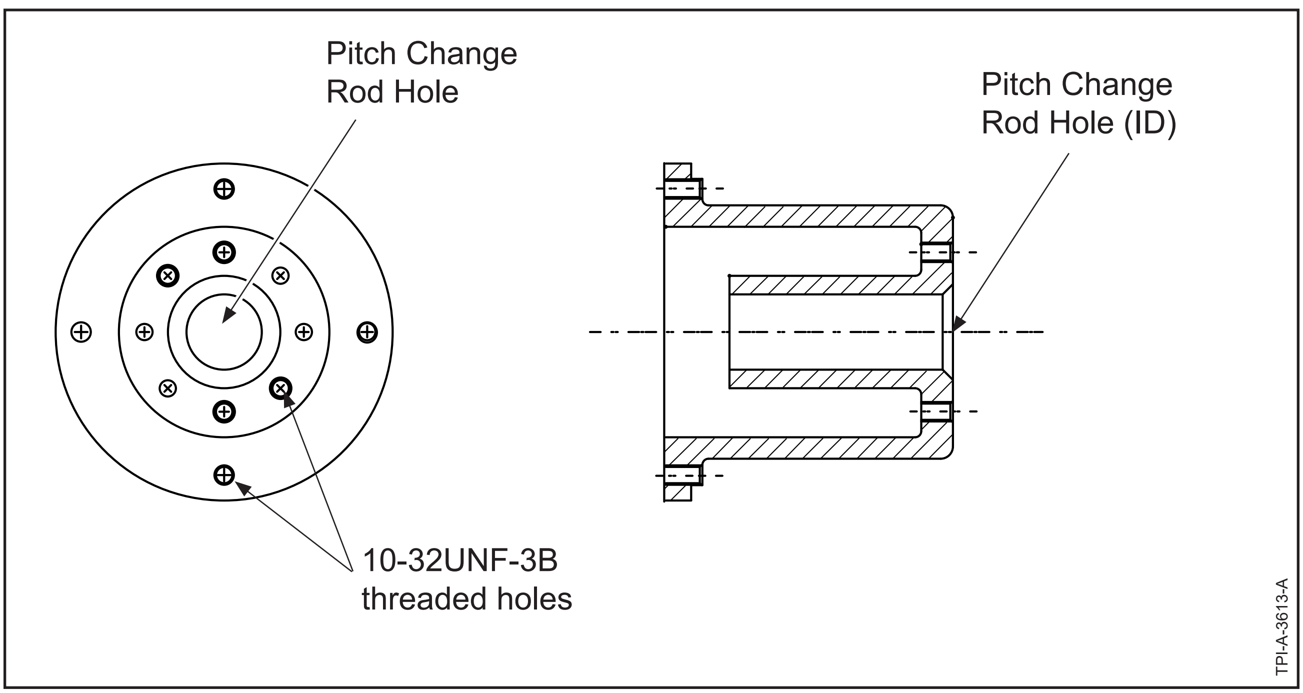
Inspect	Serviceable Limits	Corrective Action
Y. A-866 REAR SPRING RETAINER (1370)		
(1) Visually examine the rear spring retainer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the A-866 rear spring retainer.
(2) Visually examine the rear spring retainer for indications of wear and pitting.	The maximum permitted depth of wear or pitting is 0.010 inch (0.25 mm).	If the wear or pitting is deeper than the permitted serviceable limits, replace the A-866 rear spring retainer.
(3) Visually examine the rear spring retainer for damage caused by the spring.	If there is damage, measure. The maximum permitted depth of damage is 0.005 inch (0.12 mm).	Remove material that is raised above the surface in areas where the depth of damage is less than the maximum permitted serviceable limits. If damage is deeper than the permitted serviceable limits, replace the A-866 rear spring retainer.
(4) Visually examine the OD surface of the rear spring retainer that contacts the hub/engine shaft bore for wear.	If there is wear, measure the OD of the rear spring retainer. The minimum permitted OD of the rear spring retainer is 1.236 inches (31.40 mm).	If the OD is less than the permitted serviceable limits, replace the rear spring retainer.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
Z. A-1460 REAR SPRING RETAINER (1370)		
(1) Visually examine the rear spring retainer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the A-1460 rear spring retainer.
(2) Visually examine the rear spring retainer for wear and pitting.	If there is wear or pitting, Measure. The maximum permitted depth of wear or pitting is 0.005 inch (0.12 mm)	If the wear or pitting is deeper than the permitted serviceable limits, replace the A-1460 rear spring retainer.
(3) Visually examine the rear spring retainer for damage caused by the feathering compression spring.	If there is damage, Measure. The maximum permitted depth of damage is 0.005 inch (0.12 mm).	Remove material that is raised above the surface in areas where the depth of damage is less than the maximum permitted serviceable limits. If the damage is deeper than the permitted serviceable limits, replace the rear spring retainer.
(4) Visually examine the OD surface of the rear spring retainer that contacts the hub/engine shaft bore for wear.	If there is wear, measure the OD of the rear spring retainer. The minimum permitted OD of the rear spring retainer is 2.227 inches (56.57 mm).	If the OD is less than the permitted serviceable limits, replace the rear spring retainer.



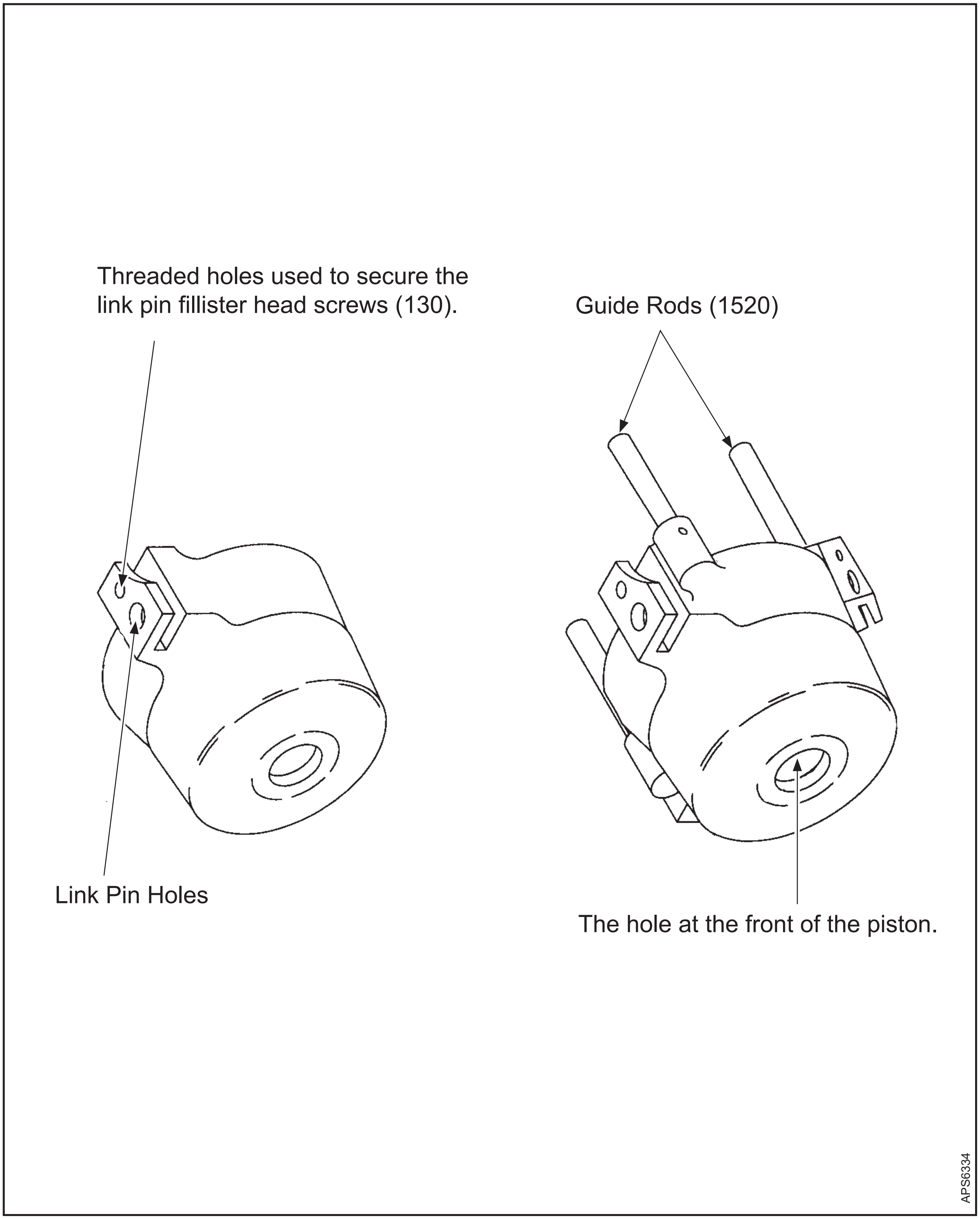
Spring Retainer Cup Typical Crack Locations
Figure 5-13



Spring Retainer Cup Inspection
Figure 5-14

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AA. SPRING RETAINER CUP (1400) Refer to Figure 5-13 and Figure 5-14.		
(1) Visually examine the spring retainer cup for damage to the threads.	Slight damage may have been done to the first thread when the initial hole was drilled for the safety wire. This damage is permitted. A maximum of 1/4 of one thread total accumulated damage (excluding drill damage to the first three threads) is permitted. Additional thread damage is not permitted.	If the thread damage is greater than the permitted serviceable limits, replace the spring retainer cup.
(2) Visually examine the 10-32UNF-3B threaded holes for damage.	A maximum of 1/2 of one thread total accumulated damage is permitted for each 10-32UNF-3B threaded hole.	If the thread damage is greater than the permitted serviceable limits, replace the spring retainer cup.
(3) Visually examine the spring retainer cup for damage to the safety wire hole area.	Safety wire holes may be "pulled out" of the spring retainer cup. This damage is permitted if a new safety wire hole can be established. Other damage is not permitted.	If the damage is greater than the permitted serviceable limits, replace the spring retainer cup.
(4) Visually examine the spring retainer cup for cracks.	A crack is not permitted.	If there is a crack, replace the spring retainer cup.
(5) Measure the ID of the pitch change rod hole of the spring retainer cup for wear.	The maximum permitted ID of the pitch change rod hole is 0.741 inches (18.82 mm).	If the ID is greater than the permitted serviceable limits, replace the spring retainer cup.
(6) Perform a penetrant inspection of the spring retainer cup in accordance with the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the spring retainer cup is anodized, it is not necessary to remove the anodize coating before penetrant inspection.	A relevant indication is not permitted.	If there is a relevant indication, replace the spring retainer cup.



Piston Inspection
Figure 5-15

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AB. PISTON (1500) Refer to Figure 5-15.		
(1) Visually examine the outside of the piston for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Chemical conversion coat bare aluminum in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the piston is chemical conversion coated, the outside of the piston must also be painted with a Polane® paint mixture in accordance with the Paint and Finish chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the piston.
(2) Visually examine the outside of the piston for pitting, scratches or damage.	The maximum permitted depth of pitting, scratches, or damage is 0.006 inch (0.15 mm). Scratches must not be longer than 2 inches (50.8 mm) in length. The maximum permitted area of damage or scratches must not be greater than 1 square inch (645 square mm). The maximum permitted diameter of an individual pit is 0.0625 inch (1.588 mm). Linear pitting is not permitted.	If the pitting, scratches, or damage is greater than the permitted serviceable limits, replace the piston.

Component Inspection Criteria
Table 5-1

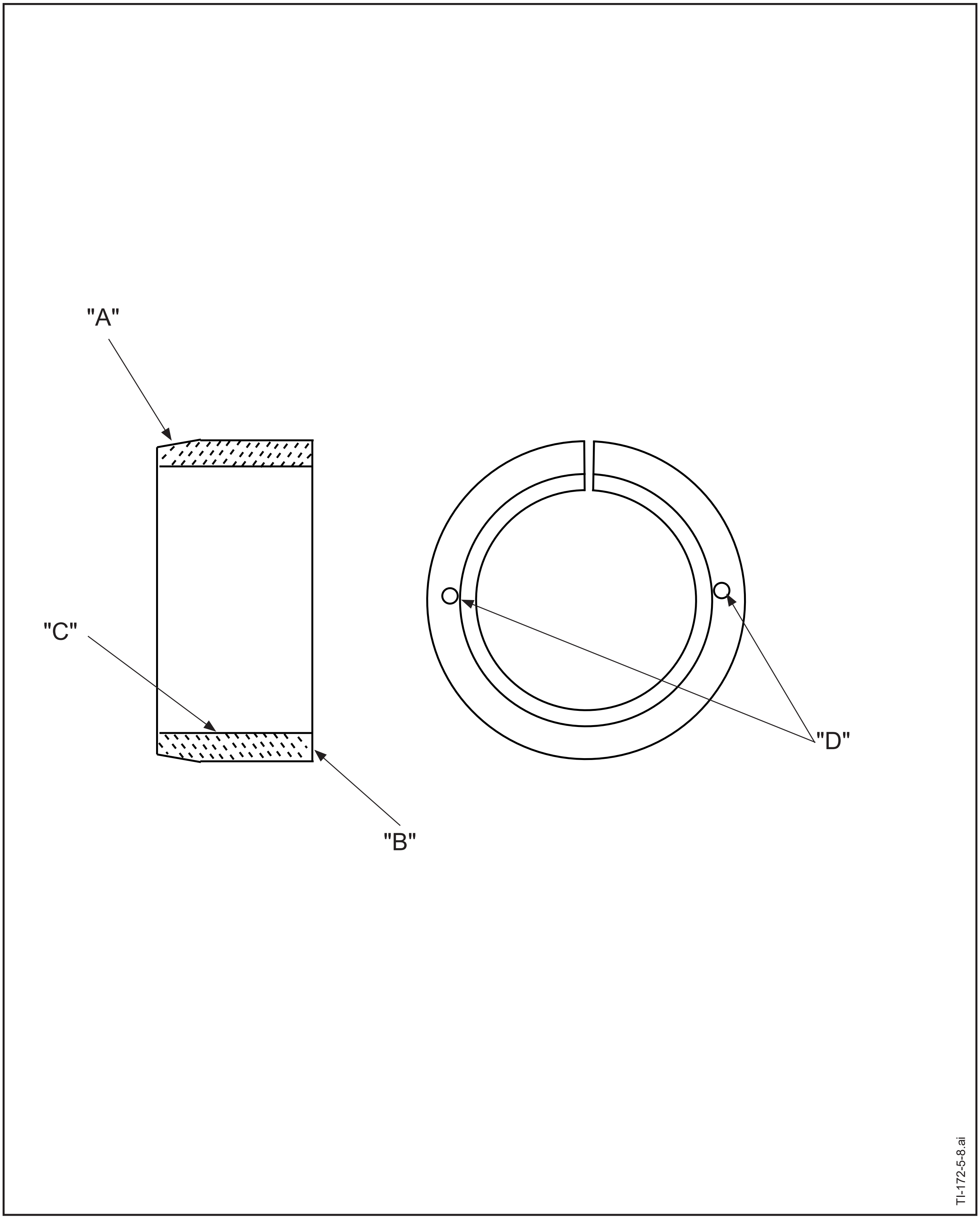
Inspect	Serviceable Limits	Corrective Action
AB. PISTON (1500), continued Refer to Figure 5-15.		
(3) Visually examine the threaded holes that are used to secure the link pin fillister head safety screws (130).	Enough threads must be present to hold the fillister head safety screw in place. A minimum of three full threads are required.	Make sure that the correct fillister head safety screw is installed. A worn screw used with short threads can result in the link pin disconnecting from the piston. Repair a damaged threaded hole in accordance with the Standard Repairs chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(4) Visually examine the hole at the front of the piston for damage caused by inserting or removing the piston from the pitch change rod (1320).	There are no dimensional limits. Damage must not interfere with the ability of the O-ring to seal.	If damage interferes with the O-ring seal, replace the piston.
(5) Measure the ID of the piston bushing (1510).	The maximum permitted ID for the piston bushing is 3.786 inches (96.16 mm).	If the ID of the piston bushing is greater than the permitted serviceable limits, replace the bushing in accordance with the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(6) If installed, inspect each guide rod (1520) for damage.	Scratches are permitted. Wear through the chrome plating is not permitted. Gouges are not permitted.	If there are gouges or wear through the chrome plating, replace the guide rod(s) in accordance with the Standard Repairs chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(7) If installed, inspect each guide rod (1520) for movement in the piston.	Movement of a guide rod is not permitted. Apply hand pressure perpendicular to the rod centerline to make sure that the rod is secure in the piston.	If there is movement of a guide rod, replace the guide rod(s) in accordance with the Standard Repairs and Instructions chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AB. PISTON (1500), continued Refer to Figure 5-15.		
(8) Measure the piston link pin holes for wear.	The maximum permitted diameter of a piston link pin hole is 0.377 inches (9.58 mm).	If the diameter of a link pin hole is greater than the permitted serviceable limits, replace the piston.
(9) Perform a penetrant inspection of the entire piston in accordance with the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). It is not necessary to remove the anodized coating or piston plastic bushing (1510) before penetrant inspection.	A relevant indication is not permitted.	If there is a relevant indication, replace the piston.

Component Inspection Criteria
Table 5-1

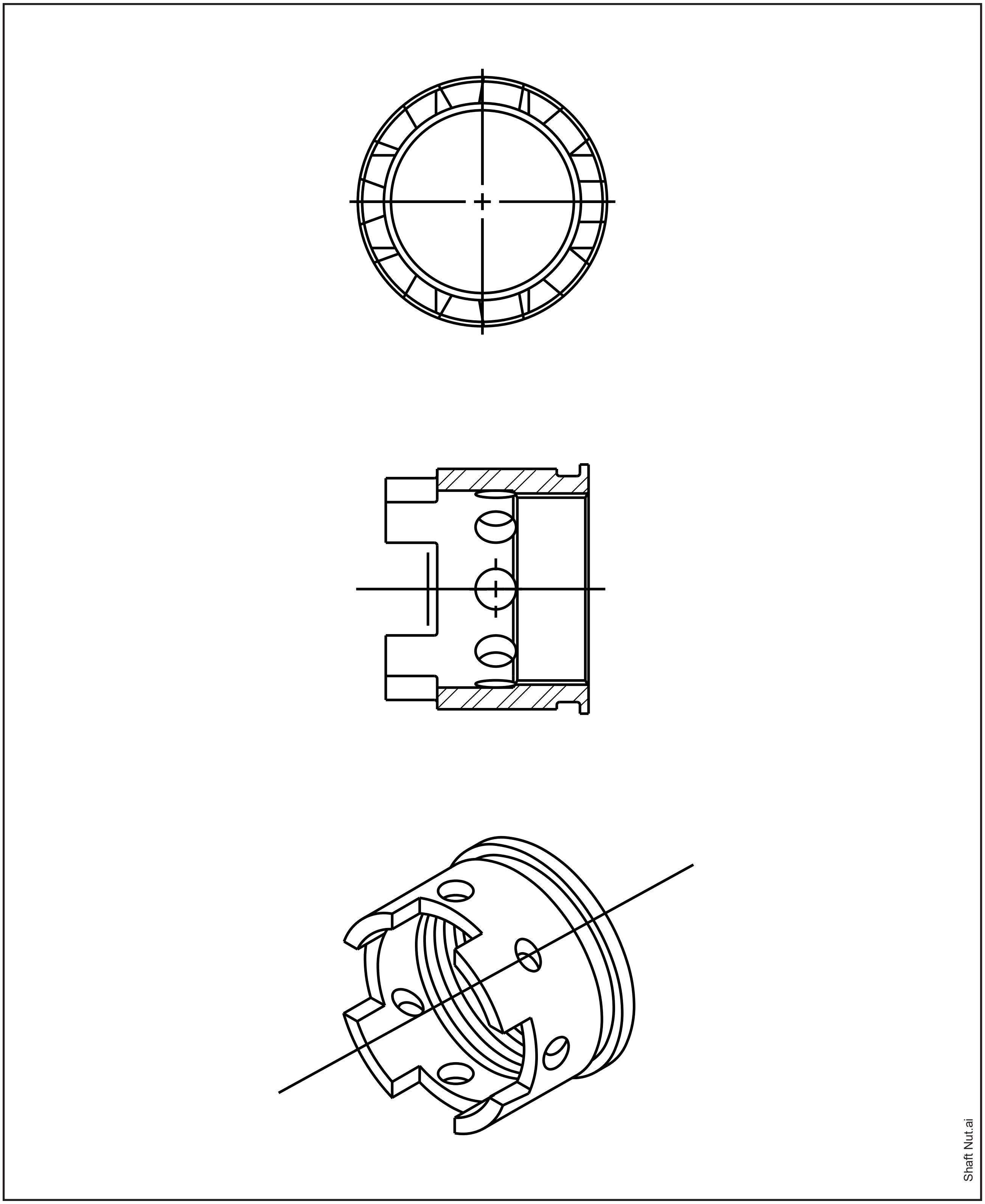
Inspect	Serviceable Limits	Corrective Action
AC. GUIDE COLLAR (1550)		
(1) Visually examine the guide collar for nicks, gouges, or other damage.	The maximum permitted depth of nicks, gouges, or other damage is 0.020 inch (0.50 mm).	Using an abrasive pad CM47 or equivalent, polish the nick, gouge,or other damaged area. Apply an Alodine coating in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If the depth of nick, gouge, or other damage is greater than the permitted serviceable limits, replace the guide collar.
(2) Perform a Penetrant inspection of the guide collar in accordance with the Penetrant Inspection chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). Removal of the Anodize coating is not required.	A relevant indication is not permitted.	If there is a relevant indication, replace the guide collar.
AD. GUIDE COLLAR BUSHING (1560)		
(1) Measure the ID of the plastic bushings.	The plastic bushing may not be worn in an oval shape greater than 0.008 inch (0.20 mm).	If the ID of the plastic bushing is worn to an oval shape greater than the permitted serviceable limits, replace the plastic bushing. Refer to the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
	The maximum permitted ID of the plastic bushing is 0.513 inch (13.03 mm).	If the ID of the plastic bushing is greater than the permitted serviceable limits, replace the plastic bushing. Refer to the Special Adhesive and Bonding Procedures chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Rear Mounting Cone Inspection
Figure 5-16

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AE. 20 SPLINE REAR MOUNTING CONE (2360) Refer to Figure 5-16.		
(1) Visually examine the OD taper surface "A" and surface "B" of the 20 spline rear mounting cone for surface finish.	Surface finish must be 63 micro finish or smoother.	If the surface finish does not meet the permitted serviceable limits, replace the 20 spline rear mounting cone.
(2) Visually examine the OD of taper surface "A" and surface "B" of the 20 spline rear mounting cone for damage.	Except for light scratches, damage is not permitted.	If the damage is greater than the permitted serviceable limits, replace the 20 spline rear mounting cone.
(3) Visually examine the ID surface "C" for damage.	Except for light scratches, damage is not permitted.	If the damage is greater than the permitted serviceable limits, replace the 20 spline rear mounting cone.
(4) Visually examine pin holes “D” for damage or unwanted material.	Damage or unwanted material in either hole is not permitted.	If there is damage or unwanted material in either hole, replace the 20 spline rear mounting cone.
(5) Visually examine pin holes “D” for broken pins remaining in the holes.	A broken pin in either hole is not permitted.	If there is a broken pin in either hole, replace the 20 spline rear mounting cone.
(6) Visually examine pin holes “D” for elongated holes.	An elongated hole is not permitted.	If a hole "D" is elongated, replace the 20 spline rear mounting cone.
(7) Visually examine pin holes “D” for raised material surrounding the holes.	Raised material surrounding the hole is not permitted.	Using an abrasive pad CM47 or equivalent, locally polish the area surrounding the pin hole to remove pushed up material. The surface finish must be equal to the undamaged surface area adjacent to the repaired area.



Shaft Nut Inspection
Figure 5-17

Component Inspection Criteria
Table 5-1

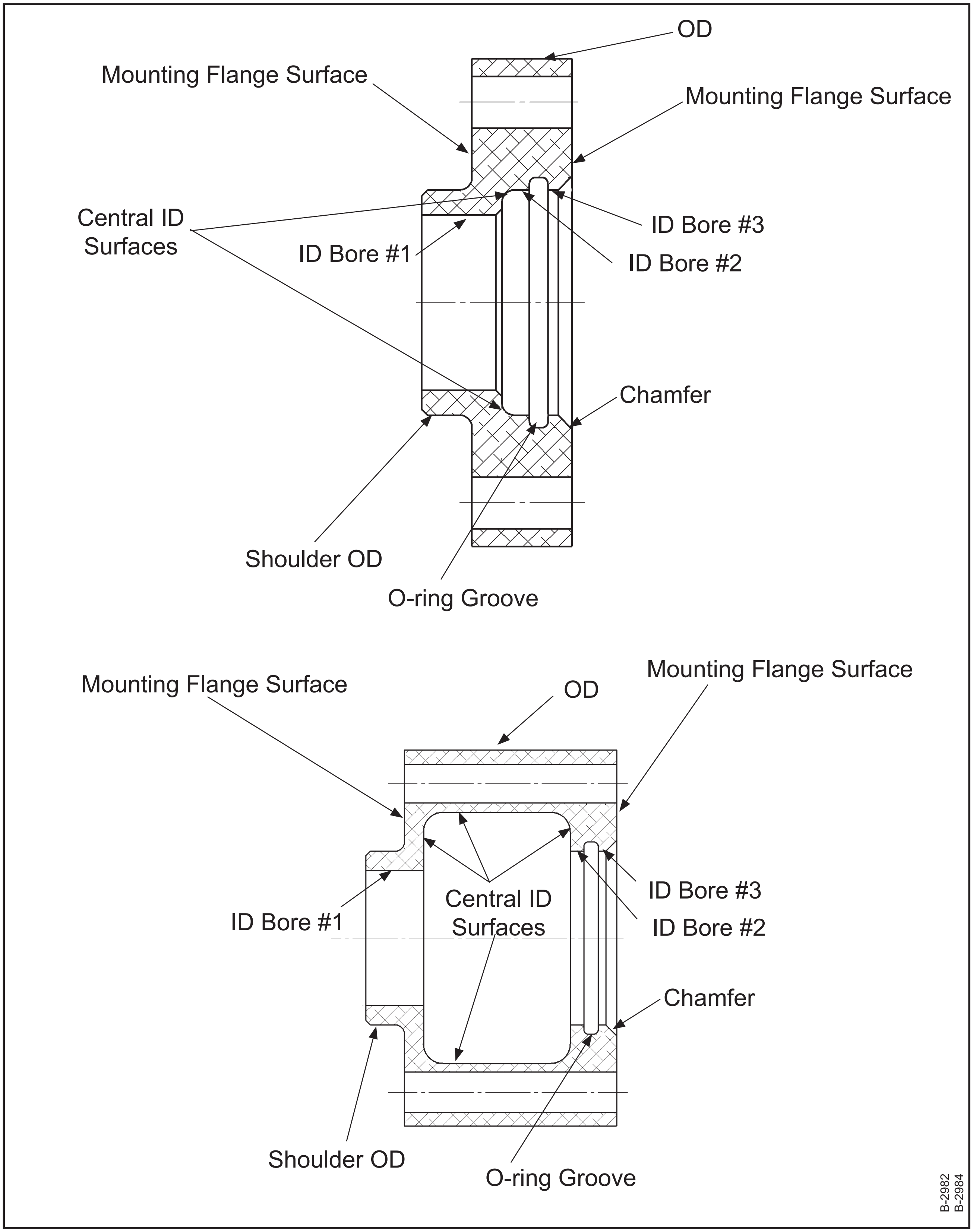
Inspect	Serviceable Limits	Corrective Action
AF. 20 SPLINE SHAFT NUT (2370) Refer to Figure 5-17.		
(1) Visually examine the spline shaft nut surfaces (excluding threads) for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product is greater than the permitted serviceable limits, replace the spline shaft nut.
(2) Visually examine the spline shaft nut surfaces (excluding threads) for indications of pitting.	The maximum permitted depth of pitting is 0.005 inch (0.012 mm). The damage must not interfere with the engine shaft threads.	If pitting is greater than the permitted serviceable limits, replace the spline shaft nut.
(3) Visually examine the spline shaft nut for cadmium plating coverage.	A few random scratches are permitted; otherwise, cadmium plating must completely cover the hub nut.	If the cadmium plating does not meet the permitted serviceable limit, replate and bake the spline shaft nut in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(4) Visually examine the threads on the spline shaft nut for damage.	A maximum of 1/2 of one thread total accumulated damage is permitted. The damage must not interfere with the engine shaft threads.	If damage is greater than the serviceable limit, replace the spline shaft nut.
(5) Visually examine the threads on the spline shaft nut for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product is greater than the permitted serviceable limits, replace the spline shaft nut

Component Inspection Criteria
Table 5-1

Inspect		Serviceable Limits	Corrective Action
AF.	20 SPLINE SHAFT NUT (2370), continued Refer to Figure 5-17.		
(6)	Visually examine the threads on the spline shaft nut for pitting.	The maximum permitted depth of pitting is 0.003 inch (0.07 mm).	If pitting is greater than the permitted serviceable limits, replace the spline shaft nut.
(7)	Perform a magnetic particle inspection of the spline shaft nut 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 spline shaft nut.

Component Inspection Criteria
Table 5-1

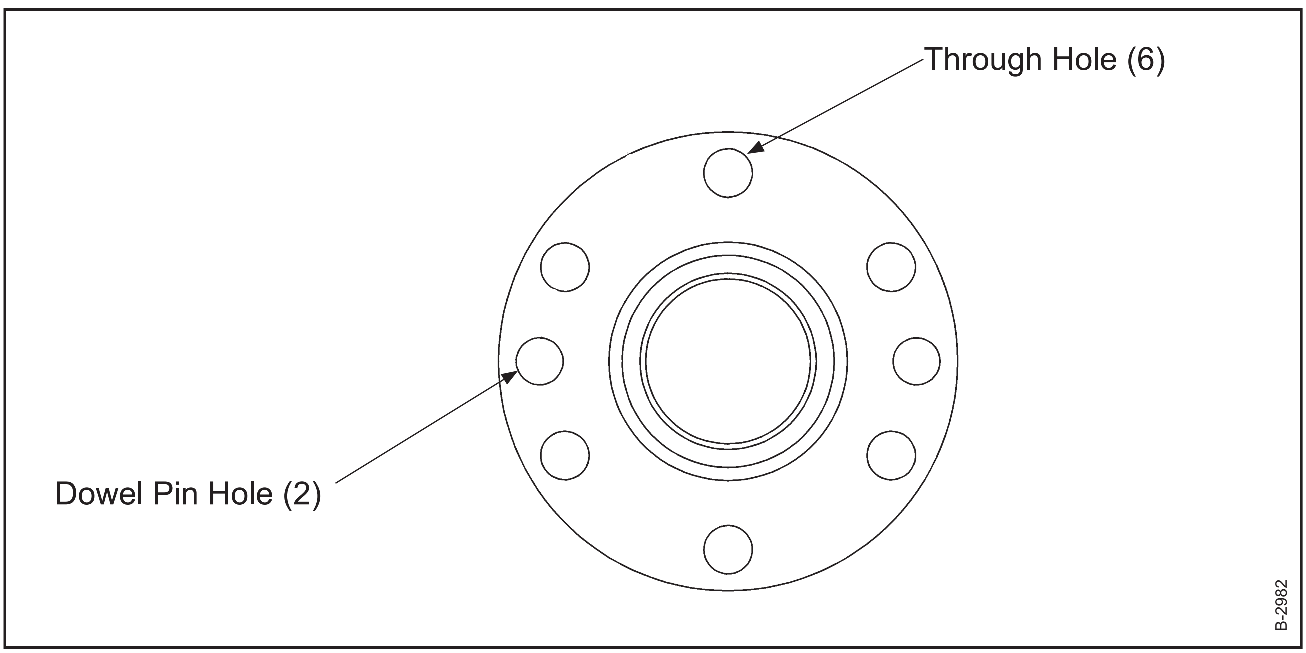
Inspect	Serviceable Limits	Corrective Action
AG. HUB PULLER RING (2400)		
(1) Visually examine the hub puller ring for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning. Refer to the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02). If corrosion product cannot be removed, replace the hub puller ring.
(2) Visually examine the hub puller ring for pitting.	The maximum permitted depth of pitting is 0.003 inch (0.07 mm).	If pitting is deeper than the permitted serviceable limits, replace the hub puller ring.
(3) Visually examine the hub puller ring for cadmium plating coverage.	A few random scratches are permitted; otherwise, cadmium plating must completely cover the hub puller ring.	If the cadmium plating does not meet the permitted serviceable limit, replate and bake the puller ring in accordance with the Cadmium Replating chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Spacer F-flange Inspection
Figure 5-18

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AH. SPACER, F-FLANGE (2460) Refer to Figure 5-18 and Figure 5-19.		
(1) Visually examine the F-flange spacer for corrosion product.	Corrosion product is not permitted. Remove corrosion product in accordance with the corrective action limits.	Remove corrosion product by using glass bead cleaning in accordance with the Cleaning chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).
(2) Visually examine the OD of the F-flange spacer for nicks, scratches, gouges, pitting, or other damage.	The maximum permitted depth of a nick, scratch, gouge, pitting, or damage is 0.004 inch (0.10 mm). The maximum permitted diameter of an individual pit is 0.062 inch (1.57 mm). Linear pitting is not permitted. The maximum permitted total area of all described damage is 1 square inch (645 square mm).	The maximum permitted depth of repair is 0.010 inch (0.25 mm). The maximum permitted total area of damage and repair is 1 square inch (645 square mm). If the damage or repair is greater than the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.



Spacer F-flange Inspection
Figure 5-19

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AH. SPACER, F-FLANGE (2460), continued Refer to Figure 5-18 and Figure 5-19.		
(3) Visually examine both mounting flange surfaces of the F-flange spacer for nicks, scratches, gouges, pitting, or other damage.	The maximum permitted depth of a nick, scratch, gouge, pitting, or damage is 0.002 inch (0.05 mm). Material may not be pushed up above the undamaged adjacent surfaces. The maximum permitted diameter of an individual pit is 0.062 inch (1.57 mm). Linear pitting is not permitted.	The maximum permitted depth of repair is 0.005 inch (0.12 mm). The maximum permitted total area of damage and repair is 1 square inch (645 square mm). The maximum permitted area of an individual repair is 0.25 square inch (161.2 square mm) and must be at least 0.250 inch (6.35 mm) from any other repaired area. If the damage or repair is greater than the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.
(4) Visually examine for wear on the shoulder OD of the F-flange spacer that interfaces with the propeller hub.	If there is wear, measure the OD of the shoulder. The minimum permitted OD is 2.2475 inch (57.087 mm).	If the OD is less than the permitted serviceable limits, replace the F-flange spacer.
(5) Visually examine for wear on the ID of the O-ring groove of the F-flange spacer that interfaces with the engine.	If there is wear, measure the ID of the O-ring groove. The maximum permitted ID is 2.500 inches (63.50 mm).	If the ID of the F-flange spacer is greater than the permitted serviceable limits, replace the F-flange spacer.
(6) Visually examine the ID bore #1 of the F-flange spacer for nicks, scratches, gouges, pitting, or other damage.	If there is a nick, scratch, gouge, pitting, or other damage, measure. The maximum permitted depth of a nick, scratch, gouge, pitting, or damage is 0.002 inch (0.05 mm). The maximum permitted diameter of an individual pit is 0.062 inch (1.58 mm). Linear pitting is not permitted. The maximum permitted total area of all described damage is 1 square inch (645 square mm).	The maximum permitted depth of repair is 0.005 inch (0.12 mm). The maximum permitted total area of damage and repair is 0.5 square inch (322 square mm). If the damage or repair is greater than the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.

Component Inspection Criteria
Table 5-1

Inspect		Serviceable Limits	Corrective Action
AH.	SPACER, F-FLANGE (2460), continued Refer to Figure 5-18 and Figure 5-19.		
(7)	Visually examine the central ID surfaces of the F-flange spacer for nicks, scratches, gouges, pitting, or other damage.	The maximum permitted depth of a nick, scratch, gouge, pitting, or damage is 0.004 inch (0.10 mm). The maximum permitted diameter of an individual pit is 0.062 inch (1.57 mm). Linear pitting is not permitted. The maximum permitted total area of all described damage is 1 square inch (645 square mm).	The maximum permitted depth of repair is 0.010 inch (0.25 mm). The maximum permitted total area of damage and repair is 1 square inch (645 square mm). If the damage or repair is greater than the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.
(8)	Remove the dowel pins and visually examine each dowel pin hole of the F-flange spacer for nicks, scratches, damage, or pitting.	The maximum permitted depth of a nick, scratch, damage, or pitting is 0.002 inch (0.05 mm). The maximum permitted diameter of an individual pit is 0.062 inch (1.57 mm). Linear pitting is not permitted.	The maximum permitted depth of repair is 0.005 inch (0.12 mm). Damage or repair must not affect the tight fit of the dowel pin. If the F-flange spacer is not within the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.
(9)	Examine the dowel pin hole of the F-flange spacer for the fit of a dowel pin.	A dowel pin must not be able to be inserted or removed from the dowel pin hole without using tools.	If a dowel pin can be inserted or removed from the dowel pin hole without using tools, replace the F-flange spacer.
(10)	Visually examine the ID of each through hole of the F-flange spacer for nicks, scratches, damage, or pitting.	The maximum permitted depth of a nick, scratch, damage, or pitting is 0.002 inch (0.05 mm). The maximum permitted diameter of an individual pit is 0.062 inch (1.57 mm). Linear pitting is not permitted.	The maximum permitted depth of repair is 0.004 inch (0.10 mm). Damage or repair must not affect the fit of the F-flange spacer with the mating part. If the F-flange spacer is not within the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.

Component Inspection Criteria
Table 5-1

Inspect	Serviceable Limits	Corrective Action
AH. SPACER, F-FLANGE (2460), continued Refer to Figure 5-18 and Figure 5-19.		
(11) Measure the ID of each through hole of the F-flange spacer.	The maximum permitted ID is 0.540 inch (13.71 mm).	If the ID is greater than the permitted serviceable limits, replace the F-flange spacer.
(12) Visually examine ID bore #2 and ID bore #3 of the F-flange spacer for nicks, scratches, damage, or pitting.	The maximum permitted depth of a nick, scratch, damage, or pitting is 0.002 inch (0.05 mm). The maximum permitted diameter of an individual pit is 0.062 inch (1.57 mm). Linear pitting is not permitted.	The maximum permitted depth of repair is 0.003 inch (0.07 mm). The maximum total damage or repair is 25% of each circumference for ID bore #2 and ID bore #3. If the F-flange spacer is not within the permitted serviceable limits or the corrective action limits, replace the F-flange spacer.

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 by 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) Steel Hubs: Refer to the Steel 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).

D. Blade Clamps

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

E. Spinner Assemblies

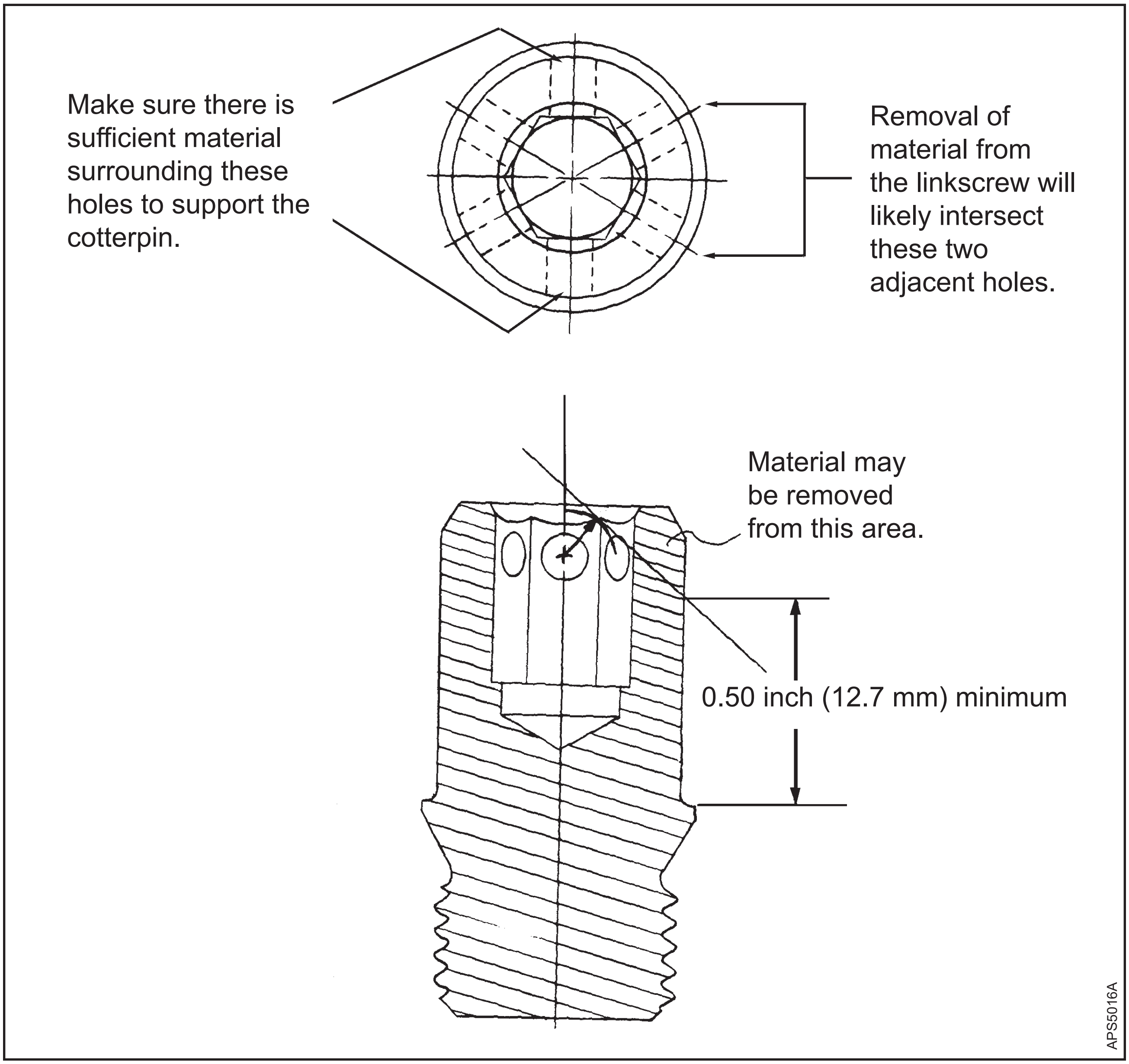
(1) Metal Spinners: Refer to Hartzell Propeller Inc. Metal Spinner Maintenance Manual 127 (61-16-27).

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

F. 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).



Linkscrew Rework Limits for Hub Clearance
Figure 6-1

3. <u>Specific Part Repair</u>

A. Repair of the A-304 Linkscrew

(1) When adjusting the pitch range of some propeller assemblies, the linkscrew may contact the hub. When this happens, the full blade angle range cannot be achieved. This condition can be eliminated by grinding the linkscrew to remove material and allow clearance.

(a) Remove only enough material from the linkscrew to permit clearance with the hub. Refer to Figure 6-1.

NOTE: Removal of material from the linkscrew will likely intersect the two adjacent holes on that side of the linkscrew.

(2) Make sure that there is sufficient material surrounding the remaining, unaffected holes in the linkscrew to support the safety cotter pin.

(3) To prevent corrosion, apply polane paint to the area where the material was removed.

B. Cylinder Repair

(1) For information about the inspection and repair of cylinders, refer to the Check chapter of this manual.

C. Piston Repair

(1) For piston repair and bushing replacement, refer to the Standard Repairs and Instructions chapter of the Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

D. Guide Collar Repair

(1) For guide collar bushing removal and replacement, refer to the Special Adhesive and Bonding chapter of the Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

E. Beta Ring Repair

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

(1) General Repair

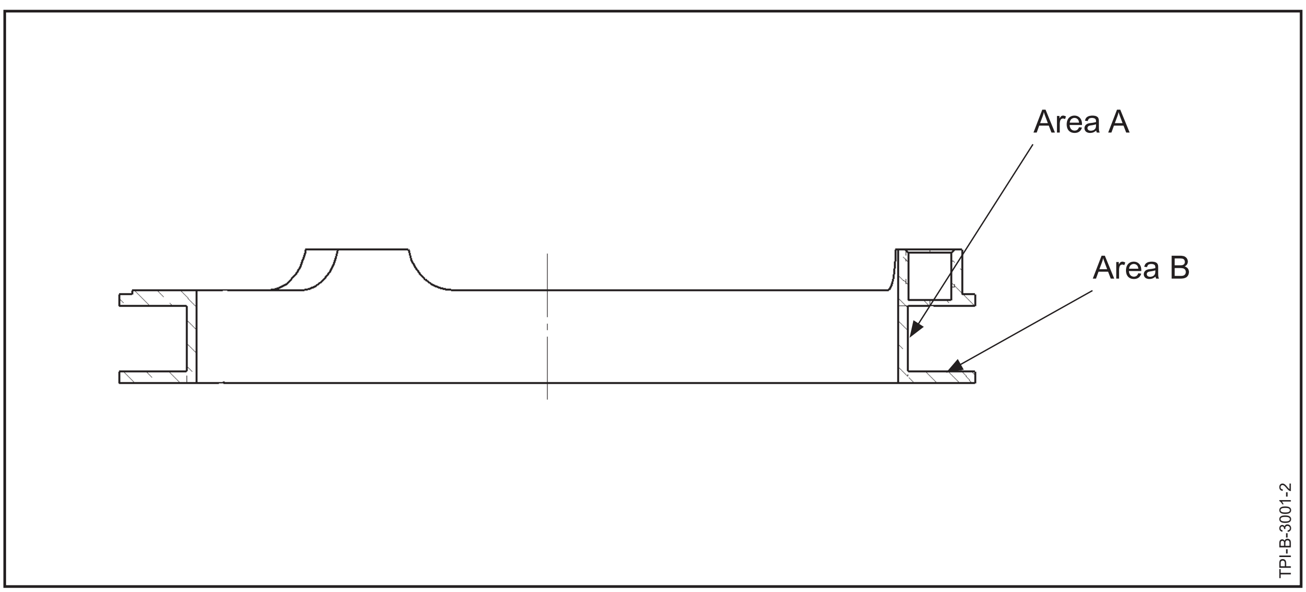
(a) Using a soft cotton wheel, polish the beta ring (840).

(2) Interior Surface Repair

(a) The surface of the beta ring groove may be repaired if it is worn or scratched:

1 Remove grooves or scratches in areas A and B of Figure 6-2. Refer to the serviceable limits found in the Check chapter of this manual.

2 Using 80 to 120 grit emery cloth and finishing with 240 grit polishing compound, make the surfaces of the beta ring smooth.



Beta Ring Interior Surface Repair
Figure 6-2

(Blank Page)

ASSEMBLY - CONTENTS

ASSEMBLY - CONTENTS, CONTINUED

ASSEMBLY - CONTENTS, CONTINUED

ASSEMBLY - CONTENTS, CONTINUED

ASSEMBLY - CONTENTS, CONTINUED

LIST OF FIGURES

LIST OF FIGURES, CONTINUED

LIST OF TABLES

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 BLADES CAN RESULT IN THE 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 arms of certain clamp models, refer to the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: BEFORE ASSEMBLING THE PROPELLER, DETERMINE IF AN ICE PROTECTION SYSTEM IS REQUIRED.

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).

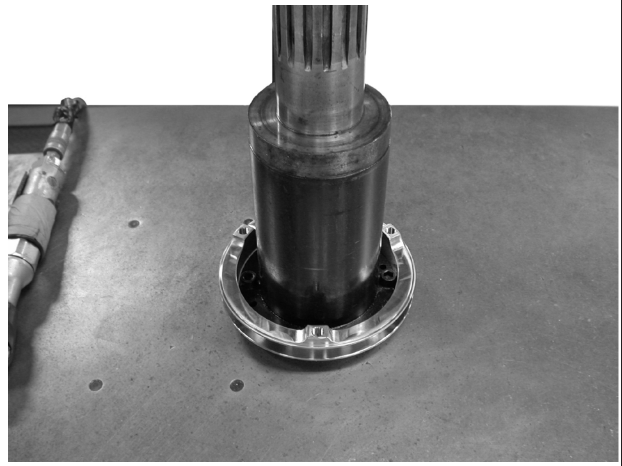
E. Blade Angle Information

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

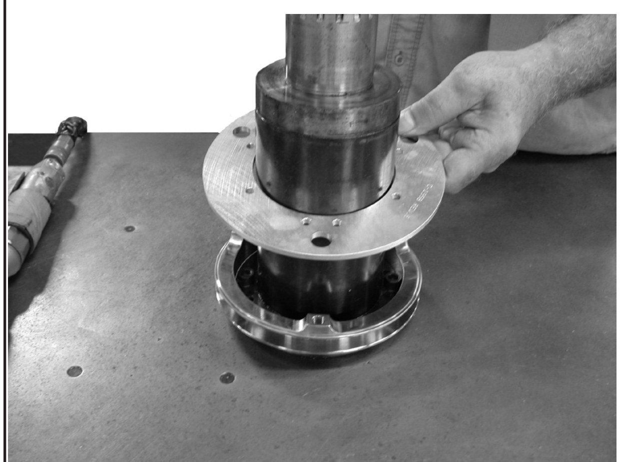
F. Blade Clamp Assembly

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

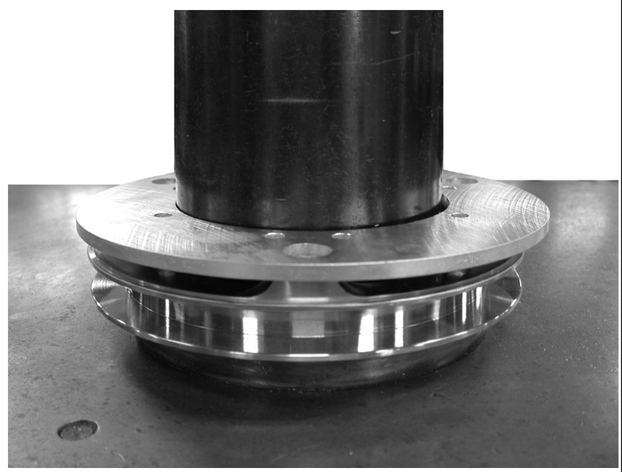
Rotatable Fixture



Beta ring (50) on build table



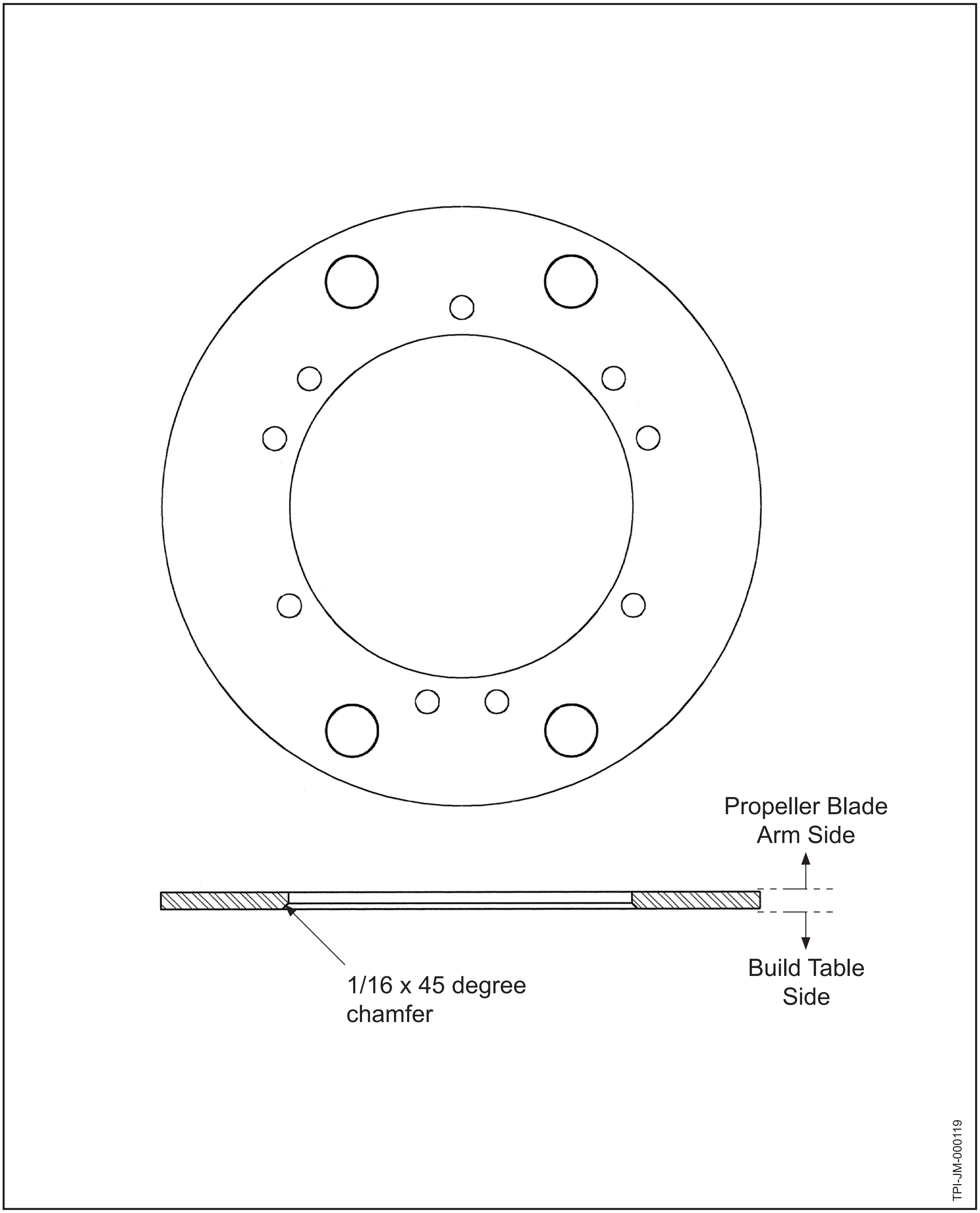
Installing guide lug plate (85) around the rotatable fixture - chamfered holes face build table



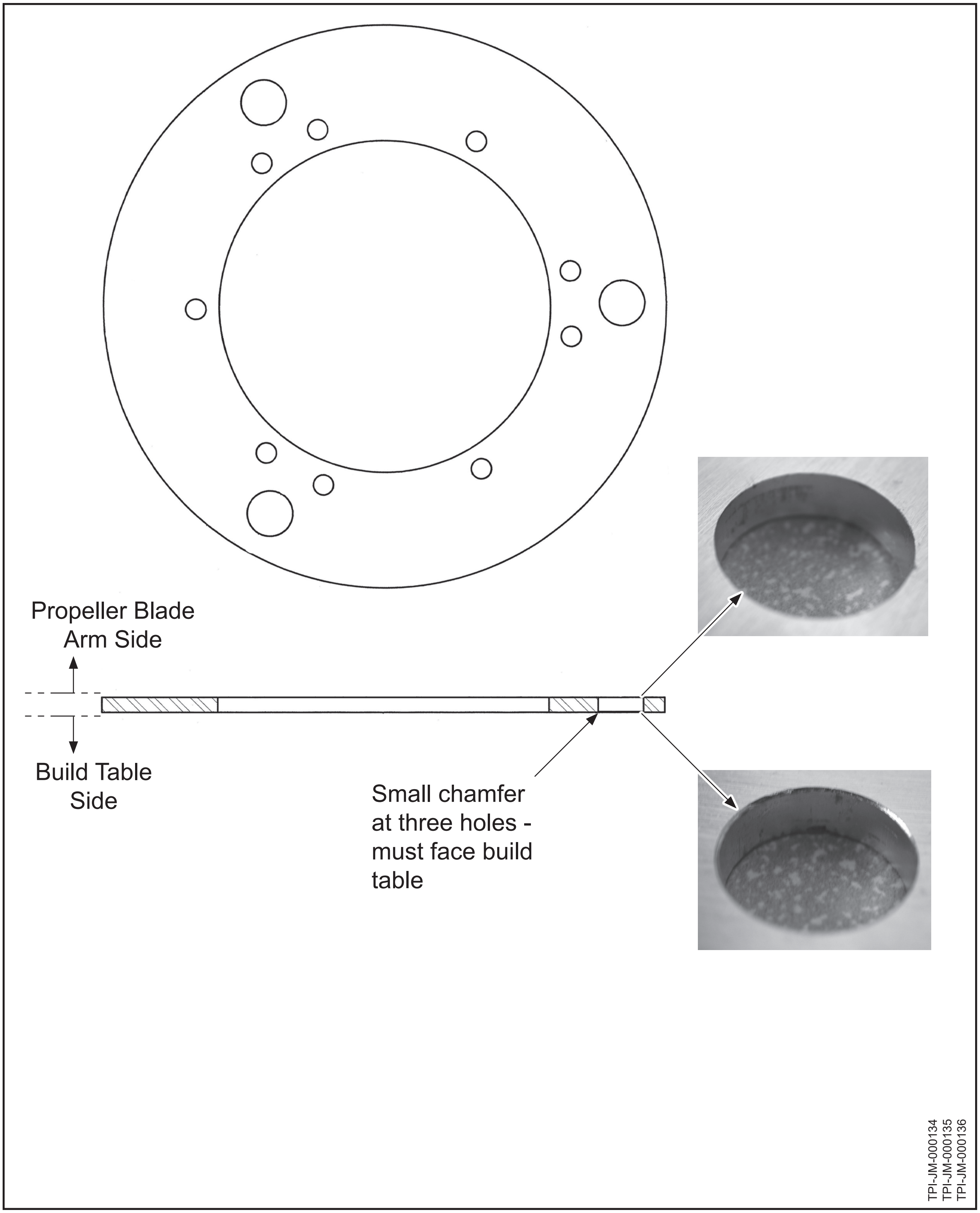
Beta ring (50) and guide lug plate (85) on build table

TPI-JM-000115
TPI-JM-000116
TPI-JM-000117
TPI-JM-000118

Locating Beta Ring and Guide Lug Plate for Build
Figure 7-1



Two-Bladed Guide Lug Plate Orientation
Figure 7-2



Three-Bladed Guide Lug Plate Orientation
Figure 7-3

2. Assembly of Propeller Models (B)HC-A(2,3)(MV,V)20-3( )

A. Blade Installing Parts Assembly

(1) Install the beta ring (50) around the rotatable fixture and lay it on the propeller assembly table with the threaded bosses facing away from the propeller assembly table. Refer to Figure 7-1.

CAUTION: A SPECIFIC SIDE OF THE GUIDE LUG PLATE (85) MUST FACE THE PROPELLER ASSEMBLY TABLE FOR BOTH TWO AND THREE BLADE PROPELLERS. REFER TO FIGURE 7-2 AND FIGURE 7-3 FOR ORIENTATION DETAILS.

(2) Install the guide lug plate (85) around the rotatable fixture onto the beta ring (50). Refer to Figures 7-1 through 7-3 for correct placement.

(3) Install the rear mounting cone (2360) on the spline shaft of the rotatable fixture with the tapered section of the rear mounting cone (2360) facing toward propeller hub (2300).

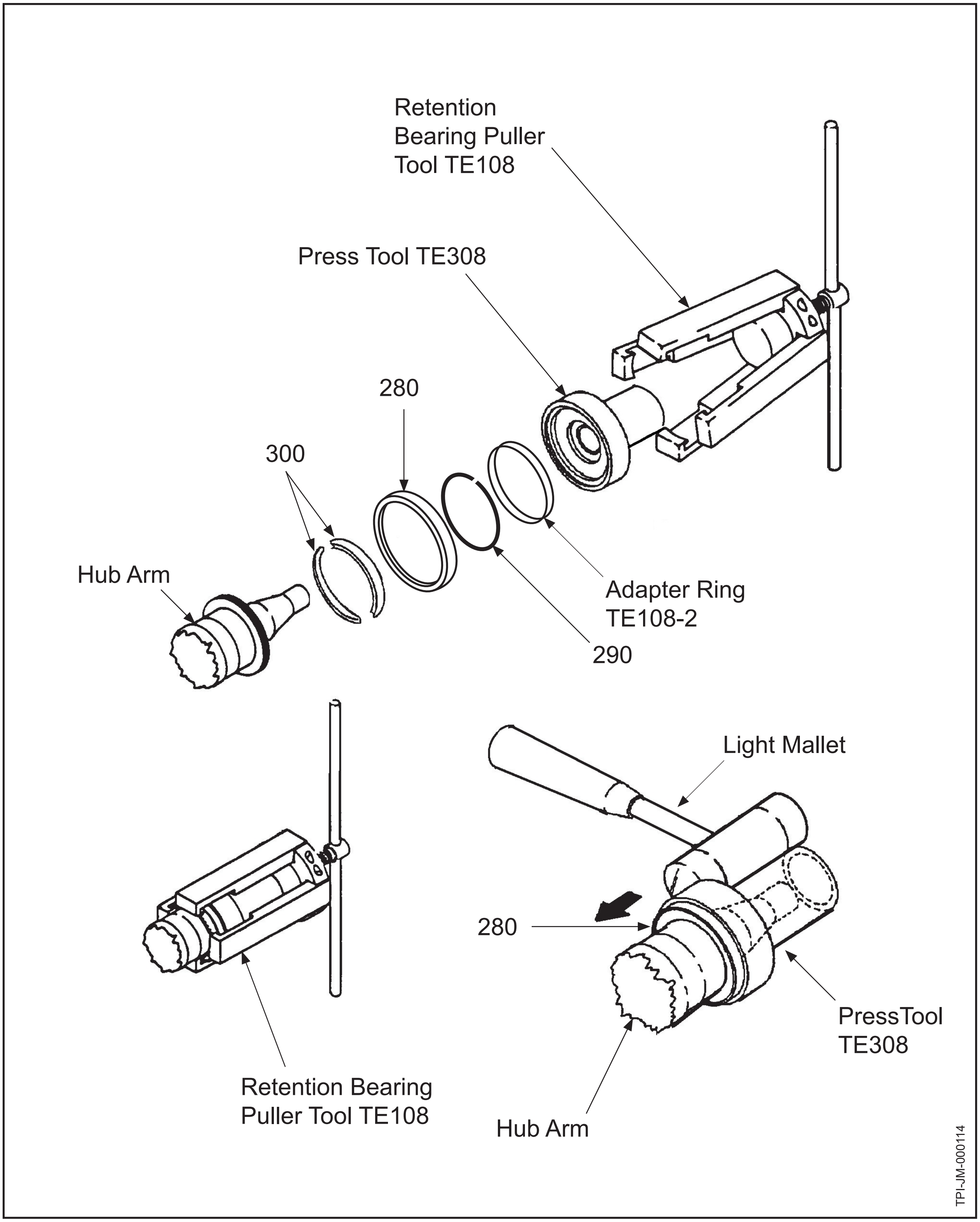
(4) Install the O-ring (2390) onto the tapered section of the rear mounting cone (2360).

NOTE: Installation of races (240, 300), ball spacer (260), bearing balls (250), wire bearing retainer (230), bearing retaining ring (280), wire ring retainer (290), and O-ring (270) on each hub blade arm may be accomplished on a locally procured fixture, as an alternate to the rotatable fixture, and press tool TE308 referenced in this manual.

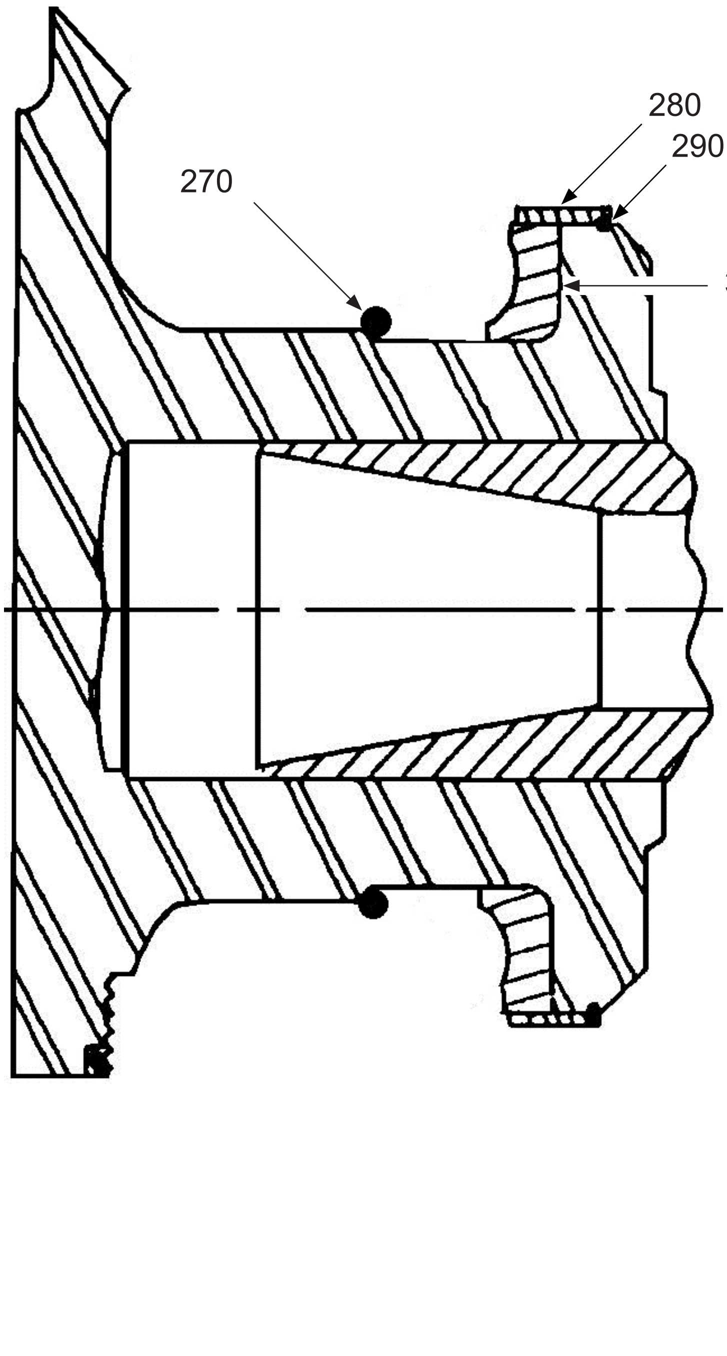
(5) Install the hub (2300) on the rear mounting cone (2360) and the rotatable fixture of the propeller assembly table.

(6) Using the shaft nut wrench TE146, the hub shaft nut (2370), and the hub puller ring (2400), install the hub (2300) to the rotatable fixture.

NOTE: Use the hub shaft nut (2370) and hub puller ring (2400) that will go with the propeller when Installed on an engine.



Hub Arm Build-Up
Figure 7-4



Flange Parts Installation
Figure 7-5

CAUTION 1: BEARING RACES (240 AND 300) MUST BE MATCHED SETS. RACE (240) IS THE INBOARD-SIDE RACE AND RACE (300) IS THE OUTBOARD-SIDE RACE.

CAUTION 2: THE INTERNAL RECESS OF THE BEARING RETAINING RING (280) MUST FACE OUTBOARD TO PROPERLY INTERFACE WITH THE WIRE RING RETAINER (290) THAT WILL BE INSTALLED IN A GROOVE AROUND THE BLADE ARM FLANGE OF THE HUB UNIT (2300).

(7) Using a light mallet and press tool TE308, or equivalent, install a bearing retaining ring (280) onto one blade arm flange of the hub unit (2300). Refer to Figure 7-4.

(a) Install the inboard edge of the bearing retaining ring (280) (internal recess is facing outboard) flush to slightly below flush with the blade arm flange surface that supports the race (300).

(8) Repeat this bearing retaining ring (280) installation procedure for all the other blade arm flanges on the hub.

(9) Using lubricant CM12, lightly grease the inboard surface of each blade arm flange that will support the race (300).

(10) Put the halves of race (300) (matched set) in position over one hub arm.

(11) Visually examine the fit of the race (300) to the hub arm.

(a) The race (300) must rest tightly against the seating area on the hub arm, with no "rocking" action evident.

(b) The race (300) halves must fully contact each other at the parting surfaces.

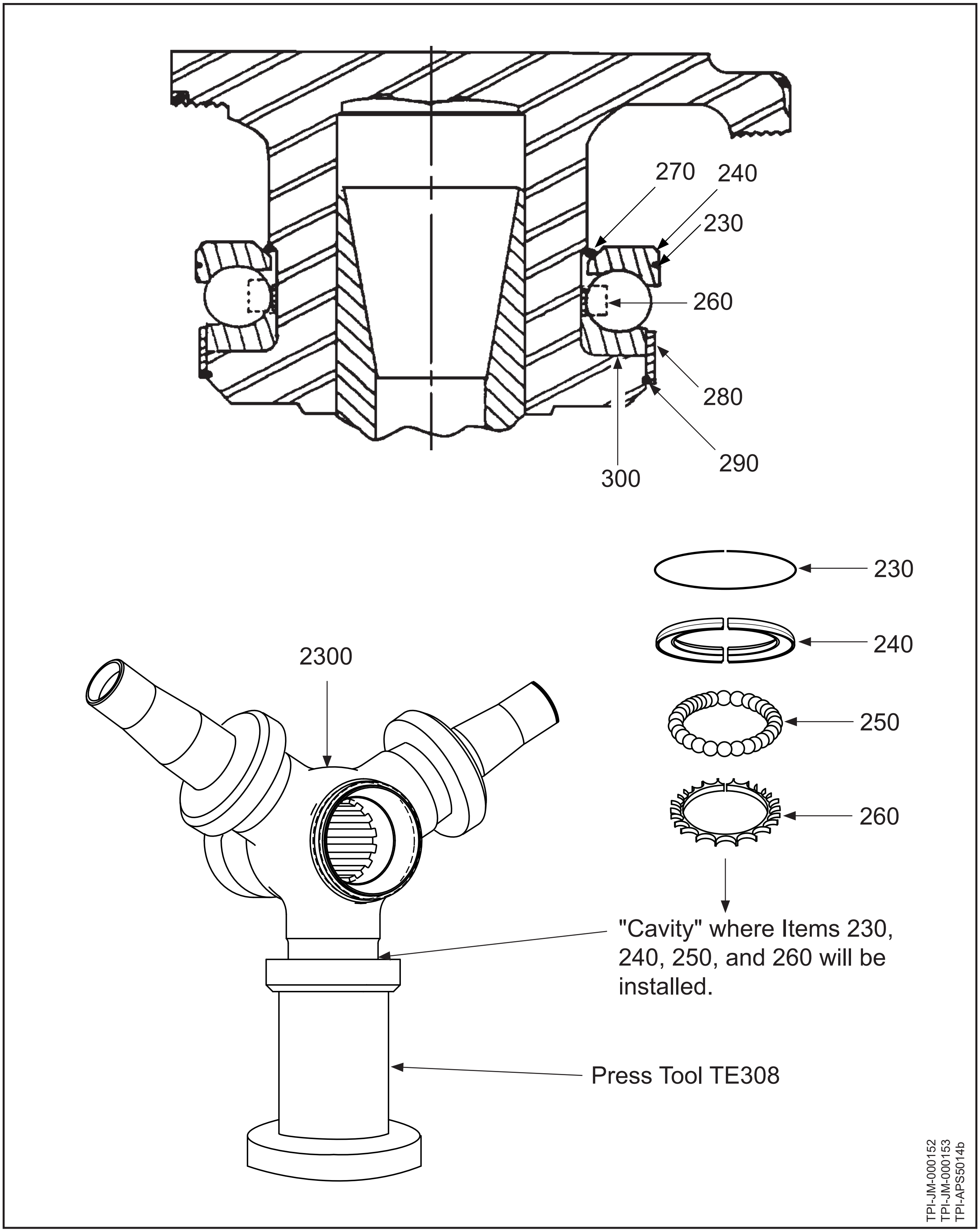
(c) Replace the race (300) if it does not fit correctly.

NOTE: The break-line for the race (300) must be vertical to the table top.

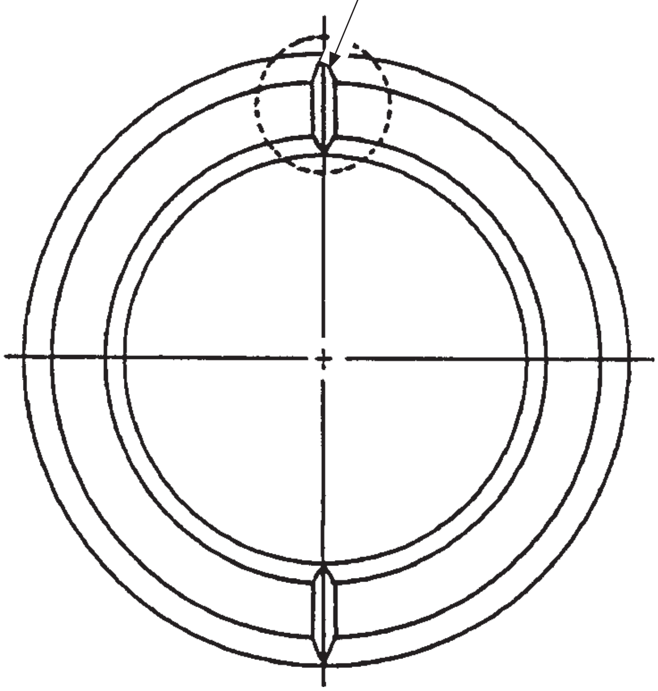
(12) Using a combination of the press tool TE308 and retention bearing puller TE108, or equivalent, push the bearing retaining ring (280) far enough onto the race (300) to position the wire ring retainer (290) in the groove in the blade arm flange. Refer to Figure 7-4.

(13) Install the wire ring retainer (290) in the outside diameter groove in the hub (2300) blade arm flange.

(14) Using a combination of press tool TE308, retention bearing puller TE108, and adapter ring TE108-2, or equivalent, pull the bearing retaining ring (280) outboard far enough to position the wire ring retainer (290) in the internal recess in the bearing retaining ring. Refer to Figure 7-4 and Figure 7-5.



Flange Parts Installation
Figure 7-6



Sealant CM93 Application
Figure 7-7

CAUTION: THE WIRE RING RETAINER (290) MUST BE FULLY ENCLOSED IN THE BEARING RETAINING RING (280) TO MAKE SURE IT IS FULLY IN THE WIRE RETENTION GROOVE OF THE BLADE ARM FLANGE.

(15) Visually examine to make sure that the wire ring retainer (290) is fully enclosed.

(16) Using lubricant CM12, lubricate the blade O-ring (270).

(17) Install the O-ring (270) where there is a radius around the entire hub (2300) blade arm that blends from a larger outside diameter to a smaller outside diameter.

(a) Leave the O-ring (270) in position for use later in the reassembly.

(18) For the remaining hub arms, repeat steps (8) through (17) of this procedure.

(19) Using a shaft nut wrench TE146, loosen the hub shaft nut (2370) with puller ring (2400) to remove the hub unit (2300) from the rotatable fixture on the assembly table.

CAUTION: DURING THE FOLLOWING PROCEDURES, THE BLADE ARM CENTERLINE ON WHICH A RETENTION BEARING IS GOING TO BE ASSEMBLED MUST BE SUPPORTED VERTICALLY WITH THE PILOT TUBE FACING DOWN AS SHOWN IN FIGURE 7-6. EASE OF INSTALLATION OF BEARING BALLS (250) AND RELATED PARTS IS GREATLY IMPROVED WITH THIS ORIENTATION.

(20) Use a press tool TE308, or an appropriate fixture, to hold each blade arm centerline vertical during the next stages of the blade retention split-bearing assembly. Refer to Figure 7-6 and Figure 7-7.

CAUTION 1: THE PARTING LINE OF RACE (240) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE BLADE CLAMP HALVES (1610).

CAUTION 2: ANY GAP BETWEEN THE HALVES OF THE RACES (240, 300) MUST NOT BE GREATER THAN 0.001 INCH (0.02 mm).

CAUTION 3: ALL BEARING BALLS (250) INSTALLED IN A SINGLE RACE (300) MUST BE OF THE SAME GAUGE. BEARING BALLS SUPPLIED BY HARTZELL PROPELLER INC. ARE OF THE SAME GAUGE.

(21) Install the ball bearing spacer (260) and the necessary number of bearing balls (250) onto the race (300).

(22) Put the inboard bearing race halves (240) around one blade arm of the hub unit (2300).

CAUTION: THE OPENING OF THE WIRE BEARING RETAINER (230) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE RACE (240).

(23) Install the wire bearing retainer (230) to hold the race (240) halves together.

CAUTION: TOO MUCH SEALANT CM93 COULD CAUSE UNEVEN SEATING BETWEEN THE CLAMP ASSEMBLY (1600) AND RACE (240).

(24) Apply sealant CM93 to fill the chamfers (at each bearing race break) flush with the adjacent surfaces of the races (240). Refer to Figure 7-7 for location of sealant CM93 application to the parting line chamfer.

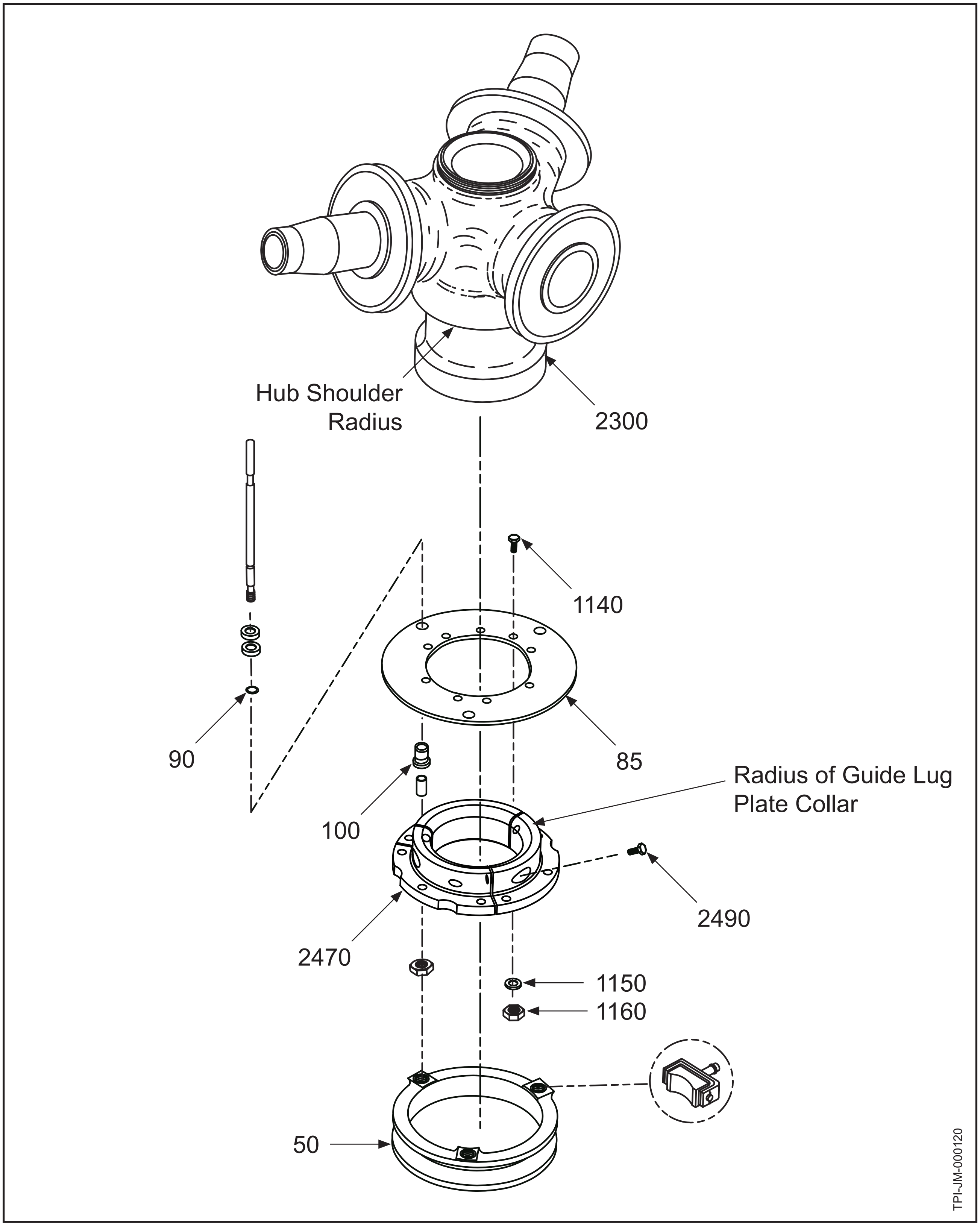
(25) Remove any excess sealant.

(26) Move the O-ring (270) between the race (240) and the hub (2300) arm radius.

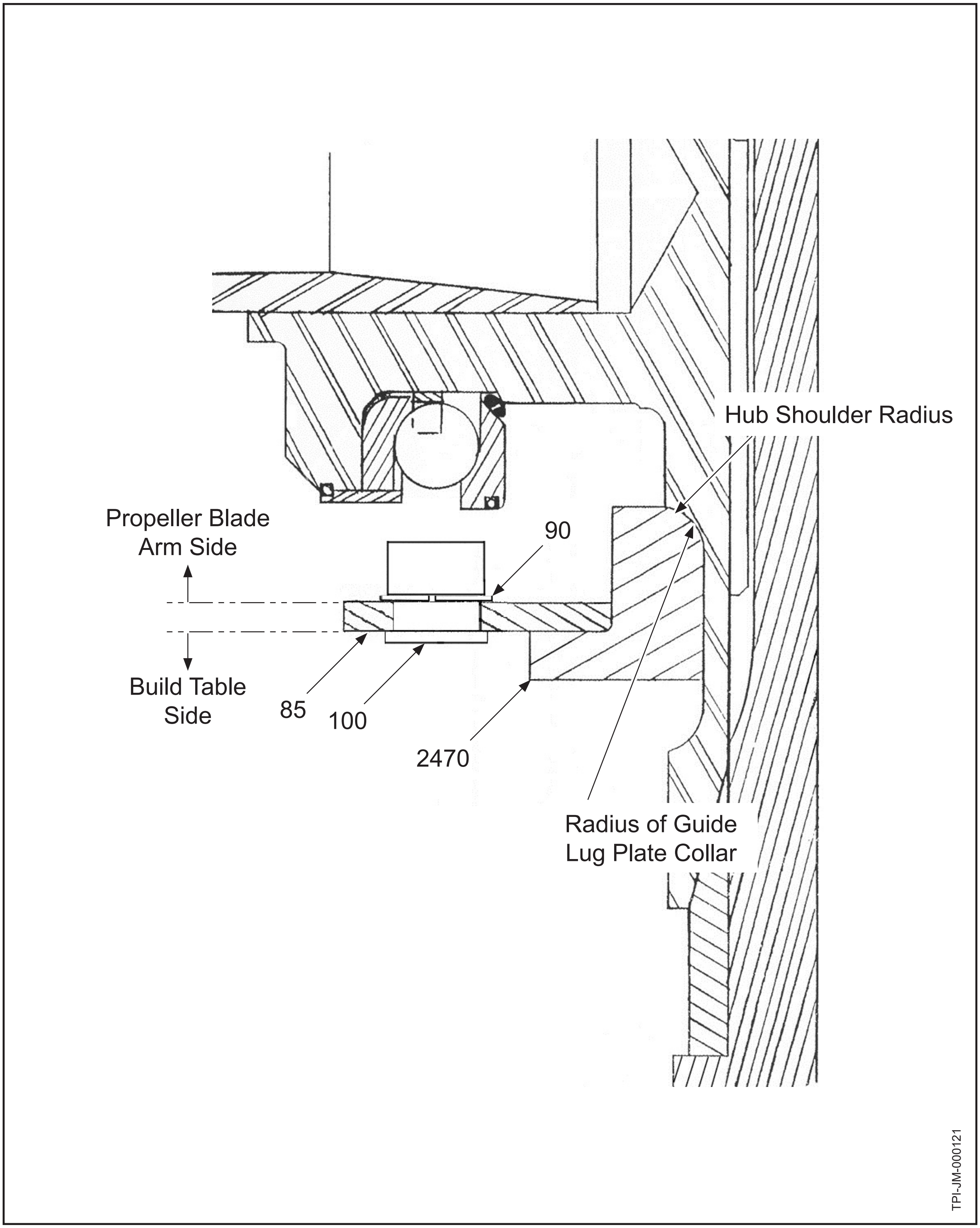
NOTE: The O-ring (270) will be touching the hub (2300) arm in a radiused section where the hub arm diameter changes. Refer to Figure 7-6.

(27) Using self-adhesive stretch wrap, wrap the outside diameter of the bearing assembly to hold the races (240/300) together and bearing balls (250) in position.

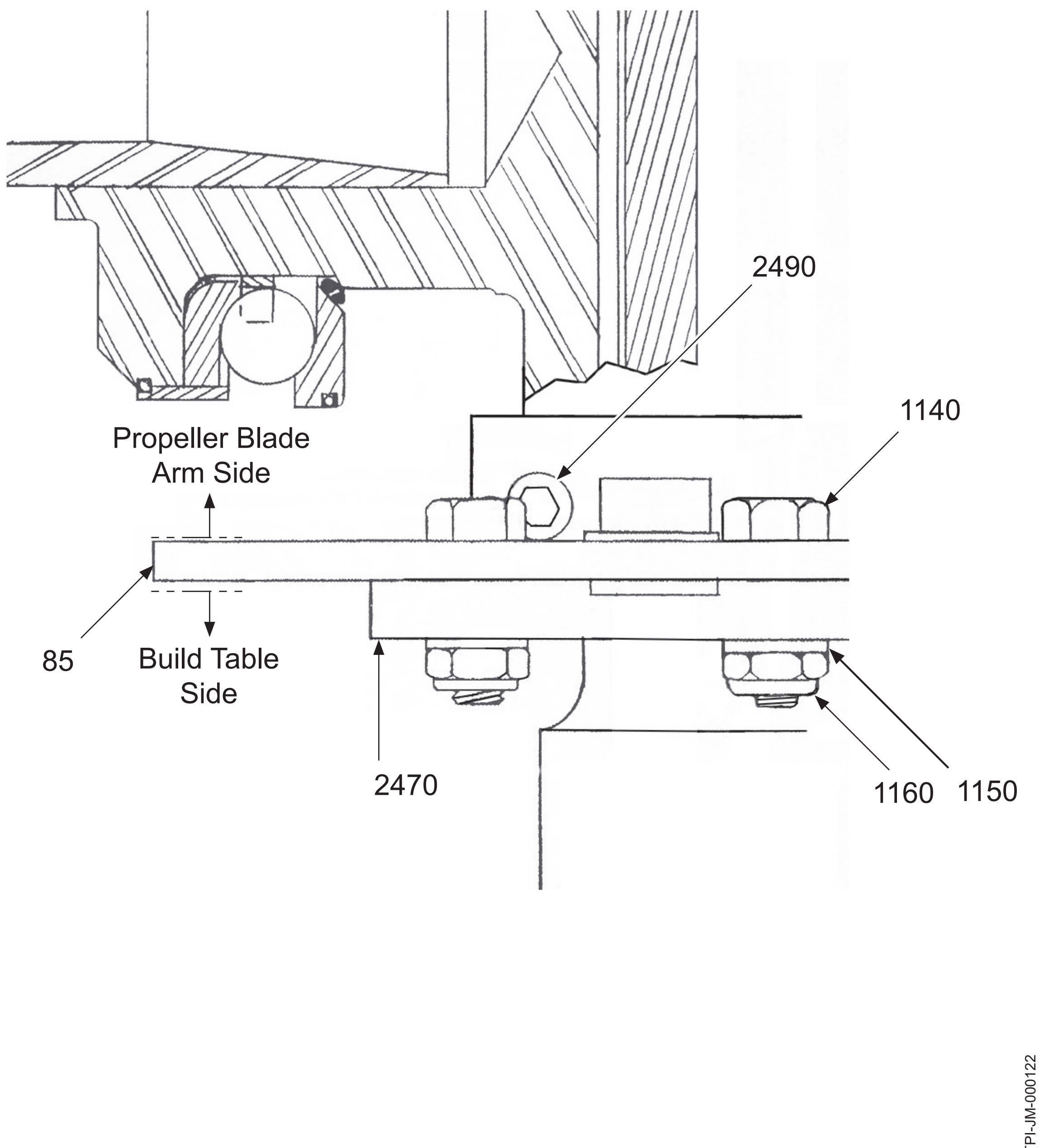
(28) For the remaining hub arms, rotate hub and repeat steps (20) through (27) of this procedure.



Location and Orientation of Guide Lug in Guide Lug Plate
Figure 7-8



Location of Guide Lug Plate Collar
Figure 7-9



Guide Lug Plate Attachment to Guide Lug Plate Collar
Figure 7-10

B. Beta System Installation (Part 1 of 3)

(1) Using the shaft nut wrench TE146, the hub shaft nut (2370), and the hub puller ring (2400), install the hub (2300) onto the rotatable fixture.

NOTE: Use the hub shaft nut (2370) and hub puller ring (2400) that will go with the propeller when installed on an engine.

CAUTION: INSTALL THE GUIDE LUGS (100) INTO THE GUIDE LUG PLATE (85) FROM THE BUILD TABLE SIDE OF THE GUIDE LUG PLATE. REFER TO FIGURE 7-8 AND FIGURE 7-9.

(2) Install each guide lug (100) into the larger holes in the guide lug plate (85).

NOTE 1: The position of the guide lug plate (85) should be on top of the beta ring (50) and encircling the rotatable fixture.

NOTE 2: Install three guide lugs (100) for a three blade propeller and four guide lugs for a two blade propeller.

(3) Install a snap ring (90) into the groove of each guide lug (100).

NOTE: The snap rings (90) are positioned on the propeller blade arm side of the guide lug plate (85). Refer to Figure 7-8 and Figure 7-9.

(4) Position the radius of the three-piece guide lug plate collar (2470) to touch the hub (2300) shoulder radius on the blade arm side. Refer to Figure 7-9.

(a) During positioning of the guide lug plate collar (2470), move the guide lug plate (85) from the build table onto the guide lug plate collar. Refer to Figure 7-9.

(5) Install three socket head cap screws (2490) into the guide lug plate collar (2470). Refer to Figure 7-8 and Figure 7-10.

(6) From the propeller blade arm side of the guide lug plate, install nine hex head bolts (1140) through the small holes in the guide lug plate (85) and through the guide lug plate collar (2470). Refer to Figure 7-8 and Figure 7-10.

NOTE: Propellers with two or three blades will require nine hex head bolts to attach the guide lug plate (85) to the guide lug plate collar (2470).

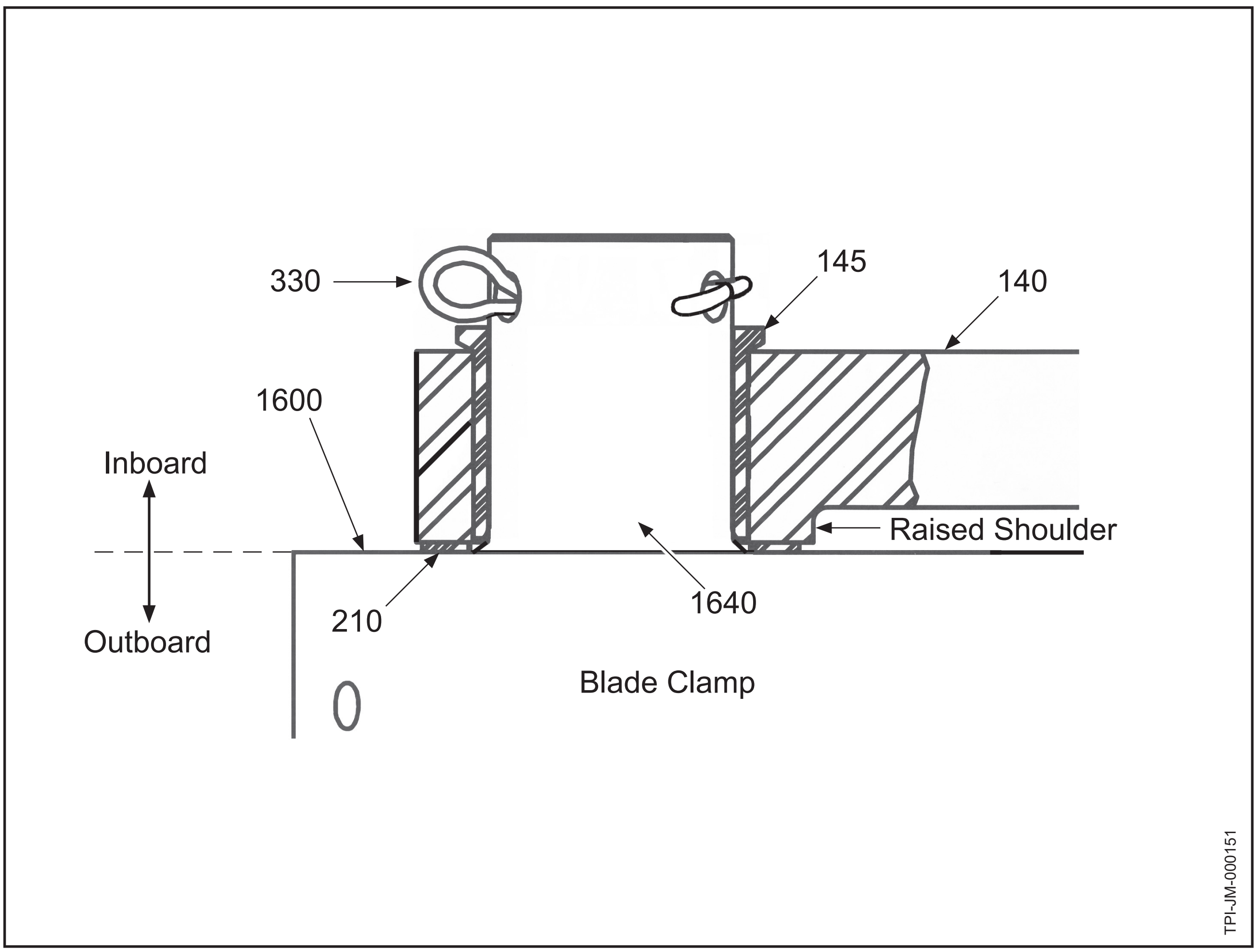
(7) Install a washer (1150) and a nut (1160) on each hex head bolt (1140). Refer to Figure 7-8 and Figure 7-10.

NOTE 1: Do not tighten the bolts (1140). Repositioning of the guide lug plate (85) on the guide lug plate collar (2470) and repositioning of both parts on the neck of the hub (2300) will be required later in the build process.

NOTE 2: The guide lug plate collar (2470) must remain tight against the hub shoulder radius. Refer to Figure 7-9.

(8) Tighten the socket head cap screws (2490) until snug to hold the guide lug plate collar (2470) in position on the hub (2300). Refer to Figure 7-8.

NOTE: Socket head cap screws (2490) are torqued later in the build process.



Link Arm Attachment to Clamp
Figure 7-11

C. Clamp Assembly
Refer to Figure 7-11.

(1) For clamp assembly procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) For information about the correct counterweight slugs and Installing hardware, refer to the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59).

CAUTION: A LINK ARM (140) CANNOT BE INSTALLED AFTER THE CLAMP (1600) HAS BEEN INSTALLED ON THE HUB.

(3) After each clamp (1600) is overhauled:

(a) Install the link screw sleeve (145) into the large hole of the link arm (140), from the side of the link arm that faces away from the clamp half (1600).

NOTE: The flange of sleeve (145) faces inboard.

(b) Install the link arm bushing (210) onto the linkscrew (1640) between the link arm (140) and the blade clamp (1600).

(c) Install the link arm (140) large hole with the previously installed linkscrew sleeve (145) onto the clamp linkscrew (1640).

NOTE: The raised shoulder of the link arm (140) must face the blade clamp (1600). Refer to Figure 7-11.

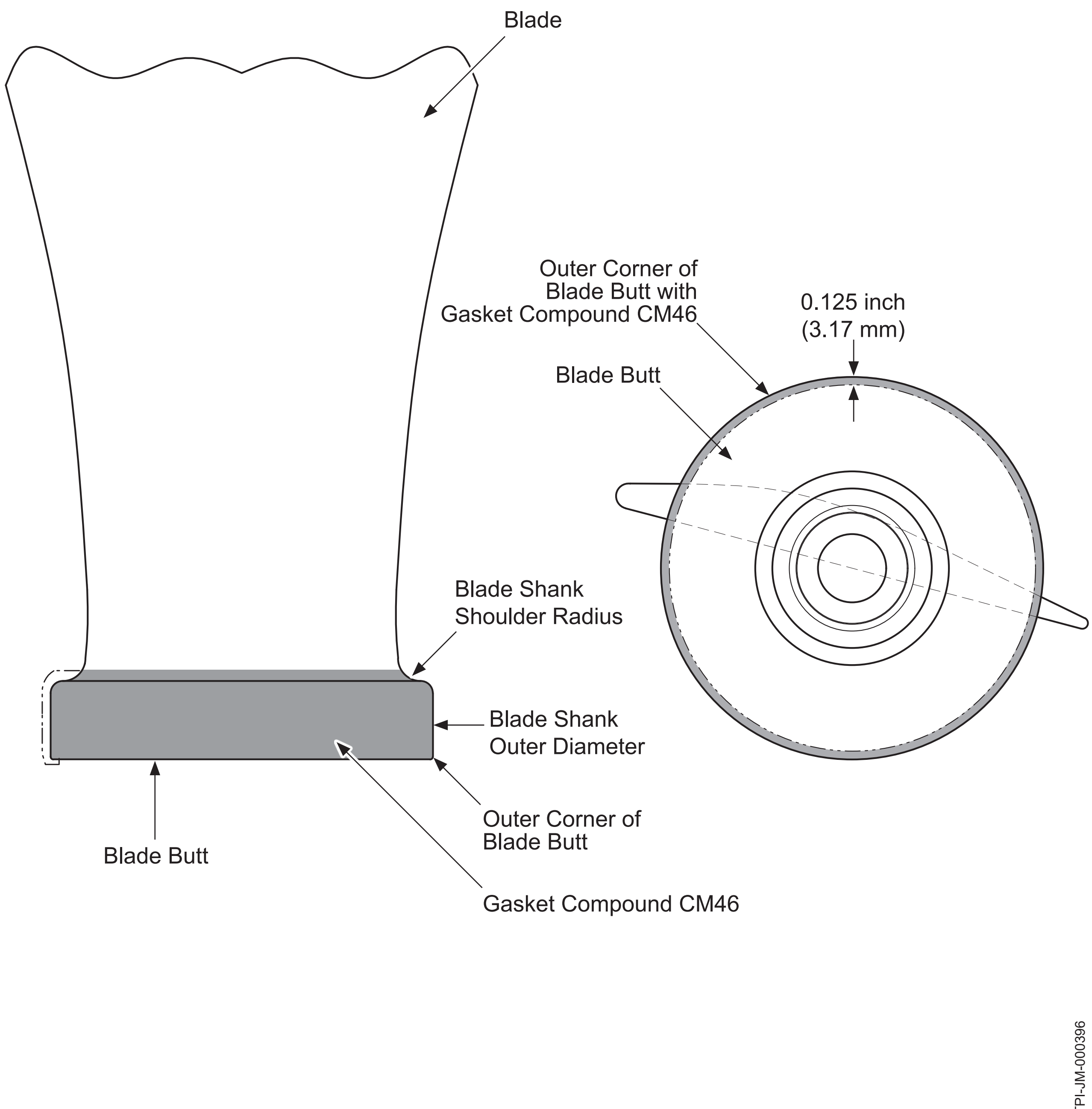
(d) Push the cotter pin (330) through the hole in the end of the linkscrew (1640) and open the cotter pin to install the link arm (140) to the clamp assembly (1600). Refer to Figure 7-11.

(e) Open the cotter pin (330) to secure it in position.

NOTE: The link arm (140) must move freely on the link screw (1640).

(f) Repeat steps (3)(a) through (3)(e) for each clamp assembly (1600).

(4) When adjusting the pitch range of some propeller assemblies, the linkscrew may touch the hub making the full blade angle range to not be achieved. To get the full blade angle range, refer to the section, "Repair of the A-304 Linkscrew" in the Repair chapter of this manual.



Gasket Compound CM46 Application
Figure 7-12

D. Blade and Clamp Installation

(1) Install the hub unit (2300) to the rotatable fixture.

NOTE: For instructions about aluminum blade balancing and all other overhaul or repair procedures, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: IF POSSIBLE, EACH BLADE MUST BE REINSTALLED ON THE HUB ARM FROM WHICH IT WAS REMOVED AT DISASSEMBLY.

(2) Position blade one in vertical position (shank up, tip down).

NOTE: As specified in the section, "Disassembly", each blade must have an identifying number to make sure of correct assembly.

(3) Fill the pilot tube cavity with grease CM12 to the top of the bottom blade needle bearing.

WARNING: AIR TRAPPED IN THE GREASE CAN AFFECT PROPELLER BALANCE AFTER RUN-UP.

(4) Make sure that air is not trapped in the grease.

(5) Move the blade onto the pilot tube (2310) and push the blade toward the center of the hub until the butt of the blade shank touches the face of the blade arm.

NOTE: If the blade has been lubricated correctly, a small amount of grease will come out around the pilot tube (2310).

(6) Repeat steps (2) through (5) of this procedure for the remaining blades.

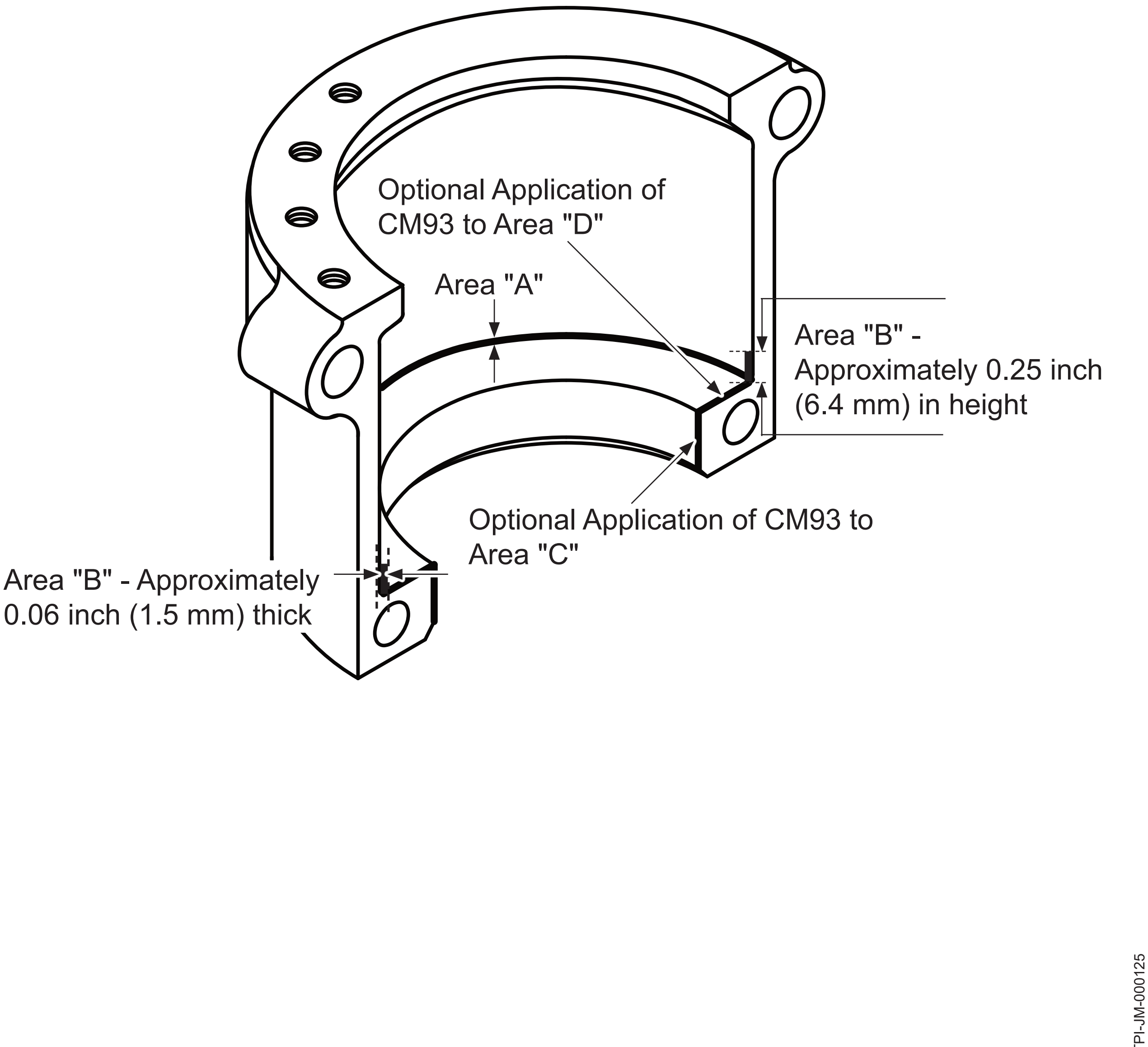
CAUTION: USE HARDENING GASKET COMPOUND CM46 ON THE SHOULDER RADIUS OF THE BLADE SHANK, THE OUTER DIAMETER OF THE BLADE SHANK, AND THE OUTER CORNER OF THE BLADE BUTT. REFER TO FIGURE 7-12.

(7) Using an acid brush or finger, optionally wearing non-powdered latex gloves, apply a smooth even layer of gasket compound CM46 on the shoulder radius of the blade shank in the area where it touches the blade clamp, the outer diameter of the blade shank and the outer corner of the blade butt. Refer to Figure 7-12.

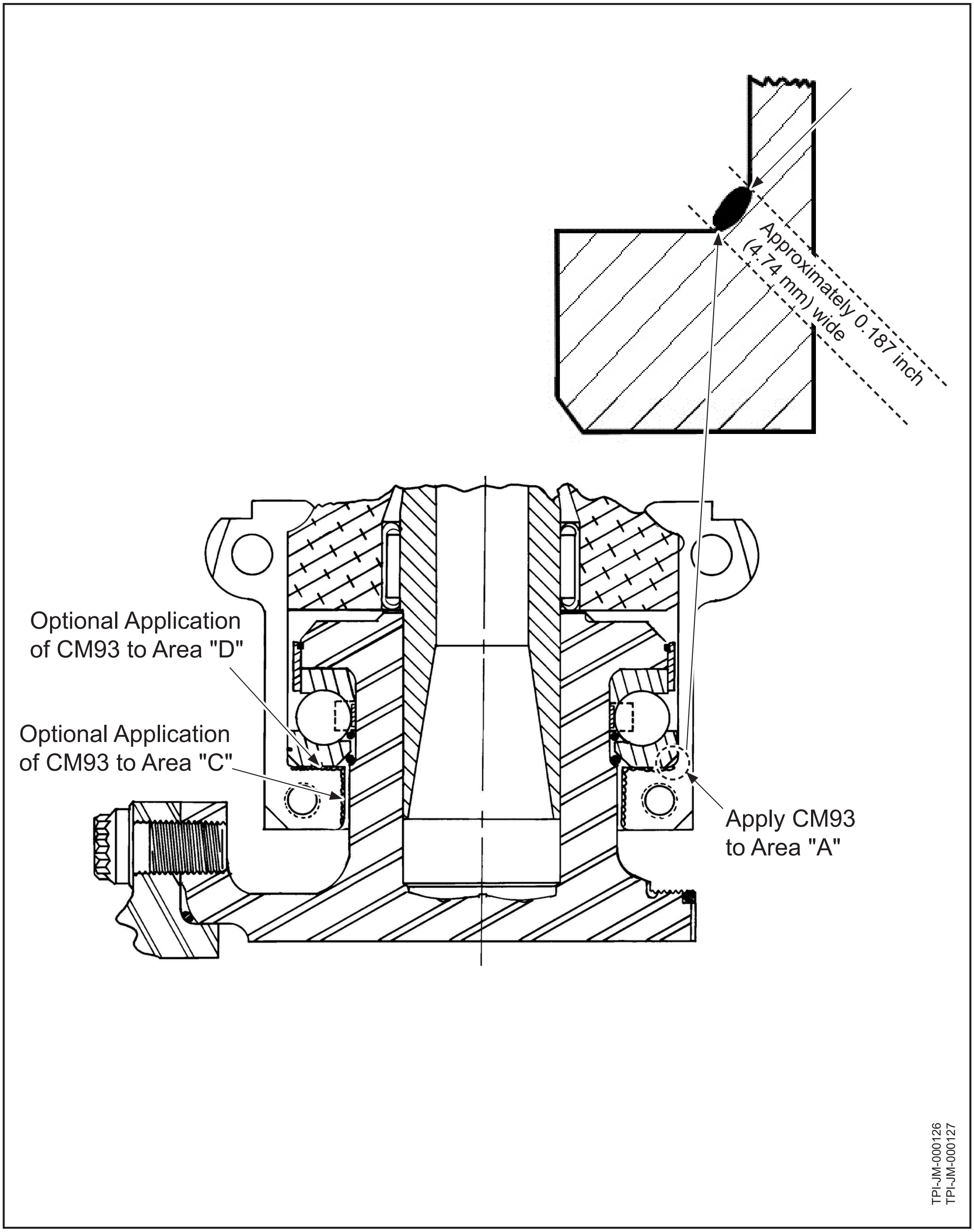
(a) Before installing a clamp, make sure the shoulder radius of the blade shank, the outer diameter of the blade shank and the outside corner of the blade butt are completely covered by a smooth even layer of gasket compound CM46. Refer to Figure 7-12.

(b) When assembling a propeller that will be disassembled for shipment, do not apply gasket compound CM46.

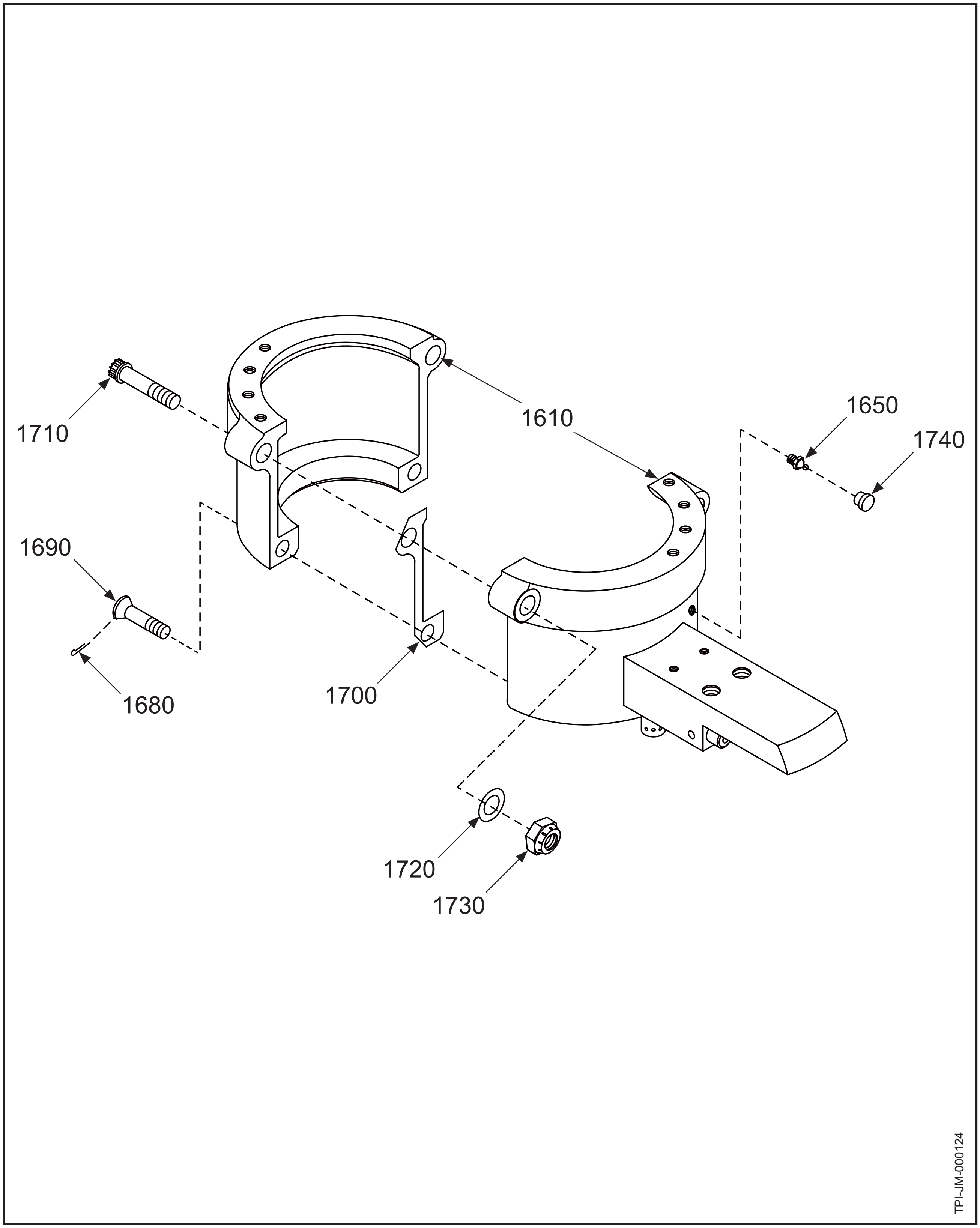
(8) Remove the self-adhesive stretch wrap that was used to temporarily hold the bearing races (240, 300) together.



Internal Sealant CM93 Application
Figure 7-13



Internal Sealant CM93 Application
Figure 7-14



Clamp Assembly
Figure 7-15

CAUTION: THE PARTING LINE OF THE BLADE CLAMP HALVES (1610) MUST BE AT A 90 DEGREE ANGLE TO THE PARTING LINE OF THE RACE (240) AND IN LINE WITH THE RACE (300).

(9) Apply a small bead of sealant CM93 to both blade clamp halves (1610) on the mating surface at the inboard bearing radius. Refer to Figure 7-13, Area "B".

NOTE 1: When assembling a propeller that will be disassembled for shipment, do not apply sealant CM93.

NOTE 2: On the blade clamp mating surfaces, the sealant supplements the sealing of the inboard end of the blade clamp gaskets (1700).

(a) Apply sealant CM93 between the blade clamp (1610) and the race (240) to fill the void from the beveled edge of the race outside diameter and the clamp radius corner. Refer to Figure 7-13 and Figure 7-14, Area "A".

(10) Optionally, apply a small bead of sealant CM93 on the clamp mating surfaces of both clamp halves. Refer to Figure 7-13 and Figure 7-14, Area "C" and Area "D".

NOTE: The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is optional. This step is highly recommended for agricultural aircraft, and is recommended for other Hartzell Propeller Inc. steel hub propeller models. Application of sealant CM93 to the clamp mating surfaces may cause the gasket (1700) to slip out of position. Refer to Figure 7-13 and Figure 7-14.

(11) Install the matching blade clamp half (1610) to which the counterweight (1630) is attached. Refer to Figure 7-15.

(12) Install the other blade clamp half (1610).

CAUTION: A 0.06 INCH (1.5 MM) MAXIMUM OF GASKET MATERIAL MUST BE EVENLY EXPOSED ALONG THE EDGES ON EACH BLADE CLAMP HALF PARTING SURFACE; HOWEVER, GASKET MATERIAL MUST BE TRIMMED, AS NECESSARY, TO PROVIDE METAL-TO-METAL CONTACT WHERE THE INBOARD CLAMP LUGS MEET.

(13) Put a new gasket (1700) between each of the blade clamp half parting surfaces.

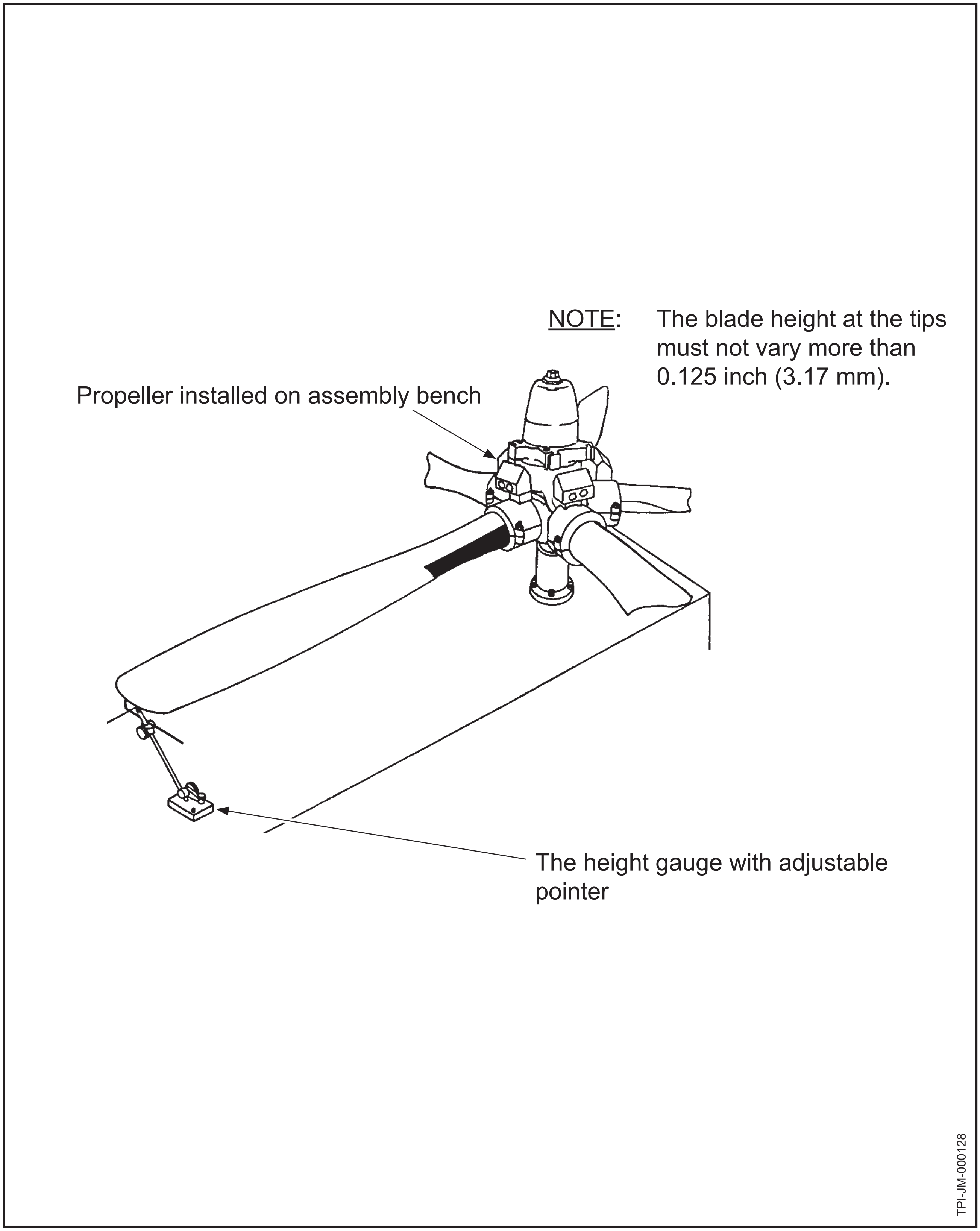
(14) Install the bolts (1710) into the outboard clamp position.

CAUTION: DO NOT TORQUE THE BOLTS (1710) AT THIS TIME. BLADE PLAY IN THE CLAMP UNIT (1600) IS REQUIRED FOR SETTING BLADE ANGLE.

(15) Install the washers (1720) and attach them with self-locking nuts (1730) onto the bolts (1710).

(a) Finger tighten the self-locking nuts (1730).

NOTE: This step helps align the blade clamp gasket (1700). Do not torque the bolts (1710) at this time.



Measuring Blade Track
Figure 7-16

(16) Install the socket screws (1690) into the clamp holes that are in the inboard position.

CAUTION 1: TORQUE THE SOCKET SCREWS (1690) IN THE SPECIFIED SEQUENCE.

CAUTION 2: DO NOT APPLY MORE THAN THE RECOMMENDED TORQUE ON THE SOCKET SCREWS (1690).

(17) Using a 5/16 inch Allen wrench, torque the socket screws (1690) in 10 Ft-Lb (14 N·m) increments (10, 20, etc.) in accordance with Table 8-1, "Torque Values", alternating between screws at each increment.

(18) Measure the blade track.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

(a) Turn the propeller on the rotatable fixture and measure the height at the tip of each blade using a gauge and adjustable pointer. Refer to Figure 7-16.

(b) If all blades do not track:

1 Make sure that there is no unwanted material between the rotatable fixture flange and the propeller hub flange.

2 A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: DO NOT CONTACT THE INNER BLADE CLAMP HALF (1610) WHILE DRILLING TO SAFETY THE SOCKET SCREWS (1690).

(19) Using a #42 (0.094 inch [2.37 mm]) size bit, drill the head of each socket screw (1690).

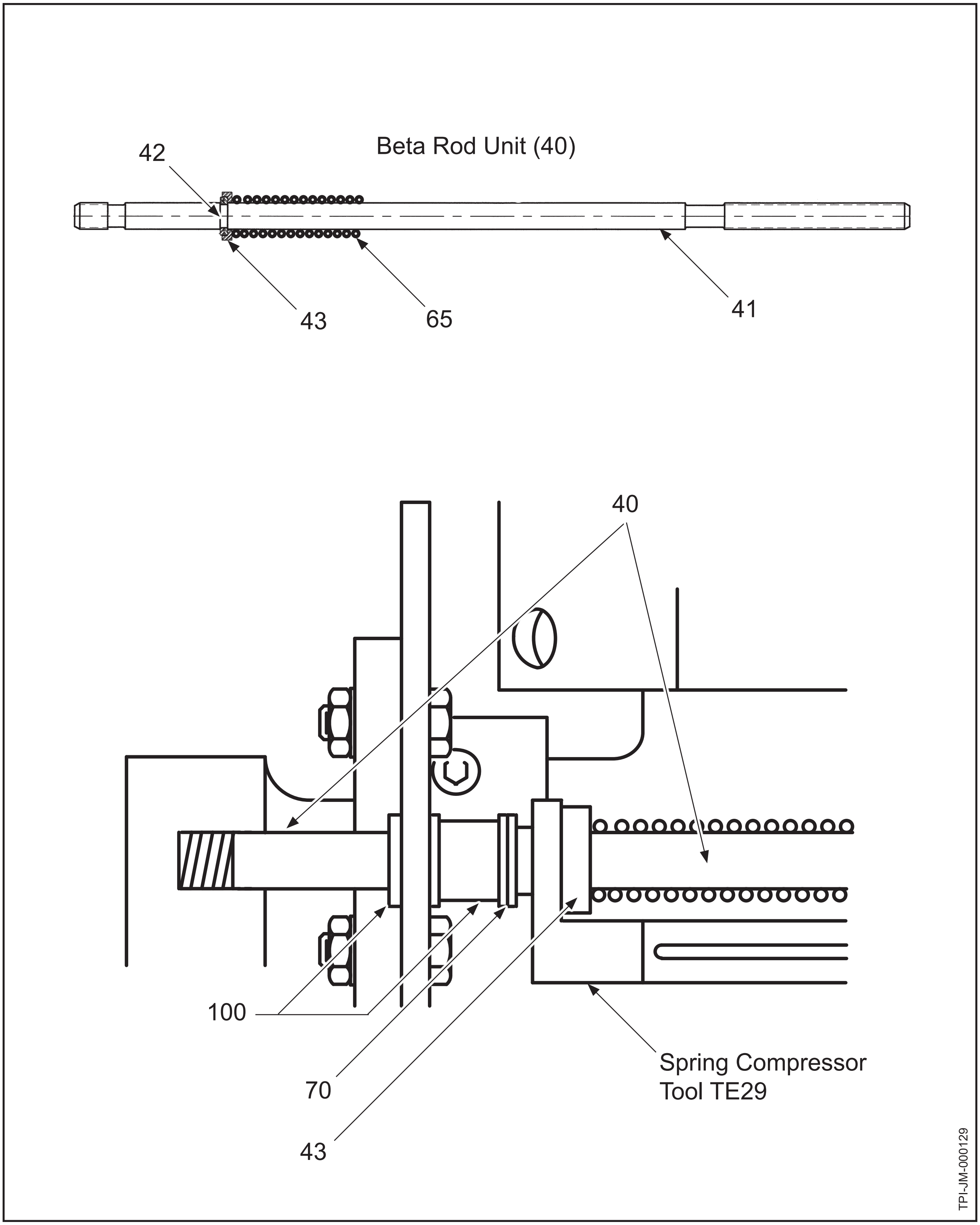
(20) Safety wire each socket screw (1690) with a cotter pin (1680) so that the cotter pin contacts the clamp half (1610) and prevents the socket screw from backing out of the clamp assembly (1600).

NOTE: When assembling a propeller that will be disassembled for shipment, do not safety the clamp socket screws (1690).

(a) If an installed cotter pin (1680) causes interference, three loops of 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131 may be used to safety the socket screw (1690).

(21) For the remaining blades, repeat steps (7) through (20) of this procedure.

(22) Install weight slugs on the clamp counterweight arms, if applicable. Refer to Hartzell Propeller Inc. Application Guide 159 (61-02-59) for specific weight slug information.



Beta Rod Installation
Figure 7-17

E. Beta System Installation (Part 2 of 3)
Refer to Figure 7-17.

CAUTION: INSTALL TWO CRIMPED RETAINING RINGS (42) ONTO THE BETA ROD (41) WITH THE SHARP EDGES AGAINST EACH OTHER.

(1) Move two crimped retaining rings (42) over the build table end of one propeller beta rod (41) and into the groove of the beta rod.

(a) The rounded edges of the crimped retaining rings (42) must face away from each other.

(2) Using beta rod retainer installation tool TE65, crimp the crimped retaining rings (42) together by compressing them to a maximum OD of 0.550 inch (13.97 mm).

(3) Move one beta spring retainer (43) over the piston end of each propeller beta rod (41) and down onto the crimped retaining rings (42).

(a) The crimped retaining rings (42) fit down inside the ID recess of the spring retainer (43).

(4) Move one beta compression spring (65) onto the piston end of the beta rod (41).

(5) Using the spring compressor tool TE29, or equivalent, compress the beta spring (65) to approximately half its length.

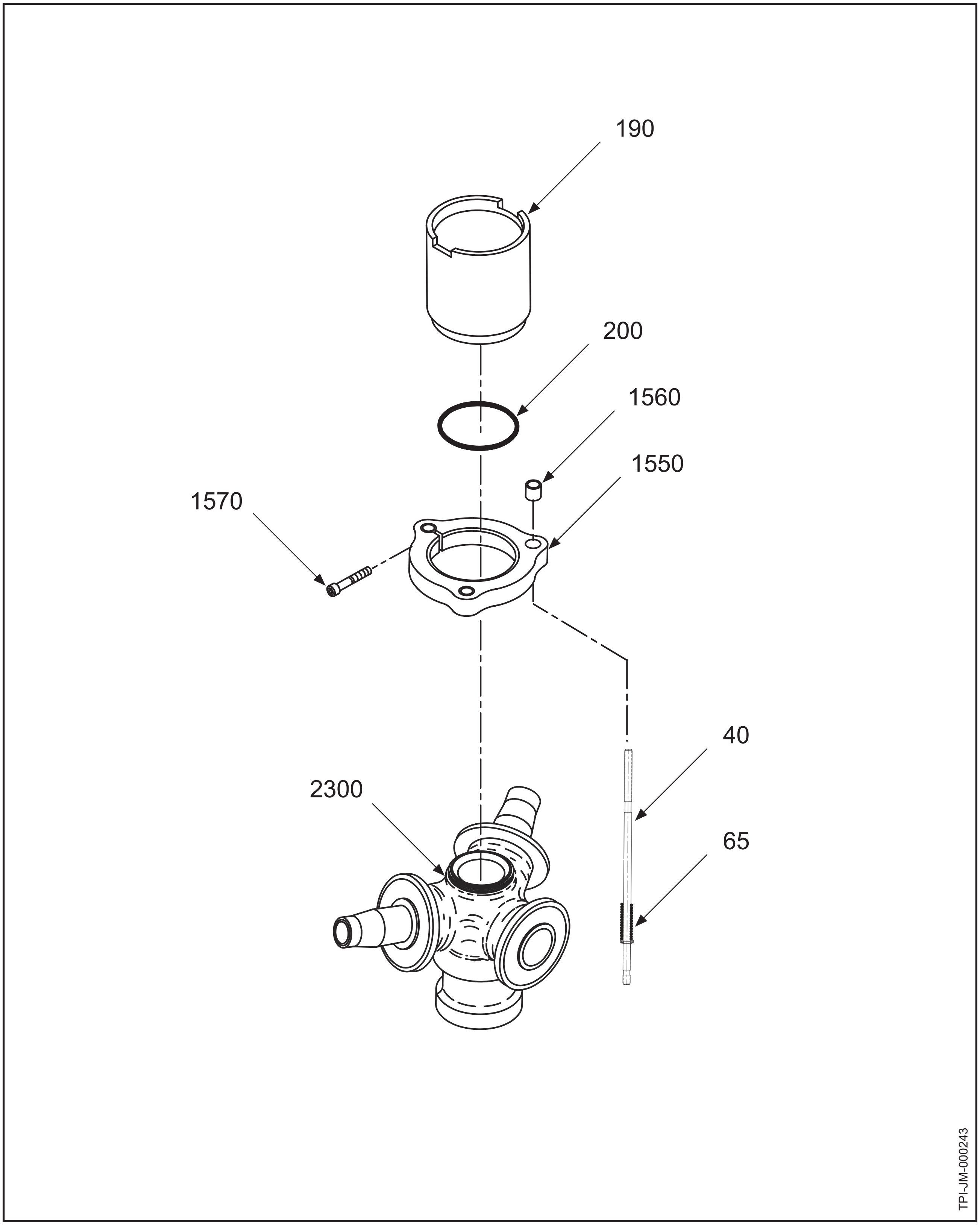
(a) Leave the spring compressor tool on the beta spring (65) to make the following assembly procedures easier.

(6) Repeat steps (1) through (5) of this procedure for each remaining propeller beta rod (41).

(7) Install each assembled beta rod unit (40), through two washers (70) and a guide lug (100) in the guide lug plate (85).

NOTE 1: The long threaded end of the beta rod unit (40) is positioned towards the piston and the short threaded end is positioned towards the build table.

NOTE 2: Washers (70) may be added/removed (from 0 to 4 at each location) later in the assembly to get the low pitch blade angle to reverse blade angle travel requirements of the beta ring (50).



Cylinder and Guide Collar Unit Installation
Figure 7-18

F. Cylinder and Guide Collar Unit Installation
Refer to Figure 7-18.

(1) Using solvent CM106, clean the threads on the hub unit (2300) and cylinder (190).

CAUTION: THE CHAMFERED SIDE OF THE GUIDE COLLAR UNIT (1550) MUST SEAT AGAINST THE SHOULDER OF THE CYLINDER (190). TO GET PROPER HUB CLEARANCE, THE LARGER INSIDE DIAMETER OF THE GUIDE COLLAR MUST FACE THE HUB UNIT (2300).

(2) Install the cap screw (1570) into the guide collar unit (1550).

(3) Install the guide collar unit (1550) onto the smaller diameter shoulder of the cylinder (190) that encircles the threaded inside diameter.

(a) The chamfer in the guide collar (1550) must face toward the cylinder (190) and away from the hub unit (2300).

(b) Do not torque the guide collar socket screw (1570) at this time.

CAUTION 1: DO NOT APPLY HYDRAULIC SEALANT CM134 TO THE THREADS OF THE CYLINDER (190).

CAUTION 2: DO NOT GET HYDRAULIC SEALANT CM134 IN THE CYLINDER (190). CONTAMINATION TO THE AIRCRAFT ENGINE OIL SYSTEM COULD OCCUR.

(4) Apply a bead of hydraulic sealant CM134 in the groove of the hub unit (2300) where the cylinder O-ring (200) fits.

(5) Install the O-ring (200) into the groove adjacent to the threaded area in the cylinder (190).

(6) Move the assembled guide collar unit (1550) and cylinder (190) down over the propeller beta rod units (40).

(a) Each beta rod unit (40) must move through a guide collar bushing (1560) when the cylinder (190) is installed onto the hub (2300).

(7) Hand tighten the cylinder (190) onto the hub unit (2300).

NOTE: The beta rod units (40) installed through the guide collar bushings (1560) will prevent the guide collar unit (1550) from rotating.

(8) Using a bar of appropriate size to fit the slot in the top of the cylinder (190), tighten the cylinder flush against the hub unit (2300).

NOTE: Early drag and tightness is caused by the O-ring (200), which acts as a seal and safety.

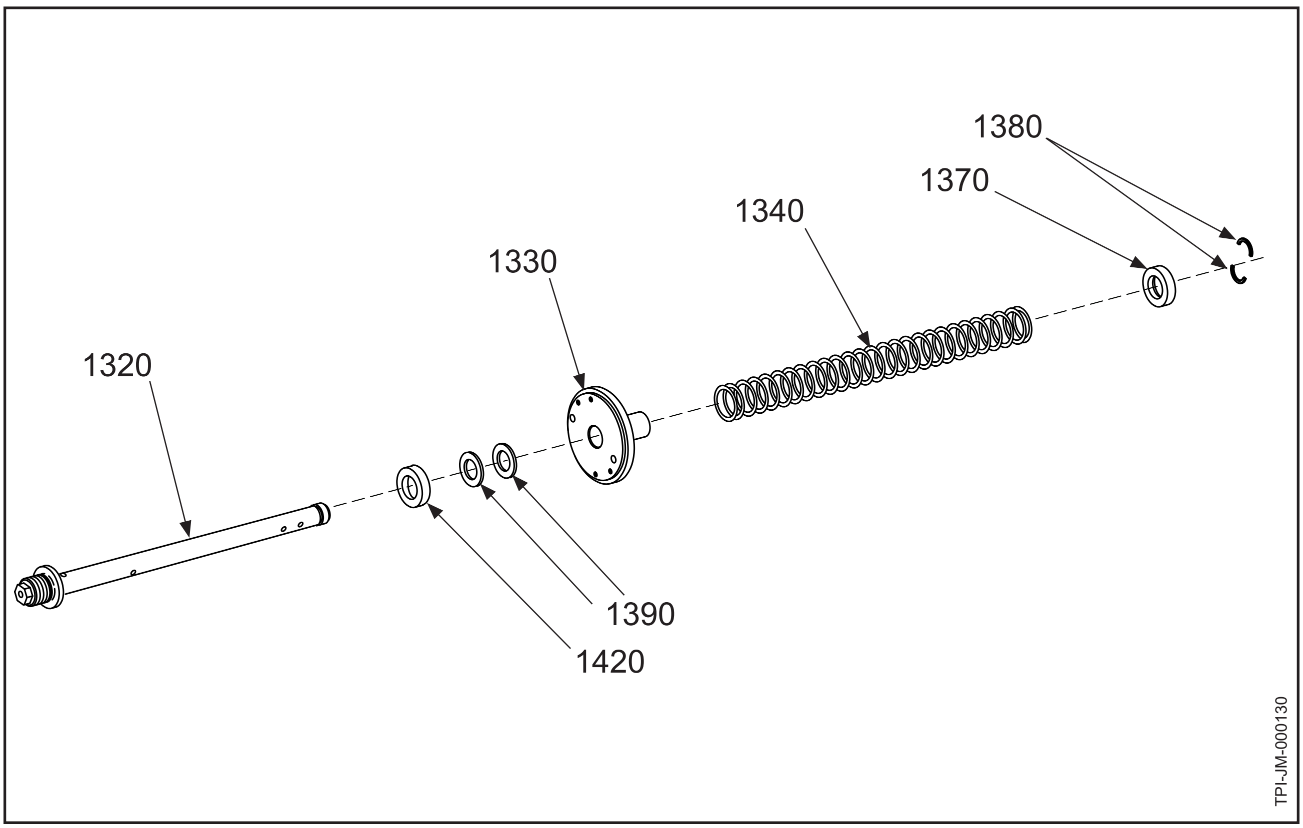
(9) Torque the cylinder (190) against the shoulder of the hub unit (2300). Refer to Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

CAUTION 1: VISUALLY EXAMINE THE INSIDE OF THE CYLINDER (190) TO MAKE SURE THAT THE O-RING (200) HAS NOT BEEN MOVED OUT OF POSITION DURING THE CYLINDER INSTALLATION PROCEDURE.

CAUTION 2: VISUALLY EXAMINE THE SLOT IN THE TOP OF THE CYLINDER (190) TO MAKE SURE THE SQUARE-BAR WRENCH USED FOR TORQUING DID NOT RAISE ANY SHARP EDGES OR DAMAGE THE SPLIT KEEPER GROOVE.

(10) If applicable, remove any sharp edges in the wrench slot on top of the cylinder (190).

(11) Loosen and remove the tools used to compress the beta compression springs (65).



831-85 Spring Assembly
Figure 7-19

G. Assembly of 831-85 Spring Assembly
Refer to Figure 7-19.

CAUTION: A SPRING COMPRESSOR FIXTURE TE59, OR EQUIVALENT, IS REQUIRED FOR COMPRESSING THE SPRING AT ASSEMBLY.

(1) Move the spacer (1420) onto the pitch change rod (1320) with the chamfer side in the direction of the pitch change rod fillet.

(2) Move the spring spacers (1390) onto the pitch change rod (1320) against the spacer (1420).

NOTE: Spring spacers (1390) may be added/removed later in the assembly process to get the desired high pitch blade angle.

(3) Move the flanged spring retainer (1330) onto the pitch change rod (1320), with the flanged plate of the spring retainer in the direction of the threaded end of the pitch change rod.

CAUTION: ONE END OF THE SPRING (1340) HAS A LARGER DIAMETER AND MUST POINT TO THE FLANGED SPRING RETAINER (1330). THIS ALLOWS THE SPRING TO FIT OVER THE SLEEVE PORTION OF THE FLANGED SPRING RETAINER.

(4) Move the compression spring (1340) over the pitch change rod (1320) and against the flanged spring retainer (1330).

(5) Put the rear spring retainer (1370) onto the compression spring (1340) over the pitch change rod (1320).

(6) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent.

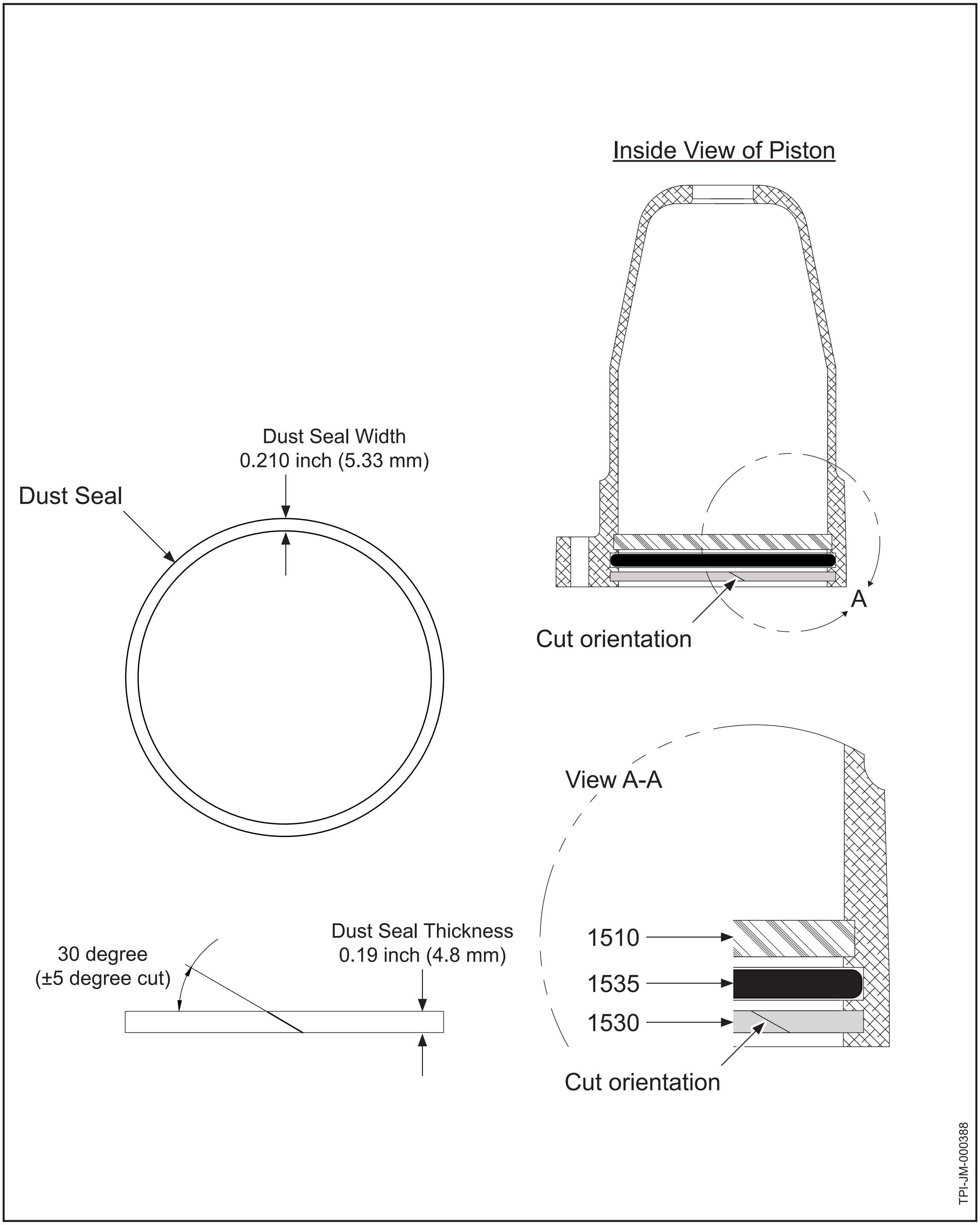
(7) Compress the spring assembly (1300) enough to install the rear split keeper (1380) into the groove in the pitch change rod (1320).

(8) Apply oil or grease to each half of the rear split keeper (1380) to hold it in position in the groove in the pitch change rod (1320) until the spring (1340) is decompressed.

WARNING: WHEN COMPRESSED, THE SPRING ASSEMBLY (1300) IS LOADED TO APPROXIMATELY 1000 POUNDS (454 KG) FORCE. MAKE SURE OF THE SAFETY OF EVERYONE IN THE AREA DURING ASSEMBLY PROCEDURES.

(9) Carefully release the pressure on the spring assembly (1300).

(10) Before removing the spring assembly from spring compressor fixture TE59, or equivalent, make sure that both rear split keeper halves (1380) are in the groove in the pitch change rod (1320), and properly positioned in the recess of the rear spring retainer (1370).



Piston Dust Seal Orientation
Figure 7-20

H. 831-85 Spring Assembly Installation

(1) Put the spring assembly (1300) in to the cylinder until the shoulder of the front spring retainer (1330) is approximately 0.25 inch (6.4 mm) into the cylinder (190).

(2) Install the split keepers (180) into the groove in the cylinder (190).

(3) Move the front spring retainer (1330) against the split keepers (180) to hold them in position.

(4) Using two fillister head screws (170) to install each pitch stop spacer (160).

(5) Torque each fillister head screw (170) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(6) Safety wire the fillister head screws (170) in pairs with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

I. Piston Installation

NOTE: Refer to Figure 7-20 for the installation and orientation of components installed in the piston (1500) and dust seal length.

(1) Using lubricant CM12, lubricate the pitch change rod O-ring (150).

(2) Carefully install the pitch change rod O-ring (150) in the groove provided for it in the pitch change rod (1320).

(3) Using lubricant CM12, lubricate the piston O-ring (1535).

(4) Carefully install the piston O-ring (1535) in the groove provided for it in the piston (1500).

CAUTION: MAKE SURE THAT THE FELT PISTON DUST SEAL (1530) IS FUZZ-FREE.

(5) Cut the piston dust seal material (1530) to length on a 30 degree diagonal so there is an overlap at the parting line with a smooth, fuzz-free surface.

(a) If the piston dust seal (1530) has fuzz or long strands that could interfere with the operation of the O-ring, replace the piston dust seal.

(6) Soak the piston dust seal (1530) in aviation grade engine oil until it is completely saturated.

(a) Squeeze the excess oil from the piston dust seal (1530).

CAUTION: MAKE SURE THAT THE DIAGONAL OVERLAP OF THE FELT PISTON DUST SEAL (1530) REMAINS VISIBLE AND DOES NOT ROTATE TO ITS SIDE AS IT IS INSTALLED IN THE GROOVE OF THE PISTON (1500).

(7) Install the thinnest section of the piston dust seal (1530) in the remaining piston OD groove.

(8) Align the propeller beta rod units (40) with the holes provided for them in the piston (1500).

(9) Move the piston (1500) into position over the beta rod units (40) and the cylinder (190).

(10) Apply a thin layer of anti-seize compound CM118 in the hole of the free end of each link arm (140).

(11) Install the free end of each link arm (140) in the slot provided in the piston (1500).

CAUTION: MAKE SURE THAT THE CORRECT SAFETY SCREW (130) IS INSTALLED AND THAT SUFFICIENT TURNS ARE AVAILABLE IN THE PISTON UNIT (1500) TO HOLD THE SCREW IN POSITION. AT LEAST THREE TURN LENGTHS MUST BE ENGAGED. DO NOT BIND THE LINK ARM.

(12) Install each link pin unit (120) through the large hole in each piston (1500) lug, and through the hole in each link arm (140).

(13) Push each link pin unit (120) flush with the piston (1500) ear.

(14) Install each link pin unit (120) with a fillister head screw (130).

(a) Torque the fillister head screw (130) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(15) Put the guide collar unit (1550) tightly against the cylinder (190) at the correct radial location to assist in aligning the beta rod units (40) with the piston unit (1500).

(a) If necessary, move the guide collar unit (1550) radially to provide the clearances required between the piston (1500) and the propeller beta rod units (40).

(16) Hold the three piece guide lug plate collar (2470) tightly against the hub (2300) shoulder radius.

(a) Rotate the guide lug plate collar to align the beta rod units (40) with the piston unit (1500).

NOTE: Rotating the guide lug plate collar (2470) will also rotate the guide lug plate (85).

(17) Tighten the socket head cap screw (1570) in the guide collar unit using an allen wrench with a torque wrench adapter in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(18) Align the guide lug plate collar (2470) with the beta rod units (40) and the piston (1500).

(19) Tighten the three socket head cap screws (2490) using an allen wrench with a torque wrench adapter in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

NOTE: All three guide lug plate collar (2470) segments must be tight against the hub (1300) shoulder radius. Refer to Figure 7-9.

(20) Remove the spring compressor fixture TE59 from each beta compression spring (65).

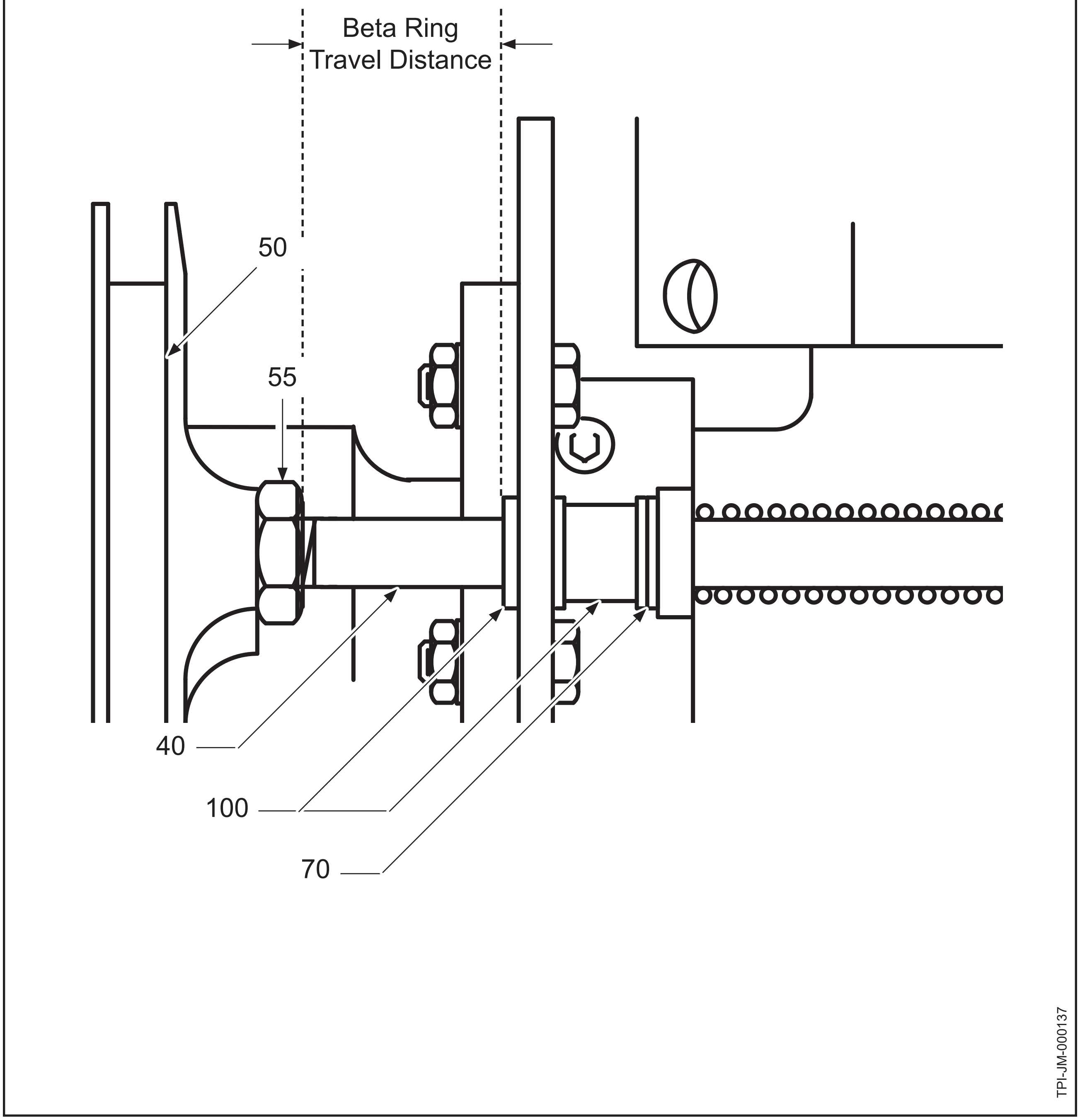
NOTE: The beta compression spring will extend between the guide lug (100) and the guide collar unit (1550).

CAUTION: FOR SETUP PURPOSES ONLY, USE A NON-LOCKING NUT ON THE END OF THE PITCH CHANGE ROD (1320). THE NON-LOCKING NUT MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110) AFTER HIGH PITCH ANGLES ARE SET.

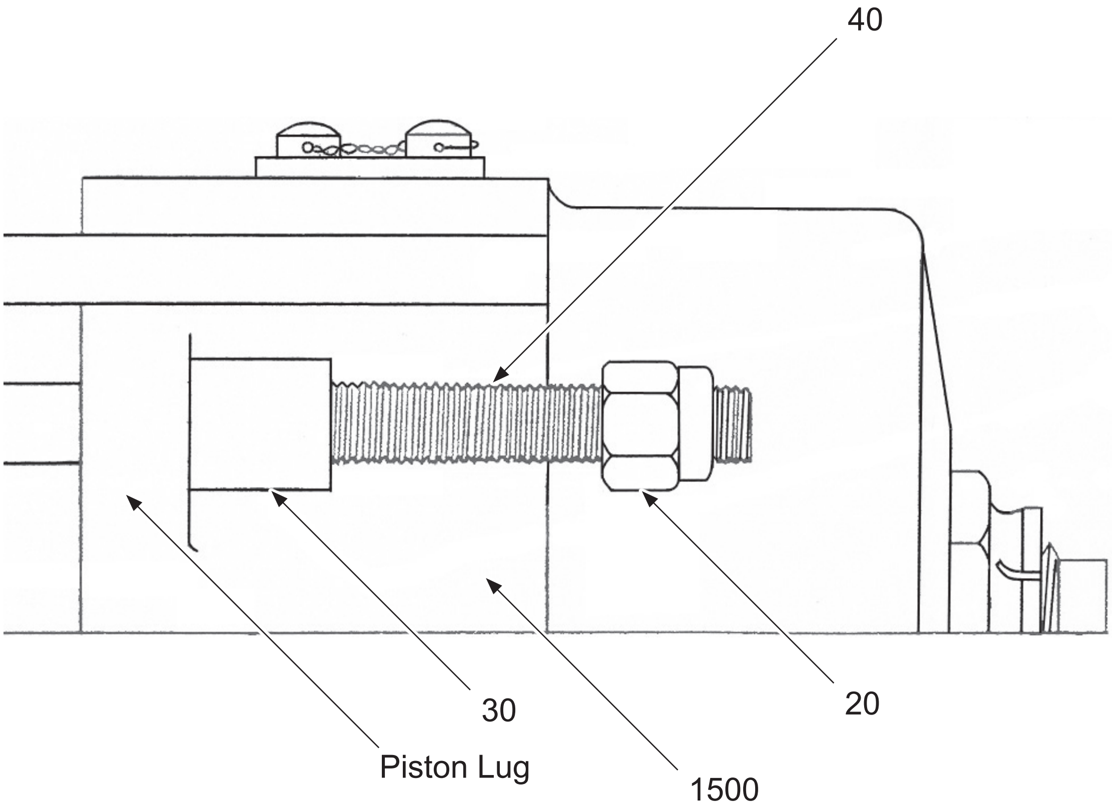
(21) Move the piston (1500) into full high pitch position (back against the hub assembly) so that the threaded end of the pitch change rod (1320) sticks out through the end of the piston.

(22) Turn the self-locking hex nut (110) onto the end of the pitch change rod (1320).

(23) Using a piston nut wrench TE144-1, or equivalent, torque the self-locking hex nut (110) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.



Getting Correct Beta Ring Travel
Figure 7-21



Initial Installation and Location of Self-Locking Hex Nut
Figure 7-22

J. Beta System Installation (Part 3 of 3)

(1) Install a thin hex nut (55) onto the engine side of each beta rod unit (40). Refer to Figure 7-21.

(2) Move the beta ring (50) from the propeller assembly table to a position next to the end of the beta rod units (40) protruding through the guide lugs (100).

(3) Align the threaded holes of the beta ring with each beta rod unit.

CAUTION: DO NOT FORCE THE BETA ROD UNITS (40) AGAINST THE BOTTOM OF THE BETA RING (50) THREADED HOLES. FORCING THE BETA ROD UNITS COULD CAUSE IRREPARABLE DAMAGE (IN THE FORM OF A RAISED DIMPLE) TO THE GROOVE IN THE BETA RING.

(4) Turn one beta rod unit (40) at a time into the threaded holes in the beta ring (50) to a depth of two turns each time.

(a) Use an open end wrench on the flats of the beta rod unit to turn the beta rod unit.

(5) Repeat the above process with each beta rod unit (40) in succession several times until each beta rod is completely threaded into the beta ring (50).

(6) Rotate each beta rod unit (40) out of the beta ring (50) until two threads of the piston rod are exposed.

(a) Tighten the self-locking hex nuts (55) while holding the beta rod units in position with an open end wrench.

NOTE: Adjusting beta ring (50) run-out and torquing of the thin hex nuts (55) against the beta ring will be done later in the build process.

(7) Install one spacer (30) on the long threaded end of the beta rod unit (40).

NOTE: Each spacer (30) will rest on a piston (1500) lug that encircles the beta rod unit.

(8) Thread one self-locking hex nut (20) on the long threaded end of the beta rod unit (40). Refer to Figure 7-22.

NOTE: Initial location of each self-locking hex nut (20) is not important. During the setting of counterweight angle and the adjustment of low pitch blade angle and beta ring (50) run-out, each nut will be relocated relative to the piston (1500) ears as needed.

Counterweight Angle (Degrees)	Degrees of Travel Range (from low pitch blade angle to reverse blade angle)							
	27	27.5	28	28.5	29	29.5	30	30.5
	Beta Ring Linear Travel Distance (from low pitch blade angle to reverse blade angle)							
0	0.744 in 18.89 mm	0.760 in 19.30 mm	0.776 in 19.71 mm	0.791 in 20.09 mm	0.807 in 20.49 mm	0.823 in 20.90 mm	0.838 in 21.28 mm	0.854 in 21.69 mm
1	0.752 in 24.18 mm	0.768 in 19.50 mm	0.784 in 19.91 mm	0.799 in 20.29 mm	0.815 in 20.70 mm	0.831 in 21.10 mm	0.847 in 21.51 mm	0.862 in 21.89 mm
2	0.760 in 19.30 mm	0.776 in 19.71 mm	0.791 in 20.09 mm	0.807 in 20.49 mm	0.823 in 20.90 mm	0.839 in 21.31 mm	0.855 in 21.71 mm	0.871 in 22.12 mm
3	0.767 in 19.48 mm	0.783 in 19.88 mm	0.799 in 20.29 mm	0.815 in 20.70 mm	0.831 in 21.10 mm	0.847 in 21.51 mm	0.862 in 21.89 mm	0.878 in 22.30 mm
4	0.774 in 19.65 mm	0.790 in 20.06 mm	0.806 in 20.47 mm	0.822 in 20.87 mm	0.838 in 21.28 mm	0.854 in 21.69 mm	0.870 in 22.09 mm	0.886 in 22.50 mm
5	0.781 in 19.83 mm	0.797 in 20.24 mm	0.813 in 20.65 mm	0.829 in 21.05 mm	0.845 in 21.46 mm	0.861 in 21.86 mm	0.877 in 22.27 mm	0.893 in 22.68 mm
6	0.788 in 20.01 mm	0.804 in 20.42 mm	0.820 in 20.82 mm	0.836 in 21.23 mm	0.852 in 21.64 mm	0.868 in 22.04 mm	0.884 in 22.45 mm	0.900 in 22.86 mm
7	0.795 in 20.19 mm	0.811 in 20.59 mm	0.827 in 21.00 mm	0.843 in 21.41 mm	0.859 in 21.81 mm	0.875 in 22.22 mm	0.891 in 22.63 mm	0.907 in 23.03 mm
8	0.801 in 20.34 mm	0.817 in 20.75 mm	0.833 in 21.15 mm	0.849 in 21.56 mm	0.865 in 21.97 mm	0.881 in 22.37 mm	0.897 in 22.78 mm	0.914 in 23.21 mm
9	0.807 in 20.49 mm	0.823 in 20.90 mm	0.839 in 21.31 mm	0.855 in 21.71 mm	0.871 in 22.12 mm	0.887 in 22.52 mm	0.904 in 22.96 mm	0.920 in 23.36 mm
10	0.813 in 20.65 mm	0.829 in 21.05 mm	0.845 in 21.46 mm	0.861 in 21.86 mm	0.877 in 22.27 mm	0.893 in 22.68 mm	0.910 in 23.11 mm	0.926 in 23.52 mm

Beta Ring Travel for a Specific Counterweight Angle
Table 7-1, page 1 of 2

Counterweight Angle (Degrees)	Degrees of Travel Range (from low pitch blade angle to reverse blade angle)						
	31	31.5	32	32.5	33	33.5	34
	Beta Ring Linear Travel Distance (from low pitch blade angle to reverse blade angle)						
0	0.870 in 22.09 mm	0.886 in 22.50 mm	0.902 in 22.91 mm	0.918 in 23.31 mm	0.933 in 23.69 mm	0.949 in 24.10 mm	0.965 in 24.51 mm
1	0.878 in 22.30 mm	0.894 in 22.70 mm	0.910 in 23.11 mm	0.926 in 23.52 mm	0.942 in 23.92 mm	0.958 in 24.33 mm	0.974 in 24.83 mm
2	0.887 in 22.52 mm	0.903 in 22.93 mm	0.919 in 23.34 mm	0.935 in 23.74 mm	0.951 in 24.15 mm	0.967 in 24.56 mm	0.983 in 24.96 mm
3	0.894 in 22.70 mm	0.910 in 23.11 mm	0.927 in 23.54 mm	0.943 in 23.95 mm	0.959 in 24.35 mm	0.975 in 24.76 mm	0.991 in 25.17 mm
4	0.902 in 22.91 mm	0.918 in 23.31 mm	0.934 in 23.72 mm	0.950 in 24.13 mm	0.967 in 24.56 mm	0.983 in 24.96 mm	0.999 in 25.37 mm
5	0.909 in 23.08 mm	0.926 in 23.52 mm	0.942 in 23.92 mm	0.958 in 24.33 mm	0.974 in 24.83 mm	0.990 in 25.14 mm	1.007 in 25.57 mm
6	0.917 in 23.29 mm	0.933 in 23.69 mm	0.949 in 24.10 mm	0.965 in 24.51 mm	0.981 in 24.91 mm	0.998 in 25.34 mm	1.014 in 25.75 mm
7	0.923 in 23.44 mm	0.940 in 23.87 mm	0.956 in 24.28 mm	0.972 in 24.68 mm	0.988 in 25.09 mm	1.005 in 25.52 mm	1.021 in 25.93 mm
8	0.930 in 23.62 mm	0.946 in 24.02 mm	0.962 in 24.43 mm	0.979 in 24.86 mm	0.995 in 25.27 mm	1.011 in 25.67 mm	1.028 in 26.11 mm
9	0.936 in 23.77 mm	0.952 in 24.18 mm	0.969 in 24.61 mm	0.985 in 25.01 mm	1.001 in 25.42 mm	1.018 in 25.85 mm	1.034 in 26.26 mm
10	0.942 in 23.92 mm	0.958 in 24.33 mm	0.975 in 24.76 mm	0.991 in 25.17 mm	1.007 in 25.57 mm	1.024 in 26.00 mm	1.040 in 26.41 mm

Beta Ring Travel for a Specific Counterweight Angle
Table 7-1, page 2 of 2

CAUTION 1: AT THIS STAGE OF PROPELLER ASSEMBLY THE BOLTS (1710) HAVE NOT BEEN TIGHTENED, BECAUSE ADJUSTMENTS OF COUNTERWEIGHT ANGLE AND BLADE PITCH USUALLY INVOLVE SOME DISASSEMBLY PROCEDURE.

CAUTION 2: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

K. Counterweight Angle

(1) Beta Ring (50) Travel Distance and Adjustment Overview

(a) The selected counterweight angle affects the required beta ring travel distance between low pitch blade angle and reverse blade angle. Refer to Figure 7-21.

1 The selected counterweight angle will affect the linear travel distance of the piston (1500) from low pitch blade angle to reverse blade angle.

2 The travel range of the beta ring from low pitch blade angle to reverse blade angle must be adjusted to match the actual travel distance of the piston from low pitch blade angle to reverse blade angle.

NOTE 1: This allows the beta ring to stop against the guide lugs (100) to act as the reverse stop for the propeller assembly.

NOTE 2: Refer to Table 7-1 for the relationship between counterweight angle and its effect on piston travel distance between low pitch blade angle and reverse blade angle.

3 Lower counterweight angles require less beta ring travel.

4 Higher counterweight angles require greater beta ring travel.

(2) Setting Counterweight Angle

NOTE: Counterweight angles for (B)HC-A(2,3)(MV,V)20-3( ) model propellers must be positive counterweight angles of 0 to 10 degrees.

(a) Calculate the degree of travel.

1 The degree of travel is the sum of the low pitch blade angle and reverse blade angle in total degrees. Refer to Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59) to get the low pitch angle and the reverse angle for the application of the propeller.

Example: The Application Guide for a specified application lists the low pitch angle as 17 degrees and reverse angle as -15 degrees. The degree of travel range is 32 degrees. This number will be used to calculate the intermediate angle and used in reference with Table 7-1.

(b) Refer to Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59) to get the counterweight angle (Cwt Angle) for the application of the propeller.

1 The counterweight angle of the application is a number between 0 through 10, refer to Table 7-1. If the counterweight angle is "Positive", go to step (2)(b)2 of this procedure.

a Using the degree of travel range and counterweight angle, locate the beta ring linear travel distance in Table 7-1.

b Measure the beta ring travel distance (distance from thin hex nut [55] to the guide lug [100] - refer to Figure 7-21).

(1) If the measured beta ring travel distance is the same as the beta ring linear travel distance in Table 7-1, go to step (2)(f) of this procedure.

(2) If the measured beta ring travel distance is not the same as the beta ring linear travel distance in Table 7-1 but is within 0.041 inch (1.04 mm) tolerance, go to step (2)(d) of this procedure.

(3) If the measured beta ring travel distance is not the same as the beta ring linear travel distance in Table 7-1 but is between 0.041 inch (1.04 mm) and 0.105 inch (2.66 mm) tolerance, refer to step (2)(c) of this procedure.

2 If the counterweight angle of the application is listed as Positive:

a Measure the beta ring travel distance (distance from thin hex nut [55] to the guide lug [100] - refer to Figure 7-21) and use Table 7-1.

b In the Degrees of Travel Range column, locate the exact or closest number to the measured beta travel ring distance (from previous step).

(1) If the exact number is found, the counterweight angle is located on the same row found in Table 7-1.

(2) If the exact number is not found, but there is a number in Table 7-1 (in the degree of travel range column) within 0.041 inch (1.04 mm) tolerance, refer to step (2)(d) of this procedure.

(3) If the exact number is not found, but there is a number in Table 7-1 (in the degree of travel range column) greater than 0.041 inch (1.04 mm) but less than 0.105 inch (2.66 mm) tolerance, refer to step (2)(c) of this procedure.

(c) Perform coarse adjustment.

NOTE: During the build process, two washers (70) were installed on each beta rod unit (40). Washers are to be of equal value on each of the piston units. The purpose of the coarse adjustment is to increase/decrease 0.032 inch (0.81 mm) to 0.064 (1.62 mm) of linear travel to or from the beta ring.

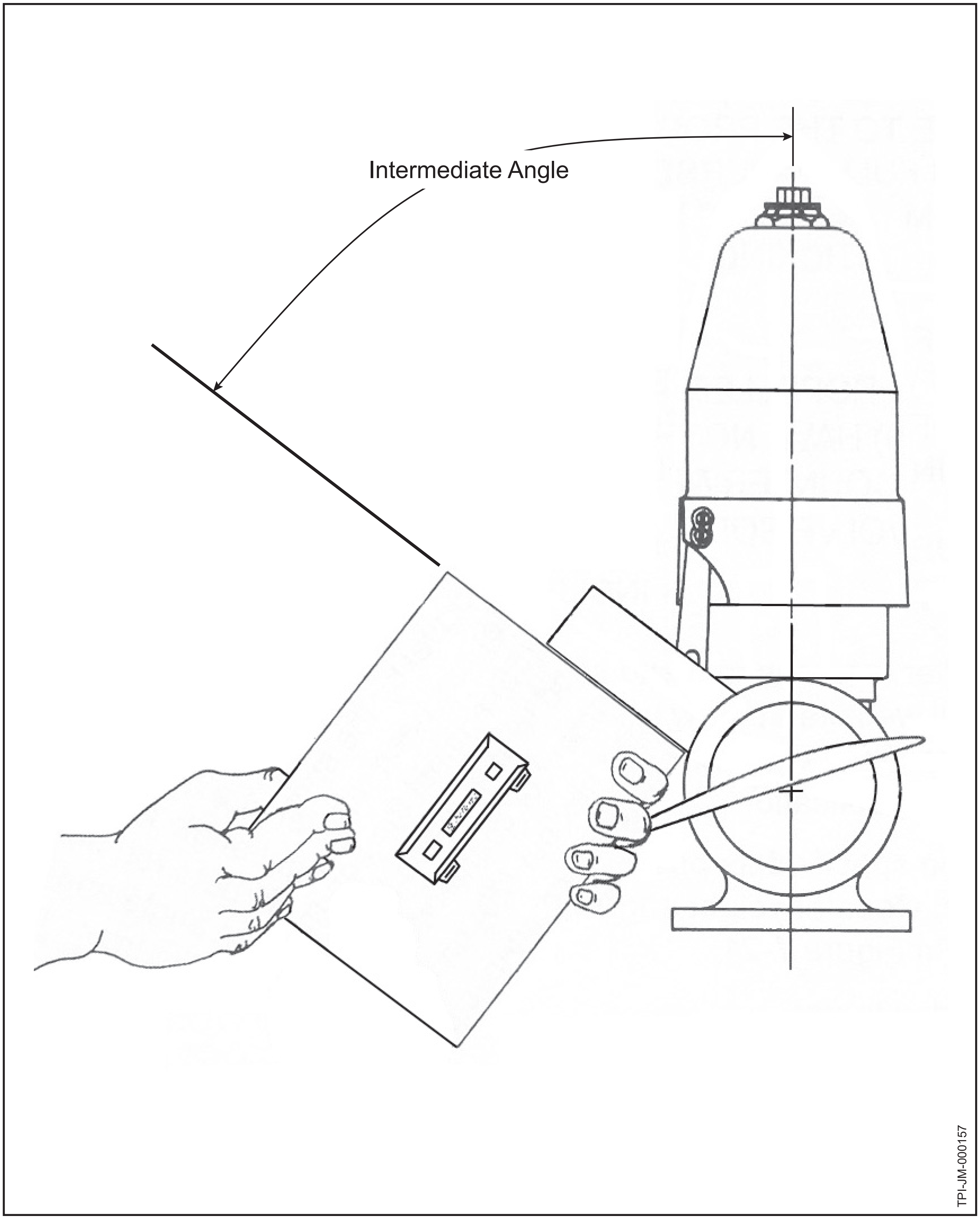
1 Disassemble the unit.

2 Install or remove up to two washers (70) in between the guide lug (100) and the two crimped retaining rings (42), as applicable. Refer to Figure 7-17 for location of washer(s).

NOTE: The maximum permitted number of washers is 4.

a Installing a washer will decrease linear travel of the beta ring (50) by 0.032 inch (0.81 mm).

b Removing a washer will increase linear travel of the beta ring (50) by 0.032 inch (0.81 mm).



Intermediate Angle of Counterweight Relative to Propeller Assembly Centerline
Figure 7-23

CAUTION 1: THE MAXIMUM ALLOWABLE NUMBER OF THE BETA RING (50) THREADS NOT ENGAGED BY THE BETA ROD UNIT (40) IS TWO.

CAUTION 2: DO NOT FORCE THE BETA ROD UNITS (40) AGAINST THE BOTTOM OF THE BETA RING (50) THREADED HOLES. FORCING THE BETA ROD UNITS CAN CAUSE PERMANENT DAMAGE TO THE GROOVE IN THE BETA RING.

(d) Perform fine adjustment of beta ring travel distance:

1 To decrease linear travel of the beta ring (50), rotate the beta rod unit (40) in to the beta ring (50) threaded hole not to exceed one full turn.

2 To increase linear travel of the beta ring (50), rotate the beta rod unit (40) out of the beta ring (50) not to exceed one full turn.

(e) Measure the beta ring travel distance.

1 If the measured beta ring travel distance matches the desired beta ring travel distance in Table 7-1, go to step (2)(f) of this procedure.

CAUTION: THE MAXIMUM DISTANCE OF EACH BETA ROD UNIT (40) FROM THE BOTTOM OF EACH THREADED HOLE IN THE BETA RING (50) IS TWO THREADS.

2 If the measured beta ring travel distance does not match the desired beta ring travel distance in Table 7-1, rotate the beta rod unit (40) in or out of the beta ring (50) until beta ring travel distance is obtained and within the limitations listed in step (2)(d) of this procedure.

(f) Calculate the intermediate angle.
Intermediate Angle =
90 degree – (Counterweight Angle + Degree of Travel Range)

(g) Install one aluminum spacer (30) and one self-locking hex nut (20) on each beta rod unit (40).

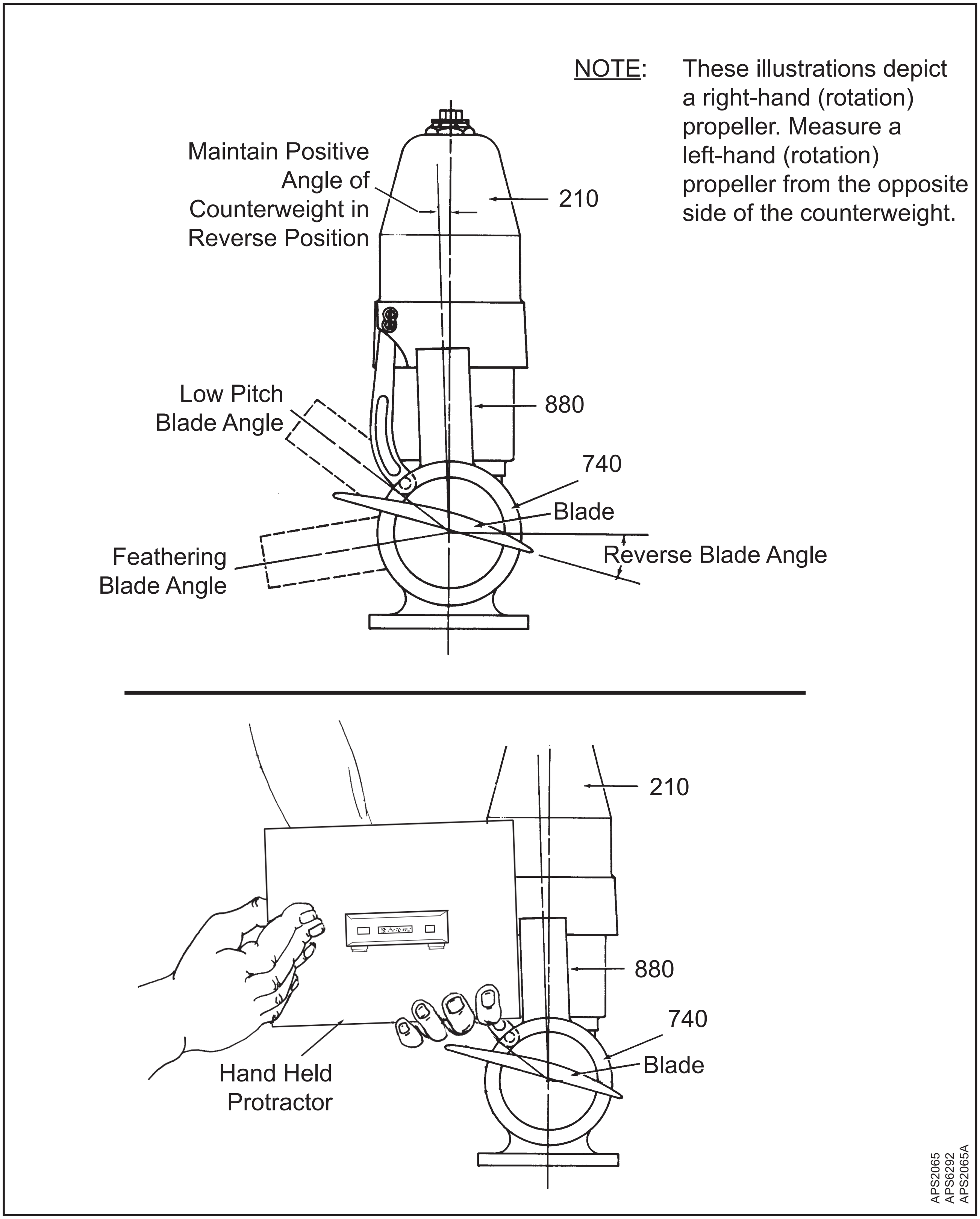
NOTE: Position each self-locking hex nut (20) on each beta rod unit (40) to be at what will be the low pitch blade angle position relative to each piston unit (1500) lug.

(h) Apply air pressure to the piston unit (1500) through the rotatable fixture on the propeller assembly table.

NOTE: This moves the piston to full reverse position. Refer to Figure 7-23

(i) Position the piston unit (1500) with applied air pressure to obtain the intermediate counterweight location.

NOTE: The intermediate angle is the angle between each counterweight and the propeller centerline.



Correct Angle of Counterweight Relative to Axis of Piston
Figure 7-24

WARNING: THE COUNTERWEIGHT (1630) MUST HAVE A POSITIVE ANGLE WITH REFERENCE TO THE PROPELLER CENTERLINE WHEN THE PISTON IS IN FULL REVERSE POSITION TO PREVENT THE PROPELLER FROM “STICKING” IN REVERSE. REFER TO FIGURE 7-24.

CAUTION 1: ALL COUNTERWEIGHT ANGLES MUST BE WITHIN 1.5 DEGREES OF EACH OTHER.

CAUTION 2: BETA RING (50) TRAVEL AND HEX NUT (20) LOCATION WILL NEED CORRECTION IF COUNTERWEIGHT ANGLE IS CHANGED.

(j) Using a hand-held protractor TE97 or equivalent, measure blade 1 counterweight angle relative to the axis of the piston. Refer to Figure 7-24.

(k) Verify the measured counterweight angle is the same as the counterweight angle located on the IDS of the propeller.

1 If they are the same, go to step (2)(l) of this procedure.

CAUTION: ROTATION OF THE BETA ROD UNIT (40) WILL CHANGE THE BETA RING TRAVEL DISTANCE AND WILL NEED CHECKED AND CORRECTED.

2 If they are different, adjust the self-locking nuts while not rotating the beta rod unit (20) to the required counterweight angle.

a Threading the nuts towards the piston increases the counterweight angle.

b Threading the nut away from the piston decreases the counterweight angle.

c Recheck counterweight angle after adjustment.

(l) Using a hand-held protractor TE97 or equivalent, measure blade 1 intermediate angle. Refer to Figure 7-23

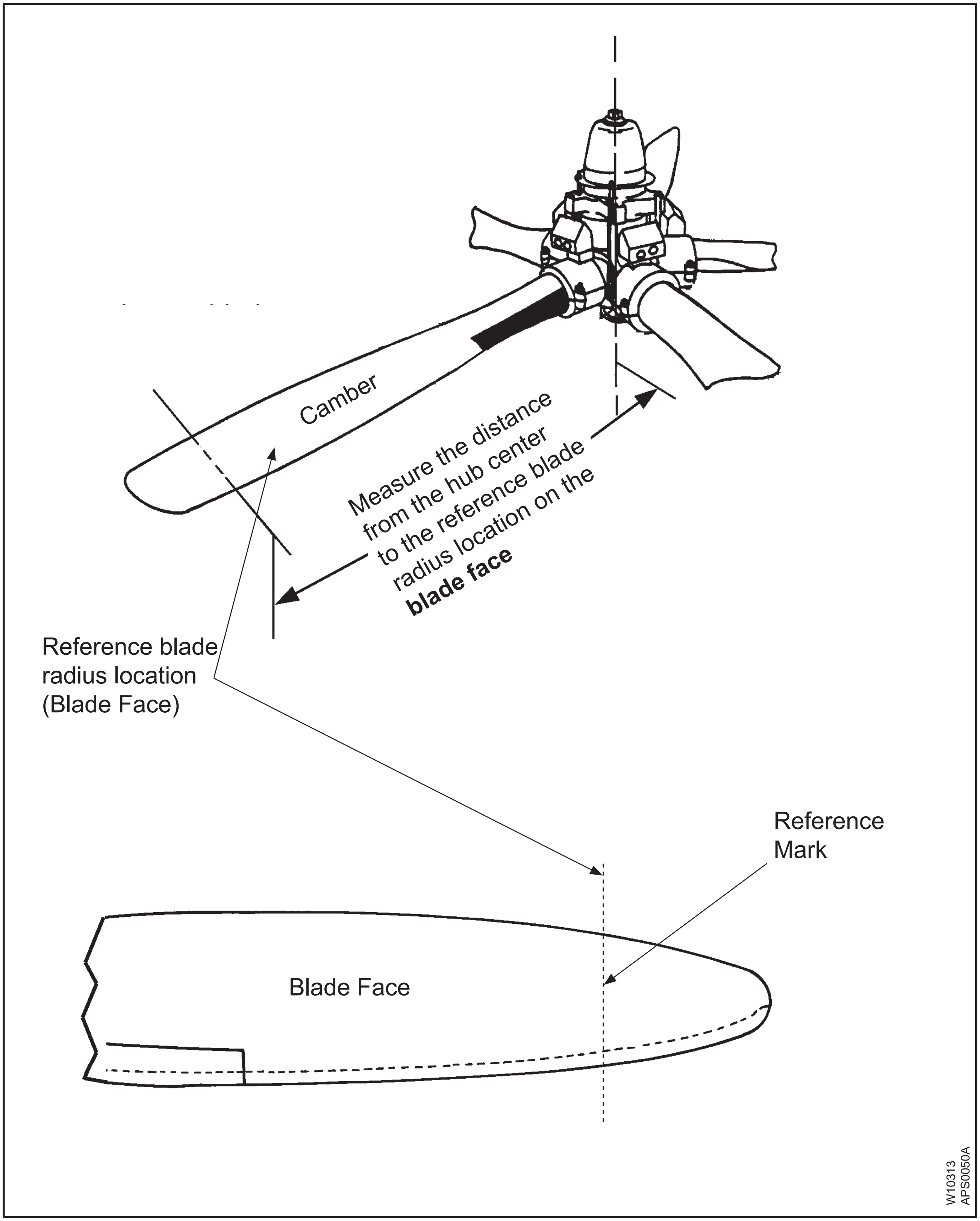
(m) Verify the measured intermediate angle match the calculated intermediate angle.

1 If they are the same, go to step (2)(n) of this procedure.

2 If they are different, repeat the Setting Counterweight Angle procedure.

(n) Once the beta ring travel and counterweight angle is set, torque the thin hex nuts (55) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

NOTE: Setting the counterweight angle is complete when the selected counterweight angle and the measured beta ring travel distance are within Table 7-1 tolerances.



Establishing Reference Blade Radius
Figure 7-25

L. Establishing Reference Blade Radius

CAUTION: DO NOT CONFUSE BLADE STATION WITH REFERENCE BLADE RADIUS. BLADE STATION AND REFERENCE BLADE RADIUS OF THE SAME NUMBER MAY NOT ALWAYS INDICATE THE SAME LOCATION ON THE BLADE.

(1) Reference blade radius is measured from the center of the propeller hub to a predetermined reference location on the blade for blade angle measurement.

(2) Blade stations are used during the repair or overhaul process of a blade to define a blade span location for dimensional measurement.

(3) Establish a reference blade radius location

(a) For the reference blade radius location specified for the applicable aircraft installation, refer to the Aircraft Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

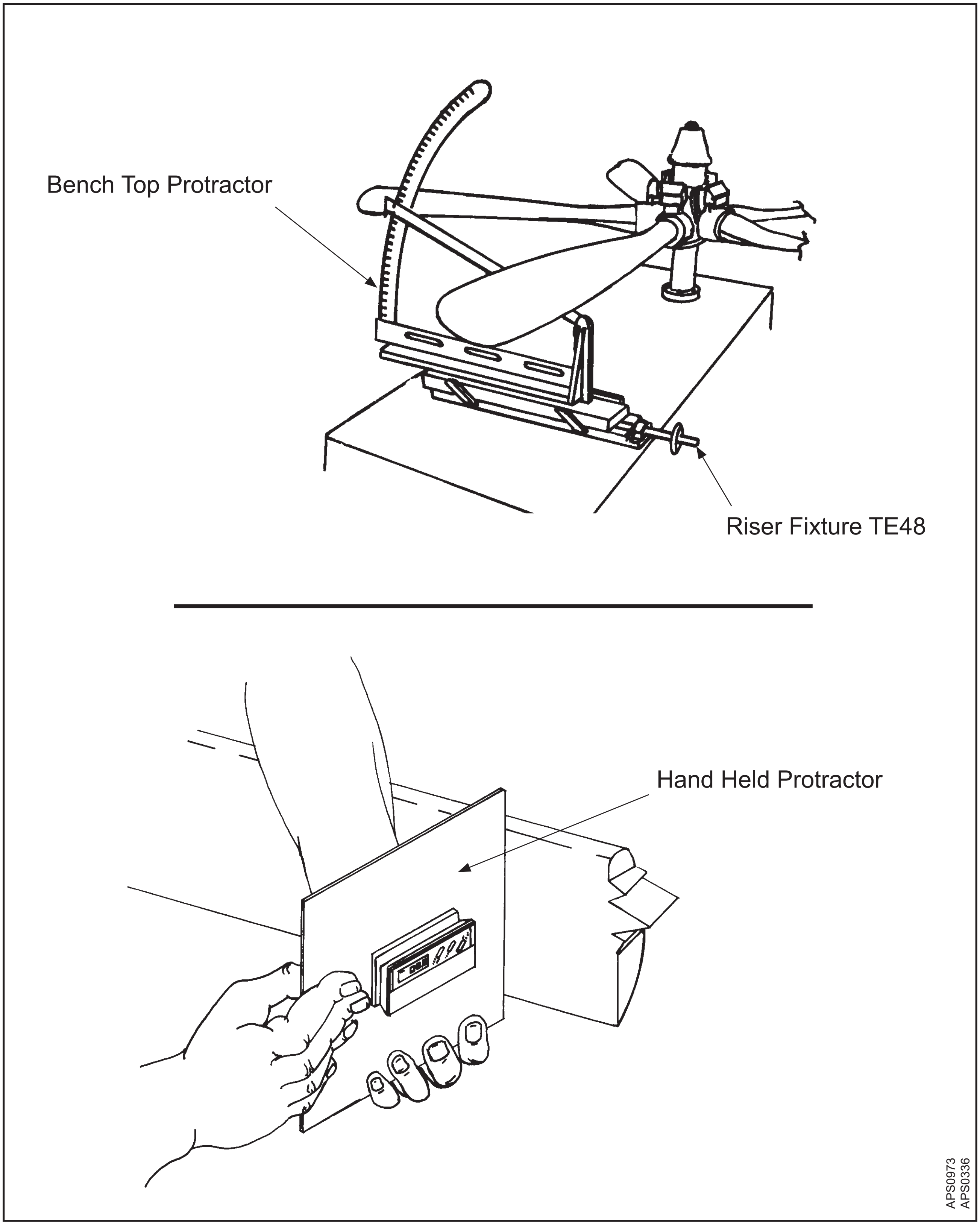
(b) Beginning with blade one, measure from the center of the propeller hub to the reference blade radius location specified. Refer to Figure 7-25.

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.

(c) Using a crayon or soft, non-graphite pencil CM162 or equivalent, mark a line perpendicular to the blade centerline.

(d) Repeat this procedure for each remaining blade.



Setting the Blade Angle
Figure 7-26

M. Setting Reverse Blade Angles

CAUTION: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

(1) Apply air pressure to the piston through the rotatable fixture on the propeller assembly table to bring the propeller pitch change system to reverse angle position.

NOTE: Reverse angle position is when movement of the piston unit (1500) and beta ring (50) is stopped by the guide lugs (100).

(2) Using a hand held protractor TE97 or bench-top protractor TE96 and stud fixture plate TE48, or equivalent, measure the reverse angle on blade one at the reference blade radius specified in the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59). Refer to Figure 7-26.

NOTE: For the specific requirements for reverse blade angle and blade-to-blade tolerance at reverse blade angle, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(3) Rotate the blade in the clamp assembly (1600).

NOTE: This allows setting the reverse blade angle while the propeller assembly is held at the selected counterweight angle.

(4) Using a clamp nut wrench TE142, or equivalent, hold the self-locking nut (820) and a standard 12-point socket to torque the bolts (1710) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(a) While torquing the bolts (1710), make sure that the position of the gasket (1700) is kept in order to provide a sufficient grease seal.

(b) Make sure a nearly equal gap between the two halves is kept after final torque is applied.

(5) Repeat this reverse angle setting procedure for each of the other blades.

(6) Measure the blade-to-blade reverse angle variance at the reference blade radius, and readjust the blade reverse angles if they are not within tolerance.

(a) A blade-to-blade tolerance is applicable when setting the reverse blade angle.

(b) A blade-to-blade tolerance is also applicable when setting the low pitch and high pitch blade angles. It is recommended that a minimum blade-to-blade tolerance be met in the reverse blade angle. This will make sure of the best opportunity to meet all blade angle tolerance requirements for each subsequent angle setting.

(c) To confirm the correct blade angle setting, cycle the propeller from reverse blade angle to high pitch blade angle, and back to reverse blade angle.

N. Setting High Pitch Blade Angles

NOTE: The correct amount of spacers (1420) and spring spacers (1390) will limit travel of the piston (1500) toward the propeller hub (2300) and achieve the desired high pitch blade angle.

(1) Release the air pressure to the rotatable fixture.

(2) Using a hand-held protractor TE97, or equivalent, measure the high pitch blade angle on blade one at the reference blade radius specified in the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(a) For the specific high pitch blade angle, blade-to-blade tolerance at high pitch blade angle, and reference blade radius required, refer to the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: BEFORE REMOVING THE PISTON, MARK A PISTON EAR WITH A GREASE PENCIL CM162, AND MATCH MARK THE GUIDE COLLAR TO MAKE SURE THAT THE PISTON IS REINSTALLED IN THE SAME POSITION.

(3) Adjust the high pitch blade angle, as necessary, by removing the piston unit (1500) and spring assembly (1300).

(a) Using a special wrench TE144-1 or equivalent, and a one inch (25.4 mm) socket wrench, remove the self-locking nut (110) on the end of the pitch change rod (1320).

(b) Rotate the blades by hand from high pitch blade angle to low pitch blade angle or when the piston unit (1500) engages with aluminum spacers (30) and self-locking hex nuts (20).

(c) Remove all of the link pin units (120).

(d) Disconnect the link arms (140) from the piston unit (1500).

(e) For installation purposes, measure the distance between the self-locking hex nut (20) and the end of the beta rod unit (40) at each location (three locations for a three-bladed propeller and four locations for a two-bladed propeller).

(f) Remove each self-locking hex nut (20) and aluminum spacer (30) from each beta rod unit (40).

(g) Remove the piston unit (1500).

(h) Remove safety wire if installed from each fillister head screw (170) in the flanged spring retainer (1330).

(i) Remove the four fillister head screws (170), the two pitch stop spacers (160), and the two split keeper (180) halves that hold the spring assembly (1300) in the front of the cylinder (190).

(j) Remove and disassemble the spring assembly (1300).

CAUTION: A SPRING COMPRESSOR FIXTURE TE59, OR EQUIVALENT, IS REQUIRED FOR COMPRESSING THE SPRING ASSEMBLY (1300) TO DISASSEMBLE.

(k) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent.

(l) Compress the spring assembly (1300) enough to remove the rear split keeper (1380) from the groove in the pitch change rod (1320).

(m) Remove spring assembly (1300) components from the spring compressor fixture TE59, or equivalent.

(n) Remove the pitch change rod (1320) from the spring assembly (1300) parts to allow access to spacer(s) (1420) and spring spacers (1390).

(o) Install or remove the spacer(s) (1420) and/or the spring spacers (1390) to achieve the correct high pitch blade angle.

1 Adding spacer thickness will decrease high pitch blade angle. Removing spacer thickness will increase high pitch blade angle. A change in thickness of 0.032 inch (0.812 mm) will result in a change to high pitch blade angle of approximately one degree.

(p) Reassemble the spring assembly (1300) in accordance with the section, “Assembly of 831-85 Spring Assembly” in this chapter.

(q) Reinstall the spring assembly (1300) into the cylinder (190) in accordance with the section, “831-85 Spring Assembly Installation” in this chapter.

CAUTION: BEFORE INSTALLING THE PISTON UNIT (1500), ALIGN EACH PISTON LUG WITH A GREASE PENCIL MATCH MARK ON THE GUIDE COLLAR TO MAKE SURE THAT THE PISTON IS REINSTALLED IN THE SAME POSITION IN WHICH IT WAS REMOVED.

(r) Move the piston unit (1500) into position over the beta rod units (40) and the cylinder (190) in the same orientation as before removal.

(s) Move the piston unit (1500) over the beta rod units (40) and onto the pitch change rod (1320) with the existing O-ring (150) installed in the groove.

(t) Turn the self-locking hex nut (110) onto the end of the pitch change rod (1320).

CAUTION: IF A NON-LOCKING NUT WAS USED ON THE END OF THE PITCH CHANGE ROD FOR EASE OF THE BUILDUP PROCESS THEN IT MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110) FOR THE FINAL BUILD.

(u) Using a piston nut wrench TE144-1, or equivalent, torque the self-locking hex nut (110) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(v) Install the free end of each link arm (140) in the slot provided in the piston unit (1500).

(w) Install each link pin unit (120) through the large hole in each piston (1500) lug, and through the hole in each link arm (140).

(x) Push each link pin unit (120) flush with the piston (1500) ear.

(y) Install each link pin unit (120) with a fillister head screw (130).

1 Torque the fillister head screw (130) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(z) Reinstall the spacer (30) and self-locking hex nut (20) onto the long threaded end of each beta rod unit (40).

(aa) Install each self-locking nut (20) in the same location as it was previously installed using the distance measurements relative to the end of each beta rod unit (40).

NOTE: Installation of each self-locking nut (20) re-establishes the previously adjusted counterweight angle and will be the starting location for low pitch adjustments (±0.5 degree).

(ab) Measure the high pitch blade angle of all the blades and adjust, if necessary.

(ac) Determine the blade-to-blade tolerance at high pitch blade angle. Adjust, if necessary, by rotating the blades in the blade clamp units (1600).

NOTE: Rotating the blades in the blade clamp units (1600) will also affect low pitch blade angle, reverse blade angle, and the associated blade-to-blade tolerances for each.

O. Setting Low Pitch Blade Angle

CAUTION 1: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS SECTION.

CAUTION 2: WHEN A BLADE ANGLE IS SET OR MEASURED, ACTIVATE THE ASSEMBLY AWAY FROM THE REVERSE PITCH POSITION BY HAND TO SEAT THE BLADE AND BLADE CLAMP PARTS AND TO REMOVE PLAY FROM THE ASSEMBLY.

CAUTION 3: LOW PITCH BLADE ANGLE CANNOT BE SET UNTIL THE COUNTERWEIGHT ANGLE, BETA RING TRAVEL (IN ACCORDANCE WITH TABLE 7-1), REVERSE BLADE ANGLE, AND HIGH PITCH BLADE ANGLE HAVE BEEN ADJUSTED.

(1) General

(a) Low pitch blade angle occurs when the piston unit (1500) touches the spacers (30) and self-locking nuts (20) without movement of each beta rod unit (40) and the connected beta ring (50).

NOTE 1: With the piston unit (1500) at or within ±0.5 degree of the required low pitch blade angle, the piston unit touches the spacers (30), self-locking nuts (20), beta rod units (40), and the beta ring (50).

NOTE 2: At the reverse blade angle stop, movement of the piston unit (1500) is stopped by the spacers (30), self-locking nuts (20), and beta rod units (40), and the beta ring that has stopped against the guide lugs (100).

(2) Move the self-locking nuts (20) in the opposite direction of Table 7-1 to get the required beta ring run-out (at two-blade angle locations) and the required low pitch blade angle.

NOTE: Low pitch blade angle, reverse blade angle, counterweight angle, and beta ring run-out are affected by adjusting the position of the self-locking nuts (20).

(a) Measure the angles to verify requirements are still in tolerance.

CAUTION: THE BETA ROD UNITS (40) AND THE BETA RING (50) MUST NOT MOVE WHEN VERIFYING CONTACT BETWEEN THE PISTON (1500), THE SPACERS (30), AND THE SELF-LOCKING NUTS (20).

(3) Set the low pitch angle of the blades.

(a) Apply air pressure to the piston (1500) through the rotatable fixture, from a higher blade angle to a lower blade angle until blade one reaches low pitch.

(b) Manually move the assembly toward higher blade angle to seat the blade and clamp parts and to remove play from the propeller assembly.

(c) Compare the measured low pitch blade angle to the correct low pitch blade angle for the application.

1 For the specific low pitch angle, tolerance at low pitch blade angle, and reference blade radius required for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Applications Guide Manual 159 (61-02-59).

(d) If low pitch angle needs adjusted:

1 Make adjustments to the self-locking nuts (20).

NOTE: Any change to the position of self-locking nuts (20) will also change the reverse blade angle and the counterweight angle.

a If adjustments to the self-locking nuts (20) meet the reverse blade angle/counterweight angle and tolerance requirements, proceed to step (3)(e) of this procedure.

b If adjustments to the self-locking nuts (20) do not meet the reverse blade angle/counterweight angle and tolerance requirements, go to the section, “Setting Counterweight Angle” to determine if beta ring travel was correctly set for the blade angle travel from reverse blade angle to low pitch blade angle. Make adjustments as required to meet all blade angle and tolerance requirements.

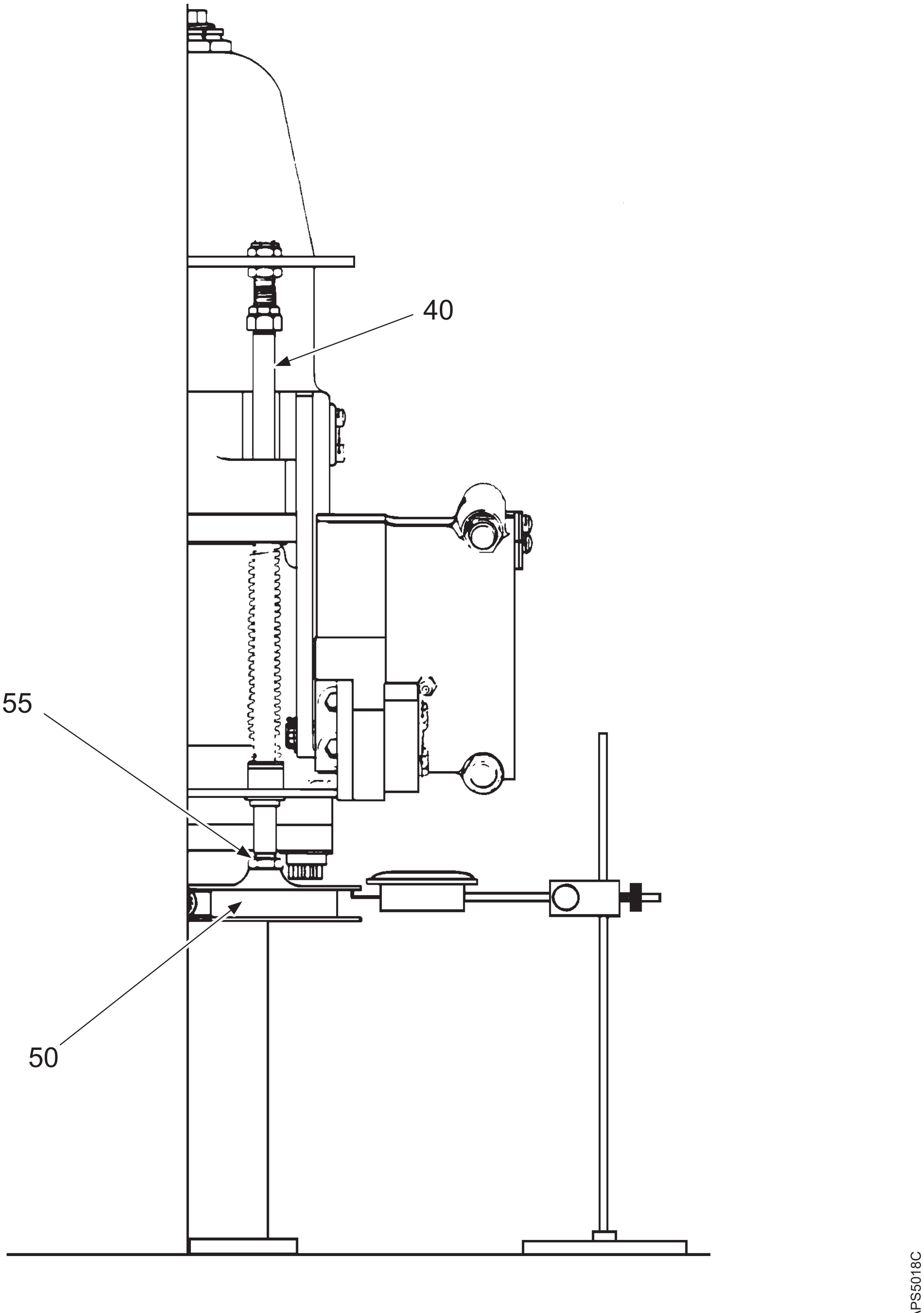
(e) Trap the air at the position of blade number one while at low pitch blade angle.

(f) Manually move the assembly toward a higher blade angle to seat all blades and clamp parts and to remove play from the propeller assembly.

(g) Measure the low pitch blade angle of the other blades to determine blade-to-blade tolerance.

1 The low pitch angle of all blades must be within a blade-to-blade tolerance of 0.2 degree from the maximum to the minimum blade angle at low pitch.

NOTE: Correction of a blade-to-blade tolerance greater than 0.2 degree is accomplished by rotating the blades in the blade clamps. If adjustment is required, blade-to-blade tolerance at reverse blade angle, high pitch blade angle, and counterweight angle must still be kept. Since blade-to-blade tolerance is greater at reverse blade angle and high pitch blade angle, it is recommended that the blades be positioned in the blade clamps to meet the tighter blade-to-blade tolerance of low pitch blade angle and still meet the looser blade-to-blade tolerance of reverse blade angle and high pitch blade angle.



Measuring Beta Ring Run-out with Dial Indicator
Figure 7-27

P. Setting Beta Ring Run-out

CAUTION: DO NOT POSITION AT LOW PITCH BLADE ANGLE OR FULL REVERSE.

(1) Apply air pressure to the rotatable fixture, moving the propeller from high pitch to a blade angle between low pitch blade angle and the reverse pitch stop.

(2) Select a blade with a beta rod adjacent to it.

(a) "Zero" the dial indicator on the beta ring (50) at a position close to the selected beta rod unit (40). Refer to Figure 7-27.

CAUTION 1: BETA RING (50) RUN-OUT MUST BE KEPT WITHIN 0.010 INCH TOTAL. ADJUST AS NECESSARY.

CAUTION 2: ADJUSTING THE BETA RING RUN-OUT BETWEEN LOW PITCH BLADE ANGLE AND REVERSE PITCH STOP WILL AFFECT THE LOW PITCH BLADE ANGLE, REVERSE BLADE ANGLE, AND COUNTERWEIGHT ANGLE.

(3) Adjust the self-locking nuts (20) to correct the beta ring (50) run-out to within 0.010 inch (0.25 mm) maximum movement for one revolution of the propeller.

(4) Release the air pressure from the rotatable fixture, allowing the propeller blade angle to move to high pitch.

(5) Apply air pressure to the rotatable fixture to move the propeller from high pitch to a random blade angle between high pitch blade angle and low pitch blade angle.

CAUTION 1: BETA RING (50) RUN-OUT MUST BE KEPT WITHIN 0.010 INCH TOTAL. ADJUST AS NECESSARY.

CAUTION 2: ADJUSTING THE BETA RING RUN-OUT BETWEEN LOW PITCH BLADE ANGLE AND HIGH PITCH BLADE ANGLE WILL AFFECT THE LOW PITCH BLADE ANGLE, REVERSE BLADE ANGLE AND COUNTERWEIGHT ANGLE.

(6) Adjust the self-locking nuts (20) to correct the beta ring (50) run-out to within 0.010 inch (0.25 mm) maximum movement for one revolution of the propeller.

(7) Release the air pressure from the rotatable fixture, allowing the propeller blade angle to move to high pitch.

Q. Final Measurement of Blade Angles and Beta Ring Run-out

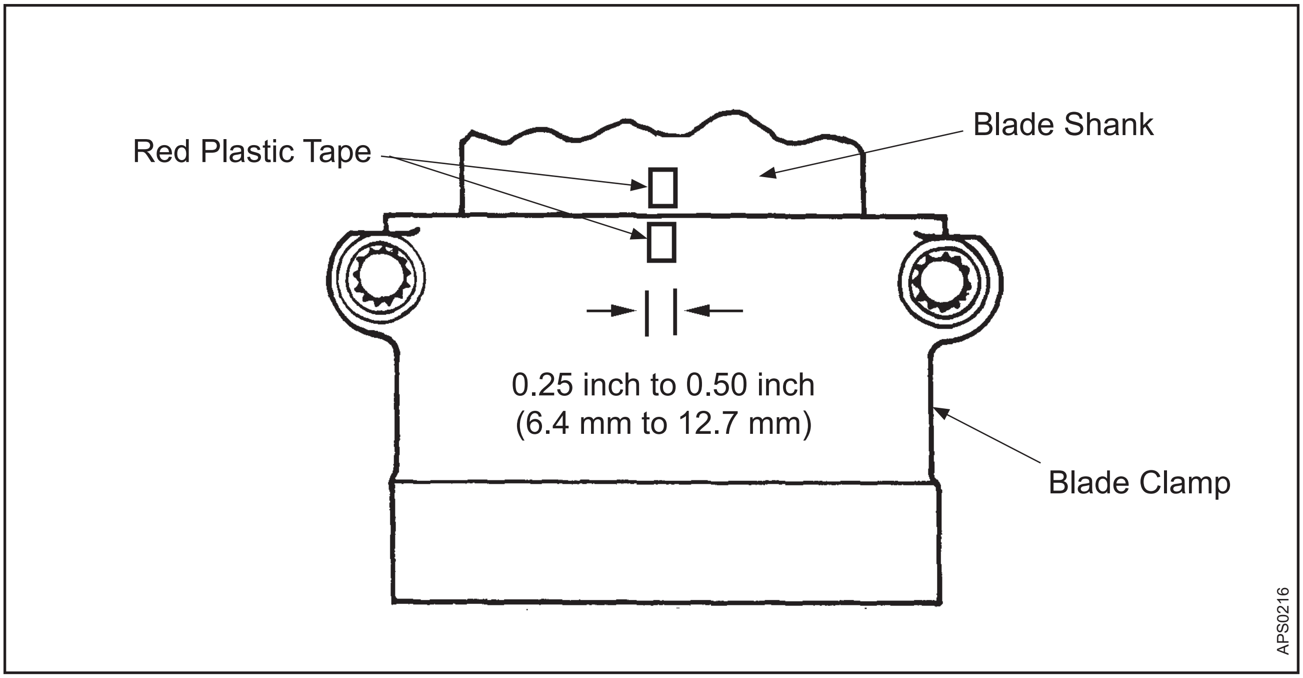
(1) Measure the counterweight angle, blade-to-blade tolerance and verify the correct settings. Refer to the section, “Setting Counterweight Angle” in this chapter.

(2) Measure the reverse blade angle, blade-to-blade tolerance and verify the correct settings. Refer to the section, “Setting Reverse Blade Angle” in this chapter.

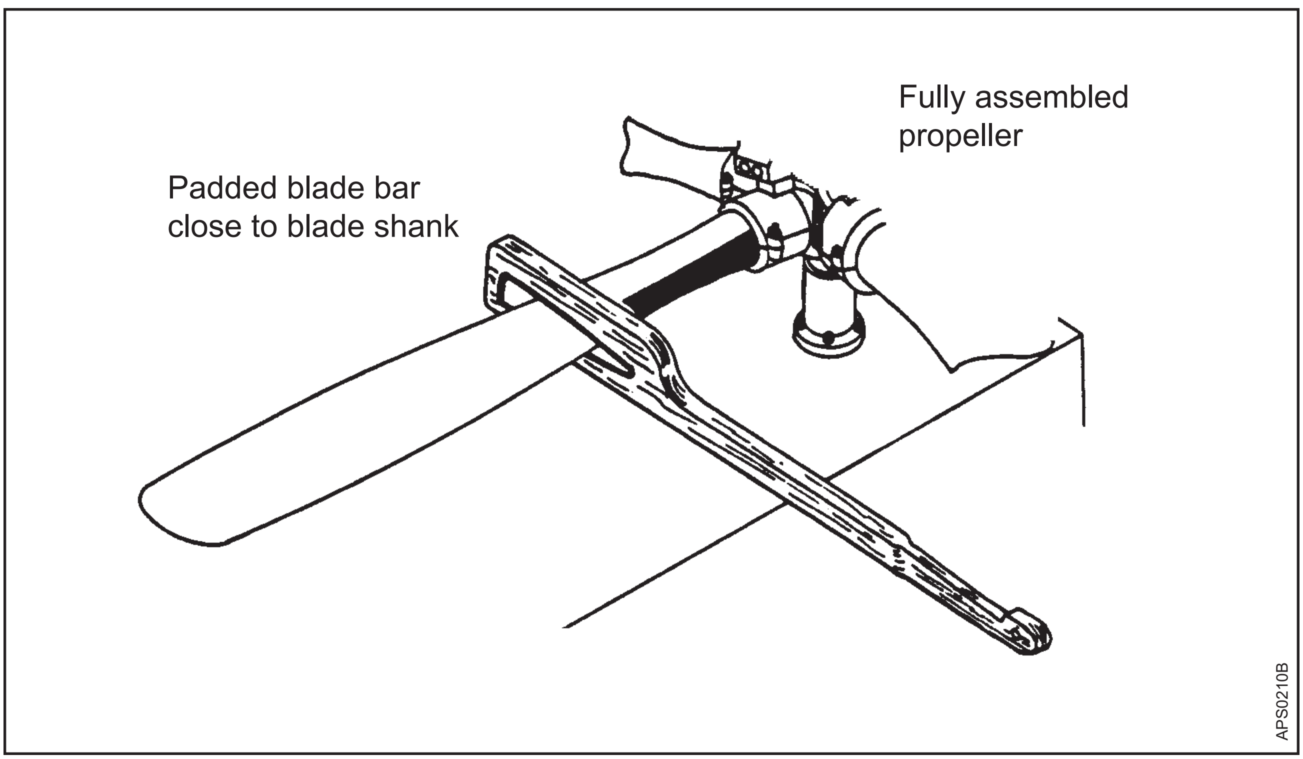
(3) Measure the high pitch blade angle, blade-to-blade tolerance and verify the correct settings. Refer to the section, “Setting High Pitch Blade Angle” in this chapter.

(4) Measure the low pitch blade angle, blade-to-blade tolerance and verify the correct settings. Refer to the section, “Setting Low Pitch Blade Angle” in this chapter.

(5) Measure the beta ring run-out at two blade angle locations and verify the correct settings. Refer to the section, “Setting Beta Ring Run-out” in this chapter.



Providing for Visual Detection of Blade Slippage in Clamp
Figure 7-28



Using Padded Blade Bar to Measure for Blade Slippage in Clamp
Figure 7-29

R. Measuring for Blade Slippage in Blade Clamp

(1) With the propeller still installed on the rotatable fixture of the assembly table, proceed as follows to provide visual detection of slippage between the blade shank and the blade clamp.

CAUTION: DO NOT USE A PUNCH OR SCRIBE A LINE ON THE BLADE SHANK. THIS COULD START A CRACK IN THE BLADE.

(a) When the correct pitch has been established in each blade, apply a strip of red plastic tape down the shank and across the blade clamp of blade number one. Refer to Figure 7-28.

1 If the blade will later be removed to facilitate shipping the propeller, apply two strips of red tape across each mated blade shank and blade clamp assembly.

(b) Carefully cut the tape along the line where the blade shank and blade clamp meet.

(c) Repeat this procedure on the other blade assemblies.

1 Misalignment of the halves of tape on a blade assembly indicates slippage between the blade shank and blade clamp. Follow the repair procedure found in the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) to correct blade slippage.

CAUTION: DO NOT PUT THE PADDED BAR IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BAR ON THE THICKEST AREA OF THE BLADE, JUST OUTBOARD OF THE DE-ICE BOOT. USE ONE BLADE PADDLE FOR EACH BLADE.

(d) Using a padded blade bar, as shown in Figure 7-29, apply torque to each blade assembly to move each blade toward low pitch in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(e) Measure blade angles in accordance with the instructions in this chapter.

(f) If it is necessary to correct blade slippage, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(g) After confirming that there is no slippage, spray each piece of tape with clear protective spray CM129 to provide a clear protective coating.

CAUTION: TO AVOID PERMANENT DAMAGE TO THE BLADE RETENTION COMPONENTS CAUSED BY TRAPPED CHEMICALS, THIS PROCEDURE MUST ONLY BE PERFORMED FOLLOWING THE ASSEMBLY OF A PROPELLER AFTER OVERHAUL OR AFTER ANY OTHER PROCEDURE INVOLVING DISASSEMBLY AND CLEANING OF THE PROPELLER BLADE RETENTION COMPONENTS.

S. Optional External Sealant CM93 Application

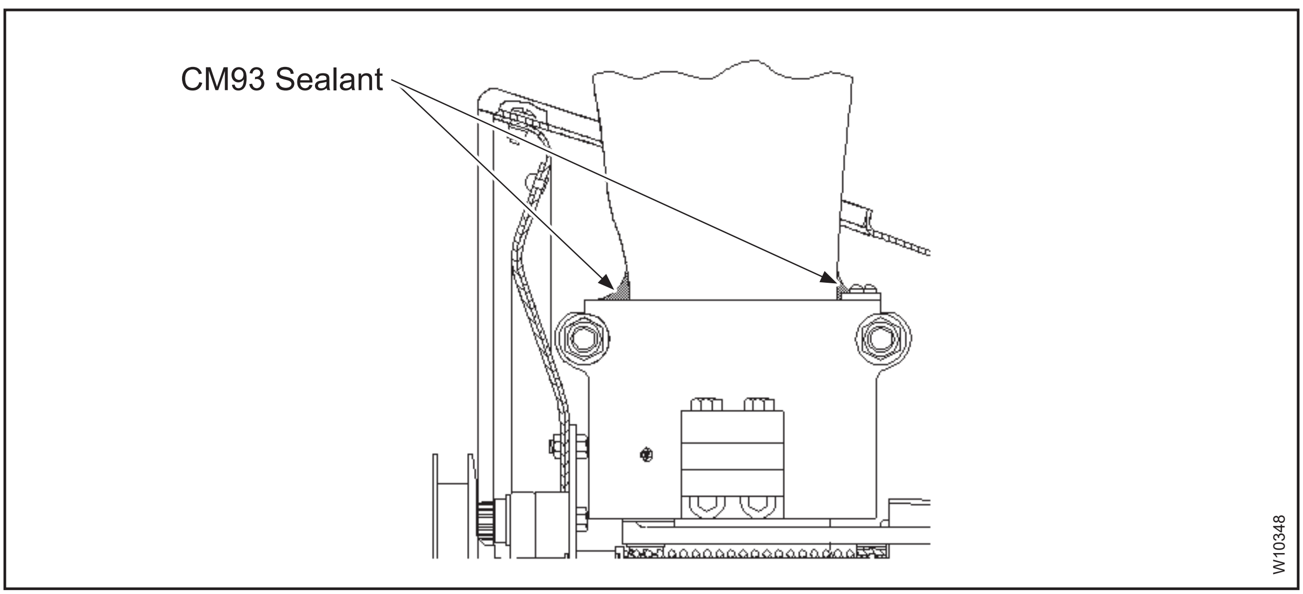
(1) The application of sealant CM93 to the blade/blade clamp interface is an optional procedure that may supply additional protection against corrosion of the blade retention components.

CAUTION 1: TO MAKE SURE OF CORRECT ADHESION OF SEALANT CM93, BLADE AND BLADE CLAMP SURFACES MUST BE FREE OF GREASE AND DIRT.

CAUTION 2: DO NOT ALLOW SEALANT CM93 TO EXTEND ONTO THE SURFACE OF THE CLAMP, WHERE BALANCE WEIGHTS AND DE-ICE HARDWARE ARE INSTALLED.

(2) After doing an examination for blade slippage in the clamp, fill the external void at the blade/blade clamp interface with a 0.25 inch (6.3 mm) maximum bead of sealant CM93, around the entire circumference of blade, as shown in Figure 7-30.

(3) Let the sealant CM93 cure for a minimum of two hours, before returning the propeller to service.



Optional Sealant CM93 Application
Figure 7-30

T. Finishing the Reassembly of the Beta System

(1) Propeller models that have a beta rod support ring (75). Refer to the Illustrated Parts List chapter in this manual.

(a) Turn a self-locking hex nut (60) onto the end of each beta rod unit (40) equal distance from the self-locking hex nut (20).

(b) Position the beta rod support ring (75) on the end of the beta rod units (40).

(c) Turn a self-locking hex nut (10) onto the end of each beta rod unit (40).

(d) Torque each self-locking hex nut (10) in accordance with the Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

U. Final Inspection of the Reassembled Propeller

(1) Use the applicable overhaul traveler for final inspection of the reassembled propeller.

(a) Make sure that propeller static balance has been accomplished. Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(b) Measure the blade track. Refer to Figure 7-16.

CAUTION: BLADE HEIGHTS AT THE TIP OF EACH BLADE MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

1 Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

2 If all blades do not track:

a Make sure that there is no unwanted material between the rotatable fixture flange and the propeller hub flange.

b A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(c) Measure each blade tip for end play (leading edge to trailing edge).

1 For the permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(d) Measure each blade tip for end play (fore-and-aft).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(e) Measure the radial play in each blade.

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(f) Measure blade pitch settings.

1 For the applicable blade pitch settings associated tolerance, and the reference blade radius specified for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

V. Label Replacement

(1) Refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) for information and label usage.

W. Reassembly of a Propeller Disassembled for Shipment

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

X. Propeller Balance

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

Y. Propeller Lubrication

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

3. Assembly of Propeller Models (B)HC-A(2,3)(MV,V)F-3( )

A. Blade Installing Parts Assembly

(1) Install the beta ring (50) around the rotatable fixture and lay it on the propeller assembly table with the threaded bosses facing away from the table.

(2) Install the hub (2300) on the rotatable fixture of the propeller assembly table.

CAUTION 1: BEARING RACES (240 AND 300) MUST BE MATCHED SETS.

CAUTION 2: THE INTERNAL RECESS OF THE BEARING RETAINING RING (280) MUST FACE OUTBOARD WHEN THE BEARING RETAINING RING IS ROTATED OVER THE BLADE ARM FLANGE OF THE HUB UNIT (2300).

(3) Using a light mallet and press tool TE308, or equivalent, as shown in Figure 7-1, install a bearing retaining ring (280) onto one blade arm flange of the hub unit (2300).

(a) Install the bearing retaining ring (280) far enough onto the blade arm flange so that the bearing retaining ring forms a narrow channel on the inboard surface of the flange.

(4) Repeat this bearing retaining ring (280) installation procedure for all the other blade arm flanges on the hub.

(5) Using lubricant CM12, lightly grease the inboard surface of each blade arm flange.

(6) Put the halves of an outboard side race (300) (matched set) in position over one hub arm.

(7) Visually examine the fit of the outboard side race to the hub arm.

(a) The outboard side race (300) must rest tightly against the seating area on the hub arm, with no "rocking" action evident.

(b) The outboard side race (300) halves must fully contact each other at the parting surfaces.

(c) Replace the outboard side race (300) if it does not fit correctly.

NOTE: The break-line for the outboard side race (300) must be vertical to the table top.

(8) Using a combination of press tool TE308 and retention bearing puller TE108, or equivalent, press the bearing retaining ring (280) far enough onto the outboard side race (300) to position the wire ring retainer (290) in the groove in the blade arm flange. Refer to Figure 7-1.

(9) Install the wire ring retainer (290).

(10) Using a combination of press tool TE308 and retention bearing puller TE108, or equivalent, with bearing retaining ring A-972, pull the bearing retaining ring (280) outboard far enough to allow the wire ring retainer (290) to seat in the wire retention groove in the bearing retaining ring. Refer to Figure 7-1.

CAUTION: THE WIRE RING RETAINER (290) MUST BE FULLY ENCLOSED TO MAKE SURE IT IS NOT PINCHED.

(11) Visually examine to make sure that the wire ring retainer (290) is fully enclosed.

(12) Using lubricant CM12, lubricate the blade O-ring (270).

(13) Move the O-ring (270) over the blade arm flange of the hub unit (2300) to a location inboard of the outboard side race (300).

(a) Leave the O-ring in position for use later in the reassembly.

(14) For the remaining hub arms, repeat steps (3) through (13) of this procedure.

CAUTION: DURING THE FOLLOWING PROCEDURES, THE BLADE ARM ON WHICH A RETENTION BEARING IS GOING TO BE ASSEMBLED MUST BE SUPPORTED VERTICALLY WITH THE PILOT TUBE FACING DOWN.

(15) Remove the hub unit (2300) from the rotatable fixture on the assembly table and use special tool TE308, or an appropriate fixture, to hold the unit vertical during the next stages of blade retention split-bearing assembly. Refer to Figure 7-5.

CAUTION 1: THE PARTING LINE OF THE INBOARD BEARING RACE (240) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE BLADE CLAMP HALVES (1610).

CAUTION 2: GAPS BETWEEN THE HALVES OF BEARING RACES (240, 300) MUST NOT BE GREATER THAN 0.001 INCH (0.02 mm).

CAUTION 3: ALL BEARING BALLS (250) INSTALLED IN A SINGLE OUTBOARD SIDE RACE (300) MUST BE OF THE SAME GAUGE. BEARING BALLS SUPPLIED BY HARTZELL PROPELLER INC. ARE OF THE SAME GAUGE.

(16) Install the ball bearing spacer (260) and the required number of bearing balls (250) onto the outboard bearing race (300).

CAUTION: EXCESSIVE USE OF SEALANT CM93 COULD CAUSE UNEVEN SEATING BETWEEN THE CLAMP ASSEMBLY (1600) AND BEARING RACE (240).

(17) Apply a slight amount of sealant CM93 to the chamfered edges (break point) of the matched set of inboard bearing races (240).

(18) Remove any excess sealant CM93 that may come out into the bearing area when the bearing race halves are joined.

(19) Put the inboard bearing race halves (240) around one blade arm of the hub unit (2300).

CAUTION: THE OPENING OF THE WIRE RING RETAINER (230) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE INBOARD BEARING RACE.

(20) Install the wire ring retainer (230) to hold the halves in position.

(21) Move the O-ring (270) outboard against the inboard bearing race (240).

(22) Using self-adhesive stretch wrap, wrap the outside diameter of the bearing assembly to hold the parts in position.

(23) For the remaining hub arms, repeat steps (16) through (22) of this procedure.

(24) Install the hub (2300) on the rotatable fixture of the propeller assembly table.

B. Spinner Mounting Plate Assembly

(1) For information about the applicable spinner assembly and spinner bulkhead, refer to the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: MAKE SURE EACH HALF OF THE SPLIT SPINNER MOUNTING PLATE (85) HAS THE SAME SERIAL NUMBER.

(2) Attach the spinner mounting plate (85) to the blade arm side of the hub installing flange with hex head bolts (1030).

NOTE: Do not tighten the hex head bolts (1030) at this step of assembly.

(3) Align the spinner mounting plate with the hub installing flange using one of the following methods:

(a) Method 1:

1 Using fixture TE184, position the spinner bulkhead support plate and drill the spinner installation holes in the spinner mounting plate, if required.

NOTE 1: A new spinner installation plate is supplied with undersized bulkhead installation holes. Drill all bulkhead installation holes using a 0.250 inch (6.35 mm) diameter drill. Remove any burrs that exist from drilling. A previously used spinner installation plate will already have the holes drilled to the proper size.

NOTE 2: For applicable spinner assembly and spinner bulkhead information, refer to the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

2 When the spinner mounting plate (85) is aligned between the fixture TE184 and the hub installing flange, torque all the hex head bolts (1030) into the hub flange in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(b) Method 2:

NOTE 1: For applicable spinner assembly and spinner bulkhead information, refer to the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59).

NOTE 2: This procedure cannot be used with new spinner mounting plates.

1 Temporarily attach the spinner bulkhead to the support plate with bolts.

2 When the spinner mounting plate (85) is aligned between the spinner bulkhead and the hub installing flange, torque all the hex head bolts (1030) into the hub flange in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

3 Remove the hex head bolts that attach the spinner bulkhead to the spinner mounting plate (85).

4 Remove the spinner bulkhead from the spinner mounting plate (85) to make the following assembly procedures easier.

(4) Safety the hex head bolts (2480) together with 0.032 inch (0.82 mm) minimum diameter stainless steel wire CM131.

C. Beta System Installation (Part 1 of 3)

(1) Using a snap ring (90) in the groove of the guide lug, install each guide lug (100) into the spinner mounting plate (85).

(a) Snap rings (90) must be on the engine side of the spinner mounting plate (85).

(2) Rotate the assembly on the hub (2300) to move each guide lug (100) into the appropriate location to receive beta rod units (40).

D. Clamp Assembly - Refer to Figure 7-11

(1) For clamp assembly procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) For information about the correct counterweight slugs and installing hardware, refer to the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59).

CAUTION: A LINK ARM (140) CANNOT BE INSTALLED AFTER THE CLAMP (1600) HAS BEEN INSTALLED ON THE HUB.

(3) After each clamp (1600) is assembled:

(a) Install the link screw sleeve (145) into the large hole of the link arm (140), from the side of the link arm that faces away from the clamp half (1600).

NOTE: The flange of the sleeve (145) faces inboard.

(b) Install the link arm bushing (210) onto the linkscrew (1640) between the link arm (140) and the blade clamp (1600).

NOTE: The raised shoulder of the link arm (140) must face the blade clamp (1600).

(c) Push the cotter pin (330) through the hole in the end of the linkscrew (1640) and open the cotter pin to install the link arm (140) to the clamp assembly (1600).

1 The link arm (140) must move freely on the linkscrew (1640).

(d) Open the cotter pin (330) to secure it in position.

NOTE: The link arm (140) must move freely on the link screw (1640).

(e) Repeat this procedure for each remaining clamp assembly (1600).

(4) When adjusting the pitch range of some propeller assemblies, the linkscrew may contact the hub. When this happens, the full blade angle range cannot be achieved. Refer to the section, "Repair of the A-304 Linkscrew" in the Repair chapter of this manual.

E. Blade and Clamp Installation

(1) Install the hub unit (2300) to the rotatable fixture.

(2) For instructions about aluminum blade balancing and all other overhaul or repair procedures, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: IF POSSIBLE, EACH BLADE MUST BE REINSTALLED ON THE HUB ARM FROM WHICH IT WAS REMOVED AT DISASSEMBLY.

(3) As specified in the disassembly procedure, each blade must have an identifying number to make sure of correct assembly.

(4) Stand blade one in vertical position (shank up, tip down) and fill the pilot tube cavity with lubricant CM12 to the top of the bottom blade needle bearing.

WARNING: AIR TRAPPED IN THE GREASE CAN AFFECT PROPELLER BALANCE AFTER RUN-UP.

(5) After making sure that no air is trapped in the grease, move the blade onto the pilot tube (2310). Push the blade toward the center of the hub until the butt of the blade shank makes contact with the face of the blade arm.

NOTE: A slight amount of grease will be squeezed out around the pilot tube (2310) if the blade has been lubricated correctly.

(6) For the remaining blades, repeat steps (3) through (5) of this procedure.

CAUTION: USE HARDENING GASKET COMPOUND CM46 ON THE SHOULDER RADIUS OF THE BLADE SHANK, THE OUTER DIAMETER OF THE BLADE SHANK, AND THE OUTER CORNER OF THE BLADE BUTT. REFER TO FIGURE 7-12.

(7) Using an acid brush or finger, optionally wearing non-powdered latex gloves, apply a smooth even layer of gasket compound CM46 on the shoulder radius of the blade shank in the area where it touches the blade clamp, the outer diameter of the blade shank, and the outer corner of the blade butt. Refer to Figure 7-12.

(a) Before installing a clamp, make sure the shoulder radius of the blade shank, the outer diameter of the blade shank, and the outside corner of the blade butt are completely covered by a smooth even layer of gasket compound CM46. Refer to Figure 7-12.

(b) Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(8) Remove the self-adhesive stretch wrap that was used to temporarily hold the blade races (240, 300) together.

CAUTION: THE PARTING LINE OF THE BLADE CLAMP-HALVES (1610) MUST BE AT A 90 DEGREE ANGLE TO THE PARTING LINE OF THE INBOARD BLADE RACES (240) AND IN LINE WITH THE OUTBOARD BLADE RACE (300).

(9) Apply a small bead of sealant CM93 to both blade clamp halves (1610) on a part of the mating surface in the inboard bearing radius, as shown in Figure 7-14.

NOTE: Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(a) On the blade clamp mating surfaces, the sealant supplements the sealing of the inboard end of the blade clamp gaskets (1700).

(b) Between the blade clamp (1610) and inboard blade thrust split bearing (240), use the sealant to fill the void from the beveled edge of the bearing outside diameter.

CAUTION: THE APPLICATION OF SEALANT CM93 TO THE CLAMP MATING SURFACES AREA "C" AND AREA "D" IS AN OPTIONAL PROCEDURE. APPLICATION OF CM93 TO THE CLAMP MATING SURFACES MAY CAUSE THE GASKET TO SLIP OUT OF POSITION.

(10) Put a small bead of sealant CM93 on a part of the mating surfaces Area "C" and Area "D" on both clamp halves. Refer to Figure 7-14 and Figure 7-15.

NOTE: Application of sealant CM93 is highly recommended for agricultural aircraft, and is recommended for other Hartzell Propeller Inc. steel hub propeller models.

(11) Install the matching blade clamp half (1610) to which the counterweight (1630) is attached.

(12) Install the other blade clamp half (1610).

CAUTION: A 0.06 INCH (1.5 MM) MAXIMUM OF GASKET MATERIAL MUST BE EVENLY EXPOSED THROUGH THE EDGES ON EACH BLADE CLAMP-HALF PARTING SURFACE; HOWEVER, GASKET MATERIAL MUST BE TRIMMED, AS NECESSARY, TO PROVIDE METAL-TO-METAL CONTACT WHERE THE INBOARD CLAMP LUGS MEET.

(13) Put a new gasket (1700) between each of the blade clamp half parting surfaces.

(14) Install the bolts (1710) into the outboard clamp position.

CAUTION: DO NOT TORQUE THE BOLTS (1710) AT THIS TIME.

(15) Install the washers (1720) and attach them with self-locking nuts (1730) onto the bolts (1710).

(a) Finger tighten the self-locking nuts (1730).

NOTE: This step helps align the blade clamp gasket (1700), but the bolts (1710) must not be torqued at this time.

(16) Install the socket screws (1690) into the clamp holes that are in the inboard position.

CAUTION 1: THE SOCKET SCREWS (1690) MUST BE TORQUED IN THE SEQUENCE SPECIFIED.

CAUTION 2: DO NOT EXCEED THE RECOMMENDED TORQUE ON THE SOCKET SCREWS (1690).

(17) Using a 5/16 inch Allen wrench, torque the socket screws (1690) in 10 Ft-Lb (14 N·m) increments (10, 20, etc.) in accordance with Table 8-1, "Torque Values", alternating between screws at each increment.

(18) Measure the blade track.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

(a) Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

(b) If all blades do not track:

1 Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

2 A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: DO NOT CONTACT THE INNER BLADE CLAMP HALF (1610) WHILE DRILLING TO SAFETY THE SOCKET SCREWS (1690).

(19) Using a #42 (0.094 inch [2.37 mm]) size bit, drill the head of each socket screw (1690).

(20) Safety wire each socket screw (1690) with a cotter pin (1680) so that the cotter pin contacts the clamp half (1610) and prevents the socket screw from backing out of the clamp assembly (1600).

NOTE: Do not safety the socket screws (1690) if the blades will be removed to facilitate shipment of the propeller.

(a) If an installed cotter pin (1680) causes interference, three loops of 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131 may be used to safety the socket screw (1690).

(21) For the remaining blades, repeat steps (7) through (20) of this procedure.

(22) Install weight slugs on the clamp counterweight arms, if applicable. Refer to Hartzell Propeller Inc. Application Guide 159 (61-02-59) for specific weight slug information.

F. Beta System Installation (Part 2 of 3)

CAUTION: THE BETA SPRING RETAINERS (42), CRIMPED RETAINING RING (43), MUST BE ASSEMBLED WITH THEIR SHARP EDGES AGAINST EACH OTHER.

(1) Move two crimped retaining ring (42) over the inboard end of one propeller beta rod (41) and into the groove provided for them in the rod.

(a) The rounded edges of the crimped retaining ring (42) must face away from each other.

(2) Using the beta rod installation tool TE65, crimp the crimped retaining ring (42) together by compressing them to a maximum OD of 0.550 inch (13.97 mm).

(3) Move a beta spring retainer (43) over the outboard end of each propeller beta rod (41) and down onto the crimped retaining rings (42).

(a) This retainer will later support a spring.

(b) The crimped retaining rings (42) fit down inside the ID recess of the spring retainer (43).

(4) Move a beta compression spring (65) onto the outboard end of the beta rod (41).

(5) Using the spring compressor tool TE29, or equivalent, to compress the beta spring (65) by hand to approximately half its length.

(a) Leave the spring compressor tool on the beta spring (65) to make the following assembly procedures easier.

(6) For each remaining propeller beta rod unit (41), repeat steps (1) through (5) of this procedure.

(7) Install each assembled beta rod unit (40) through a guide lug (100) in the spinner mounting plate (85).

G. Cylinder and Guide Collar Unit Installation

(1) Using solvent CM106, clean the threads on the hub unit (2300) and cylinder (190).

CAUTION: THE CHAMFERED SIDE OF THE GUIDE COLLAR UNIT (1550) MUST SEAT AGAINST THE SHOULDER OF THE CYLINDER (190). TO GET PROPER HUB CLEARANCE, THE LARGER INSIDE DIAMETER OF THE GUIDE COLLAR MUST FACE THE HUB UNIT (2300).

(2) Install the cap screw (1570) into the guide collar unit (1550).

(3) Install the guide collar unit (1550) onto the smaller diameter shoulder of the cylinder (190).

(a) The chamfer in the guide collar (1550) must face the flange on the cylinder (190).

(b) Do not torque the guide collar socket screw (1570) at this time.

CAUTION 1: DO NOT APPLY HYDRAULIC SEALANT ADHESIVE COMPOUND CM134 TO THE THREADS OF THE CYLINDER (190).

CAUTION 2: DO NOT GET HYDRAULIC SEALANT CM134 IN THE CYLINDER (190). CONTAMINATION TO THE AIRCRAFT ENGINE OIL SYSTEM COULD OCCUR.

(4) Using hydraulic sealant CM134, apply a bead of sealant in the groove of the hub unit (2300) where the cylinder O-ring (200) fits.

(5) Install the O-ring (200) into the chamfer in the cylinder (190).

(6) Move the assembled guide collar (1550) and cylinder (190) down over the propeller beta rod units (40).

(a) Each beta rod unit (40) must move through a guide collar bushing (1560) when the cylinder (190) is installed onto the hub (2300).

(7) Hand tighten the cylinder (190) and the guide collar unit (1550) if applicable, onto the hub unit (2300).

(8) Using a bar of appropriate size to fit the slot in the top of the cylinder (190), tighten the cylinder flush against the hub unit (2300).

NOTE: Early drag and tightness is caused by the O-ring (200), which acts as a seal and safety.

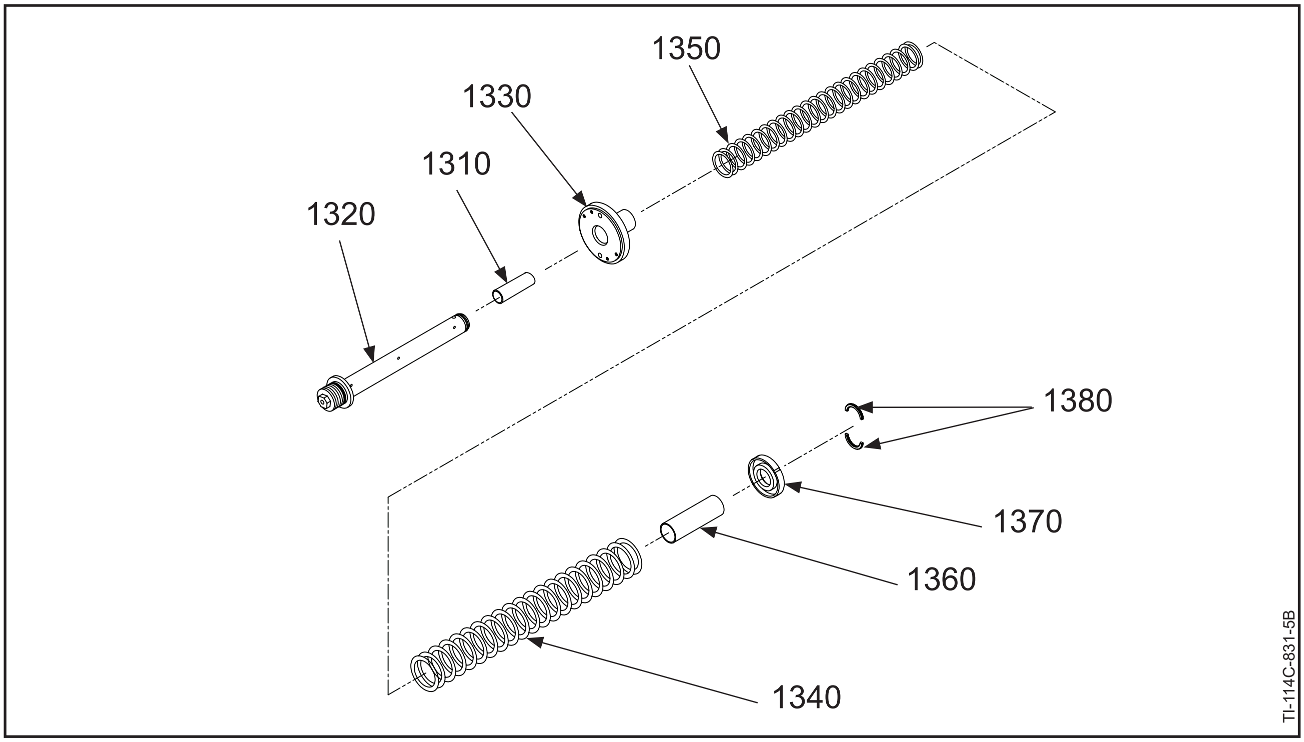
(9) Torque the cylinder (190) against the shoulder of the hub unit (2300). Refer to the Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

<u>CAUTION 1</u>: VISUALLY EXAMINE THE INSIDE OF THE CYLINDER (190) TO MAKE SURE THAT THE O-RING (200) HAS NOT BEEN MOVED OUT OF PUT DURING THE CYLINDER INSTALLATION PROCEDURE.

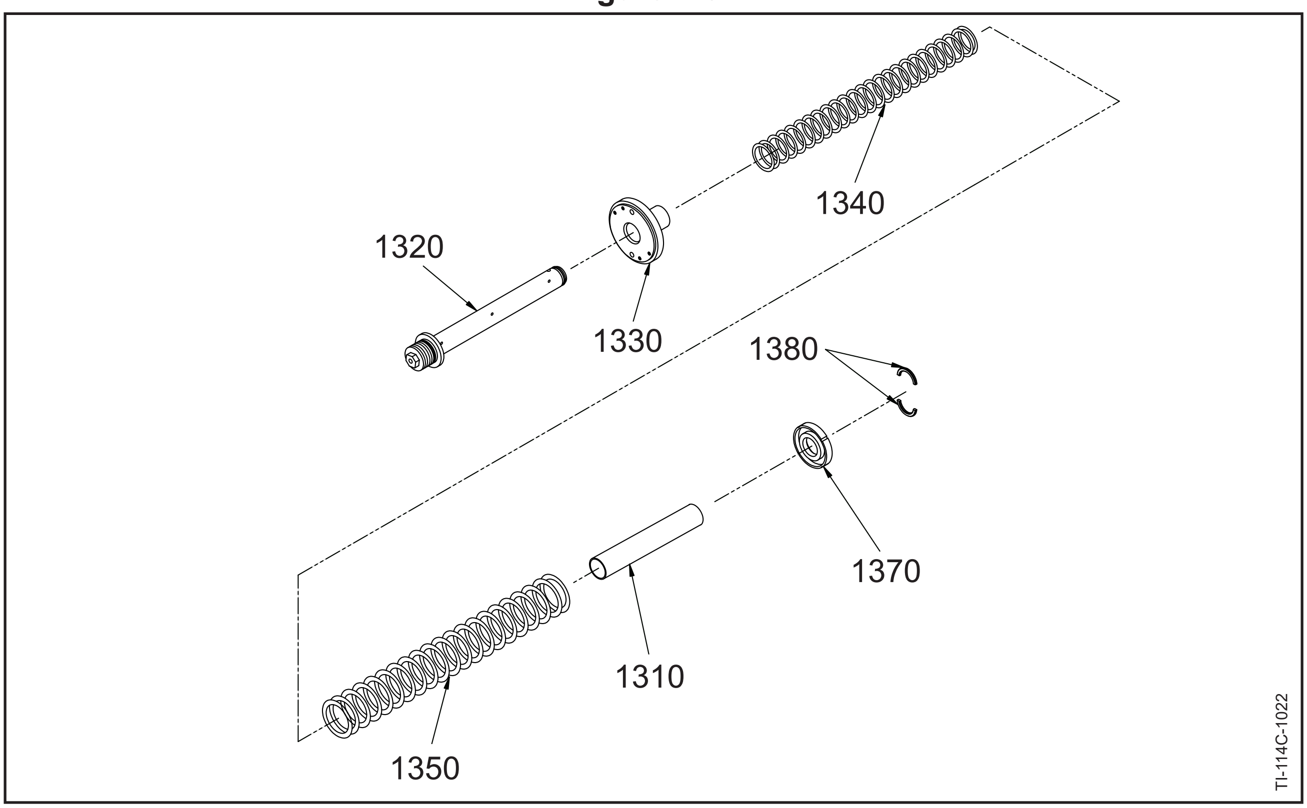
<u>CAUTION 2</u>: VISUALLY EXAMINE THE SLOT IN THE TOP OF THE CYLINDER (190) TO MAKE SURE THE SQUARE-BAR WRENCH USED FOR TORQUING DID NOT RAISE ANY SHARP EDGES OR DAMAGE THE TURNS.

(10) Remove any sharp edges in the wrench slot on top of the cylinder (190).

(11) Loosen and remove the special tools used to compress the beta compression springs (65).



831-5B Feathering Spring Assembly
Figure 7-31



831-53 Spring Assembly
Figure 7-32

H. Feathering Spring Assembly

CAUTION: A SPRING COMPRESSOR FIXTURE TE59, OR EQUIVALENT, IS REQUIRED FOR COMPRESSING THE FEATHERING SPRING AT ASSEMBLY.

(1) For the 831-5B Feathering Spring Assembly - Refer to Figure 7-31.

(a) Move the stop sleeve (1310) onto the pitch change rod (1320), with the flat plate facing the threaded end of the pitch change rod.

(b) Move the front spring retainer (1330) onto the pitch change rod (1320) with the flanged end against to the stop sleeve (1310).

(c) Move the springs (1340 and 1350) against the front spring retainer (1330).

(d) Move the stop sleeve (1360) onto the pitch change rod (1320).

(e) Put the rear spring retainer (1370) onto the pitch change rod (1320).

(f) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent.

(g) Compress the spring assembly (1300) enough to install the rear split keeper (1380) into the groove in the pitch change rod (1320).

1 Apply oil or grease to each half of the rear split keeper (1380) to hold it in position until the springs (1340, 1350) are decompressed.

WARNING: WHEN COMPRESSED, THE SPRING ASSEMBLY (1300) IS LOADED TO APPROXIMATELY 1000 POUNDS (454 KG) FORCE. MAKE SURE OF THE SAFETY OF EVERYONE IN THE AREA DURING ASSEMBLY PROCEDURES.

(h) Carefully release the pressure on the spring assembly (1300).

(i) Before removing the spring assembly from spring compressor fixture TE59, or equivalent, make sure that both rear split keeper halves (1380) are in the groove in the pitch change rod (1320), and installed by the rear spring retainer (1370).

(2) For the 831-53 Feathering Spring Assembly - Refer to Figure 7-32

(a) Move the front spring retainer (1330) onto the pitch change rod (1320), with the flanged plate facing the threaded end of the pitch change rod.

(b) Move the applicable stop sleeve (1310) onto the pitch change rod (1320) against the front spring retainer (1330).

(c) Move the springs (1340 and 1350) over the stop sleeve (1310) and against the front spring retainer (1330).

(d) Put the rear spring retainer (1370) onto the pitch change rod (1320).

(e) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent, used for the feathering spring reassembly (1300).

(f) Compress the spring assembly (1300) enough to install the rear split keeper (1380) into the groove in the pitch change rod (1320).

(g) Apply oil or grease to each half of the rear split keeper (1380) to hold it in position until the spring (1340, 1350) is decompressed.

WARNING: WHEN COMPRESSED, THE SPRING ASSEMBLY (1300) IS LOADED TO APPROXIMATELY 1000 POUNDS (454 KG) FORCE. MAKE SURE OF THE SAFETY OF EVERYONE IN THE AREA DURING ASSEMBLY PROCEDURES.

(h) Carefully release the pressure on the spring assembly (1300).

(i) Before removing the spring assembly from the spring compressor fixture TE59, or equivalent, make sure that both rear split keeper halves (1380) are in the groove in the pitch change rod (1320), and installed by the rear spring retainer (1370).

I. Feathering Spring Installation

(1) Install the spring assembly (1300) in to the cylinder until the shoulder of the front spring retainer (1330) is approximately 0.25 inch (6.4 mm) into the cylinder (190).

(2) Install the split keepers (180) into the groove in the cylinder (190).

(3) Move the front spring retainer (1330) against the split keepers (180) to hold them in position.

(4) Using two fillister head screws (170) to install each feathering pitch stop spacer (160).

(5) Torque each fillister head screw (170) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(6) Safety wire each fillister head screw (170) with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

J. Piston Installation

NOTE: Refer to Figure 7-20 for the installation and orientation of components installed in the piston (1500) and dust seal length.

(1) Using lubricant CM12, lubricate the pitch change rod O-ring (150).

(2) Carefully install the pitch change rod O-ring (150) in the groove provided for it in the pitch change rod (1320).

(3) Using lubricant CM12, lubricate the piston O-ring (1535).

(4) Carefully install the piston O-ring (1535) in the groove provided for it in the piston (1500).

CAUTION: MAKE SURE THAT THE FELT PISTON DUST SEAL (1530) IS FUZZ-FREE.

(5) Cut the piston dust seal material (1530) to length on a 30 degree diagonal so there is an overlap at the parting line with a smooth, fuzz-free surface.

(a) If the piston dust seal (1530) has fuzz or long strands that could interfere with the operation of the O-ring, replace the piston dust seal.

(6) Soak the piston dust seal (1530) in aviation grade engine oil until it is completely saturated.

(a) Squeeze the excess oil from the piston dust seal (1530).

CAUTION: MAKE SURE THAT THE DIAGONAL OVERLAP OF THE FELT PISTON DUST SEAL (1530) REMAINS VISIBLE AND DOES NOT ROTATE TO ITS SIDE AS IT IS INSTALLED IN THE GROOVE OF THE PISTON (1500).

(7) Install the thinnest section of the piston dust seal (1530) in the remaining piston OD groove.

(8) Align the propeller beta rod units (40) with the holes provided for them in the piston (1500).

(9) Move the piston (1500) into put over the beta rod units (40) and the cylinder (190).

(10) Apply a thin layer of anti-seize compound CM118 in the hole of the free end of each link arm (140).

(11) Install the free end of each link arm (140) in the slot provided in the piston (1500).

CAUTION: MAKE SURE THAT THE CORRECT SAFETY SCREW (130) IS INSTALLED AND THAT SUFFICIENT TURNS ARE AVAILABLE IN THE PISTON UNIT (1500) TO HOLD THE SCREW IN POSITION. AT LEAST THREE TURN LENGTHS MUST BE ENGAGED. DO NOT BIND THE LINK ARM.

(12) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(13) Push each link pin unit (120) flush with the piston (1500) ear.

(14) Install each link pin unit (120) with a fillister head screw (130).

(a) Torque the fillister head screw (130) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(15) Put the guide collar unit (1550) solidly against the cylinder (190) at the correct radial location to assist in aligning the piston unit (1500).

(a) If necessary, move the guide collar unit (1550) radially to provide the clearances required between the piston (1500) and the propeller beta rod units (40).

(16) When the necessary alignment is correct, use an Allen wrench with torque wrench adapter to tighten the socket head cap screw (1570) in the guide collar unit (1550). Refer to the Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(17) Remove the special tool from each beta compression spring (65) and allow the beta compression spring to extend between the guide lug (100) and guide collar unit (1550).

CAUTION: FOR SETUP PURPOSES ONLY, USE A NON-LOCKING NUT ON THE END OF THE PITCH CHANGE ROD AS AN ALTERNATIVE TO THE SELF-LOCKING HEX NUT (110). THE NON-LOCKING NUT MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110) AFTER FEATHER ANGLES ARE CORRECT.

(18) Move the piston (1500) into full feathered position (back against the hub assembly) so that the threaded end of the pitch change rod (1320) extends through the end of the piston (1500).

(19) Turn the self-locking hex nut (110) onto the end of the pitch change rod (1320).

(20) Using a wrench on the self-locking hex nut (110) and a socket on the pitch change rod (1320), torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

WARNING: THE COUNTERWEIGHT (1630) MUST HAVE A POSITIVE ANGLE WITH REFERENCE TO THE PROPELLER CENTERLINE WHEN THE PISTON IS IN FULL REVERSE POSITION TO PREVENT THE PROPELLER FROM “STICKING” IN REVERSE. REFER TO FIGURE 7-24.

CAUTION 1: AT THIS STAGE OF PROPELLER ASSEMBLY THE BOLTS (1710) HAVE NOT BEEN TIGHTENED, BECAUSE ADJUSTMENTS OF COUNTERWEIGHT ANGLE AND BLADE PITCH USUALLY INVOLVE SOME DISASSEMBLY PROCEDURE.

CAUTION 2: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

K. Setting Counterweight Angle

(1) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table to move the piston to full reverse position.

(2) Using a hand-held protractor TE97, or equivalent, measure the angle of counterweight relative to the axis of the piston. Refer to Figure 7-24.

(a) For the specific counterweight angle required, refer to the applicable aircraft specifications manual or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) As indicated in Figure 7-24, the positive angle, usually 2 degrees, is for reference only. Do not consider it for the prescribed angle.

CAUTION: THE LENGTH OF THE SPRING SPACER TUBE REQUIRED AT ASSEMBLY MAY BE THE SAME AS THE LENGTH OF THE SPACER REMOVED AT DISASSEMBLY. IF THE SPACER IS ADDED AT ASSEMBLY, USE THE CORRECT LENGTH SPECIFIED FOR THE REQUIRED CHANGE IN ANGLE.

(3) If it is necessary to adjust the counterweight angle, replace the spring spacer tube (1315) between the rear spring retainer (1370) and the spring retainer cup (1400) with a next-size-longer or shorter spacer to change the angle.

L. Establishing Reference Blade Radius

CAUTION: DO NOT CONFUSE BLADE STATION WITH REFERENCE BLADE RADIUS. BLADE STATION AND REFERENCE BLADE RADIUS OF THE SAME NUMBER MAY NOT ALWAYS INDICATE THE SAME LOCATION ON THE BLADE.

(1) Reference blade radius is measured from the center of the propeller hub to a predetermined reference location on the blade for blade angle measurement.

(2) Blade stations are used during the repair or overhaul process of a blade to define a blade span location for dimensional measurement.

(3) Establish a reference blade radius location

(a) For the reference blade radius location specified for the applicable aircraft installation, refer to the Aircraft Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) Beginning with blade one, measure from the center of the propeller hub to the reference blade radius location specified. Refer to Figure 7-25.

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.

(c) Using a crayon or soft, non-graphite pencil CM162 or equivalent, mark a line perpendicular to the blade centerline.

(d) Repeat this procedure for each remaining blade.

M. Setting Reverse Blade Angles

CAUTION: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

(1) Apply air pressure to the piston through the rotatable fixture on the propeller assembly table to bring the propeller to reverse angle position.

(2) Using a hand held protractor TE97 or bench-top protractor TE96 and special riser fixture TE48, or equivalent, measure the reverse angle on blade one at the reference blade radius specified in the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

NOTE: For the specific requirements for reverse blade angle and blade-to-blade tolerance at reverse blade angle, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(3) Rotate the blade in the clamp to obtain the correct reverse blade angle.

(4) Using a clamp nut wrench TE142, or equivalent, hold the self-locking nut (1730) and a standard 12-point socket to torque the bolts (1710) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(a) While torquing the clamp bolts (1710), make sure that the position of the gasket (1700) is kept in order to provide a sufficient grease seal.

(b) Make sure a nearly equal gap between the two halves is kept after final torque is applied.

(5) Repeat this reverse angle setting procedure for each of the other blades.

(6) Measure the blade-to-blade reverse angle variance at the reference blade radius, and readjust the blade reverse angles if they are not within tolerance.

(a) A blade-to-blade tolerance is applicable when setting the reverse blade angle.

(b) A blade-to-blade tolerance is also applicable when setting the low pitch and feather blade angle. It is recommended that a minimum blade-to-blade tolerance be met in the reverse blade angle. This will make sure of the best opportunity to meet all blade angle tolerance requirements for each subsequent angle.

(c) Confirm the correct blade angle setting by cycling the propeller from reverse to feather, and back to reverse.

N. Setting Feather Blade Angles

(1) Release the air pressure to the rotatable fixture.

(2) Using a hand-held protractor TE97, or equivalent, measure the feathering angle on blade one at the reference blade radius specified in the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(a) For the specific feathering angle, blade-to-blade tolerance at feather blade angle, and reference blade radius required, refer to the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: BEFORE REMOVING THE PISTON, MARK A PISTON EAR WITH A GREASE PENCIL CM162, AND MATCH MARK THE GUIDE COLLAR TO MAKE SURE THAT THE PISTON IS REINSTALLED IN THE SAME POSITION.

(3) Adjust the feather angle, as necessary, by removing the piston and turning the fillister head screws (1540).

(a) Using a special wrench TE144-1 or equivalent, and a one inch (25.4 mm) socket wrench, remove the non-locking nut on the end of the pitch change rod (1320).

(b) Rotate the blades by hand from feather to reverse.

(c) Remove all of the link pin units (120).

(d) Disconnect the link arms (140) from the piston unit (1500).

(e) Remove the piston unit (1500).

(f) Adjust the feather angle as necessary.

NOTE: Turning the fillister head screw (1540) in one turn will increase the feathering angle approximately 1.5 degrees. Turning the fillister head screw out one turn will decrease the feathering angle approximately 1.5 degrees.

(g) Using 0.032 inch (0.82 mm) minimum diameter stainless steel wire CM131, safety the fillister head screws (1540).

(h) Move the piston (1500) into position over the cylinder (190).

(i) Align the piston installed guide rods with the bushings in the guide collar (1550).

(j) Install the free end of each link arm (140) in the slot provided for it in the piston (1500).

(k) Apply anti-seize compound CM118 to the pin shaft of the link pin unit (120).

(l) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(m) Push each link pin unit (120) flush with the piston (1500) ear.

CAUTION: THE NON-LOCKING NUT THAT WAS USED ON THE END OF THE PITCH CHANGE ROD DURING THE BUILDUP PROCESS MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110).

(4) Install the self-locking hex nut (110) on the end of the pitch change rod (1320).

(5) Measure the feather blade angle of all the blades, and adjust as necessary.

(6) Using a 1-13/16 inch crowfoot wrench on the self-locking hex nut (110), and a one inch (25.4 mm) socket on the pitch change rod (320), torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(7) Measure the blade-to-blade tolerance at the feather blade angle.

O. Beta System Installation (Part 3 of 3)

(1) Install a hex nut (55) onto the engine side of each beta rod unit (40).

CAUTION: DO NOT FORCE THE BETA ROD UNITS (40) INTO THE BETA RING (50). FORCING THE BETA ROD UNITS COULD CAUSE IRREPARABLE DAMAGE THE GROOVE IN THE BETA RING.

(2) Turn one beta rod unit (40) at a time into the threaded holes in the beta ring (50) to a depth of two Turns each time.

(a) Using an open end wrench on the flats of the beta rod unit (40) to turn the beta rod unit (40).

(3) Repeat the above process with each beta rod unit (40) in succession several times until each beta rod is completely threaded into the beta ring (50).

(4) Turn each beta rod unit (40) out of the beta ring (50) one full Turn and then tighten the self-locking hex nuts (55) while holding the beta rod units (40) position with an open end wrench.

(5) Using a depth micrometer, measure the height of the beta ring (50).

(a) Adjust the height by rotating the beta rod units (40) clockwise to decrease or counterclockwise to increase.

(6) Using a dial indicator to measure the run-out of the beta ring (50) at full feather. Refer to Figure 7-27 for setup.

CAUTION: BETA RING (50) RUN-OUT MUST BE KEPT WITHIN 0.010 INCH TOTAL.

(7) Adjust each beta rod unit (40) and self-locking hex nut (55) to correct run-out.

(8) When the run-out is correct, torque the hex nut (55) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

CAUTION 1: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS SECTION.

CAUTION 2: WHEN A BLADE ANGLE IS SET OR MEASURED, ACTIVATE THE ASSEMBLY AWAY FROM THE REVERSE PITCH POSITION BY HAND TO SEAT THE BLADE AND BLADE CLAMP PARTS AND TO REMOVE PLAY FROM THE ASSEMBLY.

P. Setting Low Pitch Blade Angle

(1) If applicable, put the spacer (30) on each beta rod unit (40).

(2) Install the self-locking hex nut (20) on each beta rod unit (40).

(3) Setting the low pitch angle of the blades establishes hydraulic low pitch for the propeller.

(a) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table, until Blade Number One reaches the correct low pitch blade angle.

1 For the specific low pitch angle, tolerance at low pitch blade angle, and reference blade radius required for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Applications Guide Manual 159 (61-02-59).

(b) Trap the air at this position of Blade Number One, and Measure for correct low pitch angle.

1 The low pitch angle of all blades must be within a blade-to-blade tolerance of 0.2 degree from the maximum to the minimum blade angle at low pitch.

(c) Turn the self-locking hex nuts (20) on the propeller beta rod units (40) so that the nuts are against the bosses on the piston at low stop position.

(d) Apply air pressure to the rotatable fixture, forcing until the propeller is against the reverse pitch stop.

(e) Select a blade with a beta rod adjacent to it.

1 "Zero" the dial indicator on the beta ring (50) at a position close to the selected beta rod unit (40).

CAUTION: ADJUSTING THE BETA RING RUN-OUT IN REVERSE PITCH WILL AFFECT THE LOW PITCH ANGLE.

(f) Adjust the other self-locking nuts (20) to correct the beta ring (50) run-out to within 0.010 inch (0.25 mm) maximum movement for one revolution of the propeller.

(g) Release pressure from the rotatable fixture, allowing the propeller blade angle to move to feather or to a blade pitch higher than low pitch.

(h) Apply air pressure to the rotatable fixture to move the propeller from a higher blade angle to low pitch blade angle.

NOTE: Make sure that the self-locking nuts (20) are just barely engaged by the piston (1500).

CAUTION: THE BETA ROD UNITS (40) AND THE BETA RING (500) MUST NOT MOVE WHEN VERIFYING CONTACT BETWEEN THE PISTON (1500) AND THE SELF-LOCKING NUTS (20).

(i) Move the assembly away from the reverse pitch position by hand to seat the blade and clamp parts, and to remove play from the assembly.

(j) Measure the blade-to-blade low pitch angle variance at the reference blade radius, and readjust the blade low pitch angles if they are not within tolerance.

NOTE: A blade-to-blade tolerance is applicable when setting the low pitch blade angle. This will make sure of the best opportunity to meet all blade angle tolerance requirements.

(k) If the blade-to-blade tolerance is excessive, then one or more blades must be threaded in the blade clamp(s).

(l) With air pressure applied to the piston, and with the propeller assembly in full reverse position, measure the beta ring run-out. Total maximum permitted run-out is 0.010 inch (0.25 mm).

Q. Final Beta Ring Run-out Measure

CAUTION: BETA RING (50) RUN-OUT MUST BE KEPT WITHIN 0.010 INCH (0.25 MM) TOTAL. ADJUST AS NECESSARY.

(1) With the propeller at low pitch and each self-locking hex nut (20) providing a positive stop for the piston (1500), measure the beta ring (50) run-out.

(2) Actuate the propeller to reverse blade angle and measure the beta ring (50) run-out. Refer to Figure 7-27.

R. Measuring for Blade Slippage in Blade Clamp

(1) With the propeller still installed on the rotatable fixture of the assembly table, proceed as follows to provide visual detection of slippage between the blade shank and the blade clamp.

CAUTION: DO NOT USE A PUNCH OR SCRIBE A LINE ON THE BLADE SHANK. THIS COULD START A CRACK IN THE BLADE.

(a) When the correct pitch has been established in each blade, apply a strip of red plastic tape down the shank and across the blade clamp of blade number one. Refer to Figure 7-28.

1 If the blade will later be removed to facilitate shipping the propeller, apply two strips of red tape across each mated blade shank and blade clamp assembly.

(b) Carefully cut the tape along the line where the blade shank and blade clamp meet.

(c) Repeat this procedure on the other blade assemblies.

1 Misalignment of the halves of tape on a blade assembly indicates slippage between the blade shank and blade clamp. Follow the repair procedure found in the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) to correct blade slippage.

CAUTION: DO NOT PUT THE PADDED BAR ON THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BAR IN THE THICKEST AREA OF THE BLADE, JUST OUTBOARD OF THE DE-ICE BOOT. USE ONE BLADE PADDLE FOR EACH BLADE.

(d) Using a padded blade bar, as shown in Figure 7-29, apply torque to each blade assembly to move each blade toward low pitch in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(e) Measure blade angles in accordance with the instructions in this chapter.

(f) If it is necessary to correct blade slippage, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(g) After confirming that there is no slippage, spray each piece of tape with clear protective spray CM129 to provide a clear protective coating.

CAUTION: TO AVOID PERMANENT DAMAGE TO THE BLADE RETENTION COMPONENTS CAUSED BY TRAPPED CHEMICALS, THIS PROCEDURE MUST ONLY BE PERFORMED FOLLOWING THE ASSEMBLY OF A PROPELLER AFTER OVERHAUL OR AFTER ANY OTHER PROCEDURE INVOLVING DISASSEMBLY AND CLEANING OF THE PROPELLER BLADE RETENTION COMPONENTS.

S. Optional External Sealant CM93 Application

(1) The application of sealant CM93 to the blade/blade clamp interface is an optional procedure that may supply additional protection against corrosion of the blade retention components.

CAUTION 1: TO MAKE SURE OF CORRECT ADHESION OF SEALANT CM93, BLADE AND BLADE CLAMP SURFACES MUST BE FREE OF GREASE AND DIRT.

CAUTION 2: DO NOT GET SEALANT CM93 ON THE SURFACE OF THE CLAMP, WHERE BALANCE WEIGHTS AND DE-ICE HARDWARE ARE INSTALLED.

(2) After doing an examination for blade slippage in the clamp, fill the external void at the blade/blade clamp interface with a 0.25 inch (6.3 mm) maximum bead of sealant CM93, around the entire circumference of blade, as shown in Figure 7-30.

(3) Let the sealant CM93 cure for a minimum of two hours, before returning the propeller to service.

T. Finishing the Reassembly of the Beta System

(1) Propeller Models ending in -3 that have a beta rod support ring (75)

CAUTION: IF THE BETA ROD GUIDE LUGS (100) CANNOT BE THREADED SMOOTHLY WITHOUT STICKING, WITH THE PROPELLER IN REVERSE POSITION, THE GUIDE LUGS ARE BINDING AND THE GUIDE COLLAR MUST BE LOOSENED, THE SPINNER MOUNTING PLATE MUST BE ADJUSTED, OR THE PISTON AND GUIDE COLLAR ARE OUT OF ALIGNMENT.

(a) Put the aluminum spacer (30) on each beta rod.

(b) Turn a Measure nut (60) onto the end of each beta rod equal distance from the self-locking nut (20).

(c) Position the beta rod support ring (75) on the end of the beta rod units (40).

(d) Turn an self-locking nut (20) onto the end of each beta rod unit (40).

(e) Torque each self-locking nut (20) in accordance with the Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

U. Final Inspection of the Reassembled Propeller

(1) Use a Checklist, such as the appropriate Propeller Assembly Inspection Check-off Form, for final inspection of the reassembled propeller.

(a) Make sure that propeller static balance has been accomplished. Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(b) Measure the blade track. Refer to Figure 7-16.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

1 Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

2 If all blades do not track:

a Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

b A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(c) Measure each blade tip for end play (leading edge to trailing edge).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(d) Measure each blade tip for end play (fore-and-aft).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(e) Measure the radial play in each blade.

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(f) Measure blade pitch settings.

1 For the applicable blade pitch settings associated tolerance, and the reference blade radius specified for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

V. Label Replacement

(1) Refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) for information and label usage.

W. Reassembly of a Propeller Disassembled for Shipment

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

X. Propeller Balance

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

Y. Propeller Lubrication

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

4. Assembly of Propeller Model HC-A2(MV,V)20-5L

A. Blade Installing Parts Assembly

(1) Install the rear installing cone (2360) on the rotatable fixture TE125 on the assembly table TE129.

(2) Install the hub (2300) on the rotatable fixture of the propeller assembly table.

(3) Using the special tool TE146, the hub shaft nut (2370), and the puller ring (2400), install the hub (2300) to the rotatable fixture.

NOTE: Use the hub shaft nut (2370) and puller ring (2400) that will go with the propeller when installed on an engine.

CAUTION 1: BEARING RACES (240 AND 300) MUST BE MATCHED SETS.

CAUTION 2: THE INTERNAL RECESS OF THE BEARING RETAINING RING (280) MUST FACE OUTBOARD WHEN THE BEARING RETAINING RING IS SLIPPED OVER THE BLADE ARM FLANGE OF THE HUB UNIT (2300).

(4) Using a light mallet and press tool TE308, or equivalent, as shown in Figure 7-1, install a bearing retaining ring (280) onto one blade arm flange of the hub unit (2300).

(a) Install the bearing retaining ring (280) far enough onto the blade arm flange so that the bearing retaining ring forms a narrow channel on the inboard surface of the flange.

(5) Repeat this bearing retaining ring (280) installation procedure for all the other blade arm flanges on the hub unit.

(6) Using lubricant CM12, lightly grease the inboard surface of each blade arm flange.

(7) Put the halves of an outboard side race (300) (matched set) in position over one hub arm.

(8) Visually examine the fit of the outboard side race to the hub arm.

(a) The outboard side race (300) must rest tightly against the seating area on the hub arm, with no "rocking" action evident.

(b) The outboard side race (300) halves must fully contact each other at the parting surfaces.

(c) Replace the outboard side race (300) if it does not fit correctly.

NOTE: The break-line for the outboard side race (300) must be vertical to the table top.

(9) Using a combination of special tools TE308 and TE108, or equivalent, press the bearing retaining ring (280) far enough onto the outboard side race (300) to position the wire ring retainer (290) in the groove in the blade arm flange. Refer to Figure 7-1.

(10) Install the wire ring retainer (290).

(11) Using a combination of special tools TE308 and TE108, or equivalent, with special spacer A-972, pull the bearing retaining ring (280) outboard far enough to position the wire ring retainer (290) in the wire retention groove in the bearing retaining ring (280). Refer to Figure 7-1.

CAUTION: THE WIRE RING RETAINER (290) MUST BE FULLY ENCLOSED TO MAKE SURE IT IS NOT PINCHED.

(12) Visually examine to make sure that the wire ring retainer (290) is fully enclosed.

(13) Using lubricant CM12, lubricate the blade O-ring (270).

(14) Move the O-ring (270) over the blade arm flange of the hub unit (2300) to a location inboard of the outboard side race (300).

(a) Leave the O-ring in position for use later in the reassembly.

(15) For the remaining hub arms, repeat steps (6) through (14) of this procedure.

CAUTION: DURING THE FOLLOWING PROCEDURES, THE BLADE ARM ON WHICH A RETENTION BEARING IS GOING TO BE ASSEMBLED MUST BE SUPPORTED VERTICALLY WITH THE PILOT TUBE FACING DOWN.

(16) Remove the hub unit (2300) from the rotatable fixture on the assembly table and use special tool TE308, or equivalent, to hold the unit vertical during the next stages of blade retention split-bearing assembly. Refer to Figure 7-5.

CAUTION 1: THE PARTING LINE OF THE INBOARD BEARING RACE (240) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE BLADE CLAMP HALVES (1610).

CAUTION 2: ANY GAP BETWEEN THE HALVES OF BEARING RACES (240, 300) MUST NOT BE GREATER THAN 0.001 INCH (0.02 mm).

CAUTION 3: ALL BEARING BALLS (250) INSTALLED IN A SINGLE OUTBOARD SIDE RACE (300) MUST BE OF THE SAME GAUGE. BEARING BALLS SUPPLIED BY HARTZELL PROPELLER INC. ARE OF THE SAME GAUGE.

(17) Install the ball bearing spacer (260) and the required number of bearing balls (250) onto the outboard bearing race (300).

CAUTION: EXCESSIVE USE OF SEALANT CM93 COULD CAUSE UNEVEN SEATING BETWEEN THE CLAMP ASSEMBLY (1600) AND BEARING RACE (240).

(18) Apply a slight amount of sealant CM93 to the chamfered edges (break point) of the matched set of inboard bearing races (240).

(19) Remove any excess sealant that may come out into the bearing area when the bearing race halves are joined.

(20) Put the inboard bearing race halves (240) around one blade arm of the hub unit (2300).

CAUTION: THE OPENING OF THE WIRE RING RETAINER (230) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE INBOARD BEARING RACE.

(21) Install the wire ring retainer (230) to hold the halves in position.

(22) Move the O-ring (270) outboard against the inboard bearing race (240).

(23) Using self-adhesive stretch wrap, wrap the outside diameter of the bearing assembly to hold the parts in position.

(24) For the remaining hub arms, repeat steps (17) through (23) of this procedure.

(25) Install the hub on the rotatable fixture.

B. Clamp Assembly - Refer to Figure 7-11

(1) For clamp assembly procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) For information about the correct counterweight slugs and installing hardware, refer to the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59).

CAUTION: A LINK ARM (140) CANNOT BE INSTALLED AFTER THE CLAMP (1600) HAS BEEN INSTALLED ON THE HUB.

(3) After each clamp (1600) is assembled:

(a) Install the link screw sleeve (145) into the large hole of the link arm (140), from the side of the link arm that faces away from the clamp half (1600).

NOTE: The flange of the sleeve (145) faces inboard.

(b) Install the link arm bushing (210) onto the linkscrew (1640) between the link arm (140) and the blade clamp (1600).

NOTE: The raised shoulder of the link arm (140) must face the blade clamp (1600).

(c) Push the cotter pin (330) through the hole in the end of the linkscrew (1640) and open the cotter pin to install the link arm (140) to the clamp assembly (1600).

1 The link arm (140) must move freely on the linkscrew (1640).

(d) Open the cotter pin (330) to secure it in position.

NOTE: The link arm (140) must move freely on the link screw (1640).

(e) Repeat this procedure for each remaining clamp assembly (1600).

(4) When adjusting the pitch range of some propeller assemblies, the linkscrew may contact the hub. When this happens, the full blade angle range cannot be achieved. Refer to the section, "Repair of the A-304 Linkscrew" in the Repair chapter in this manual.

C. Blade and Clamp Installation

(1) Install the hub unit (2300) on the rotatable fixture TE125 on the assembly table TE129.

(2) For instructions about aluminum blade balancing and all other overhaul or repair procedures, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: IF POSSIBLE, EACH BLADE MUST BE REINSTALLED ON THE HUB ARM FROM WHICH IT WAS REMOVED AT DISASSEMBLY.

(3) As specified in the Disassembly Procedure, each blade must have an identifying number to make sure of correct assembly.

(4) Stand blade one in vertical position (shank up, tip down) and fill the pilot tube cavity with lubricant CM12 to the top of the bottom blade needle bearing.

WARNING: AIR TRAPPED IN THE GREASE CAN AFFECT PROPELLER BALANCE AFTER RUN-UP.

(5) After making sure that no air is trapped in the grease, move the blade onto the pilot tube (2310). Push the blade toward the center of the hub until the butt of the blade shank makes contact with the face of the blade arm.

NOTE: A slight amount of grease will be squeezed out around the pilot tube (2310) if the blade has been lubricated correctly.

(6) For the remaining blades, repeat steps (3) through (5) of this procedure.

CAUTION: USE HARDENING GASKET COMPOUND CM46 ON THE SHOULDER RADIUS OF THE BLADE SHANK, THE OUTER DIAMETER OF THE BLADE SHANK, AND THE OUTER CORNER OF THE BLADE BUTT. REFER TO FIGURE 7-12.

(7) Using an acid brush or finger, optionally wearing non-powdered latex gloves, apply a smooth even layer of gasket compound CM46 on the shoulder radius of the blade shank in the area where it touches the blade clamp, the outer diameter of the blade shank, and the outer corner of the blade butt. Refer to Figure 7-12.

(a) Before installing a clamp, make sure the shoulder radius of the blade shank, the outer diameter of the blade shank, and the outside corner of the blade butt are completely covered by a smooth even layer of gasket compound CM46. Refer to Figure 7-12.

(b) Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(8) Remove the self-adhesive stretch wrap that was used to temporarily hold the blade races (240, 300) together.

CAUTION: THE PARTING LINE OF THE BLADE CLAMP-HALVES (1610) MUST BE AT A 90 DEGREE ANGLE TO THE PARTING LINE OF THE INBOARD BLADE RACES (240) AND IN LINE WITH THE OUTBOARD BLADE RACE (300).

(9) Apply a small bead of sealant CM93 to both blade clamp halves (1610) on a part of the mating surface in the inboard bearing radius, as shown in Figure 7-14.

NOTE: Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(a) On the blade clamp mating surfaces, the sealant supplements the sealing of the inboard end of the blade clamp gaskets (1700).

(b) Between the blade clamp (1610) and inboard blade thrust split bearing (240), use the sealant to fill the void from the beveled edge of the bearing outside diameter.

(10) Optionally, put a small bead of sealant CM93 on a part of the mating surfaces Area "C" and Area "D" on both clamp halves. Refer to Figure 7-14 and Figure 7-15.

NOTE: The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is optional. This step is highly recommended for agricultural aircraft, and is recommended for other Hartzell Propeller Inc. steel hub propeller models.

(a) The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is an optional procedure. Application of CM93 to the clamp mating surfaces may cause the gasket to slip out of position. Refer to Figure 7-14 and Figure 7-15.

(11) Install the matching clamp-half (1610) with the counterweight to the blade/hub.

(12) Install the other blade clamp half.

CAUTION: A MAXIMUM OF 0.06 INCH (1.5 mm) OF GASKET MATERIAL MUST BE EVENLY EXPOSED THROUGH THE PARTING LINE ON EACH SIDE OF THE CLAMP ASSEMBLY (1600). THE GASKET (1700) MAY REQUIRE TRIMMING TO PROVIDE METAL-TO-METAL CONTACT WHERE THE CLAMP LUGS MEET.

(13) Put a new gasket (1700) between each of the blade clamp half parting surfaces.

(14) Install the bolts (1710) into the outboard clamp position.

CAUTION: DO NOT TORQUE THE BOLTS (1710) AT THIS TIME.

(15) Install the washers (1720) and attach them with self-locking nuts (1730) onto the bolts (1710).

(a) Finger tighten the self-locking nuts (1730).

NOTE: This step helps align the blade clamp gasket (1700), but the bolts (1710) must not be torqued at this time.

(16) Install the socket screws (1690) into the clamp holes that are in the inboard position.

CAUTION 1: THE SOCKET SCREWS (1690) MUST BE TORQUED IN THE SEQUENCE SPECIFIED.

CAUTION 2: DO NOT EXCEED THE RECOMMENDED TORQUE ON THE SOCKET SCREWS (1690).

(17) Using a 5/16 inch Allen wrench, torque the socket screws (1690) in 10 Ft-Lb (14 N·m) increments (10, 20, etc.) in accordance with Table 8-1, "Torque Values", alternating between screws at each increment.

(18) Measure the blade track.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

(a) Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

(b) If all blades do not track:

1 Make sure that there is no unwanted material between the rotatable fixture flange and the propeller hub flange.

2 A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: DO NOT CONTACT THE INNER BLADE CLAMP HALF (1610) WHILE DRILLING TO SAFETY THE SOCKET SCREWS (1690).

(19) Using a #42 (0.094 inch [2.37 mm]) size bit, drill the head of each socket screw (1690).

(20) Safety wire each socket screw (1690) with a cotter pin (1680) so that the cotter pin contacts the clamp half (1610) and prevents the socket screw from backing out of the clamp assembly (1600).

NOTE: Do not safety the clamp socket screws (1690) if the blades will be removed to facilitate shipment of the propeller.

(a) If an installed cotter pin (1680) causes interference, three loops of 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131 may be used to safety the socket screw (1690).

(21) For the remaining blades, repeat steps (7) through (20) of this procedure.

(22) Install weight slugs on the clamp counterweight arms, if applicable. Refer to Hartzell Propeller Inc. Application Guide 159 (61-02-59) for specific weight slug information.

D. Cylinder and Guide Collar Unit Installation

(1) Using solvent CM106, clean the threads on the hub unit (2300) and cylinder (190).

CAUTION: THE CHAMFERED SIDE OF THE GUIDE COLLAR UNIT (1550) MUST SEAT AGAINST THE SHOULDER OF THE CYLINDER (190). TO GET PROPER HUB CLEARANCE, THE LARGER INSIDE DIAMETER OF THE GUIDE COLLAR MUST FACE THE HUB UNIT (2300).

(2) Install the cap screw (1570) into the guide collar unit (1550).

(3) Install the guide collar unit (1550) onto the smaller diameter shoulder of the cylinder (190).

(a) The chamfer in the guide collar (1550) must face the flange on the cylinder (190).

(b) Do not torque the guide collar socket screw (1570) at this time.

CAUTION 1: DO NOT APPLY HYDRAULIC SEALANT ADHESIVE COMPOUND CM134 TO THE THREADS OF THE CYLINDER (190).

CAUTION 2: DO NOT GET HYDRAULIC SEALANT CM134 IN THE CYLINDER (190). CONTAMINATION TO THE AIRCRAFT ENGINE OIL SYSTEM COULD OCCUR.

(4) Using hydraulic sealant CM134, apply a bead of sealant in the groove of the hub unit (2300) where the cylinder O-ring (200) fits.

(5) Install the O-ring (200) into the chamfer in the cylinder (190).

(6) Manually tighten the cylinder (190) and the guide collar unit (1550) if applicable, onto the hub unit (2300).

(7) Using a bar of appropriate size to fit the slot in the top of the cylinder (190), tighten the cylinder flush against the hub unit (2300).

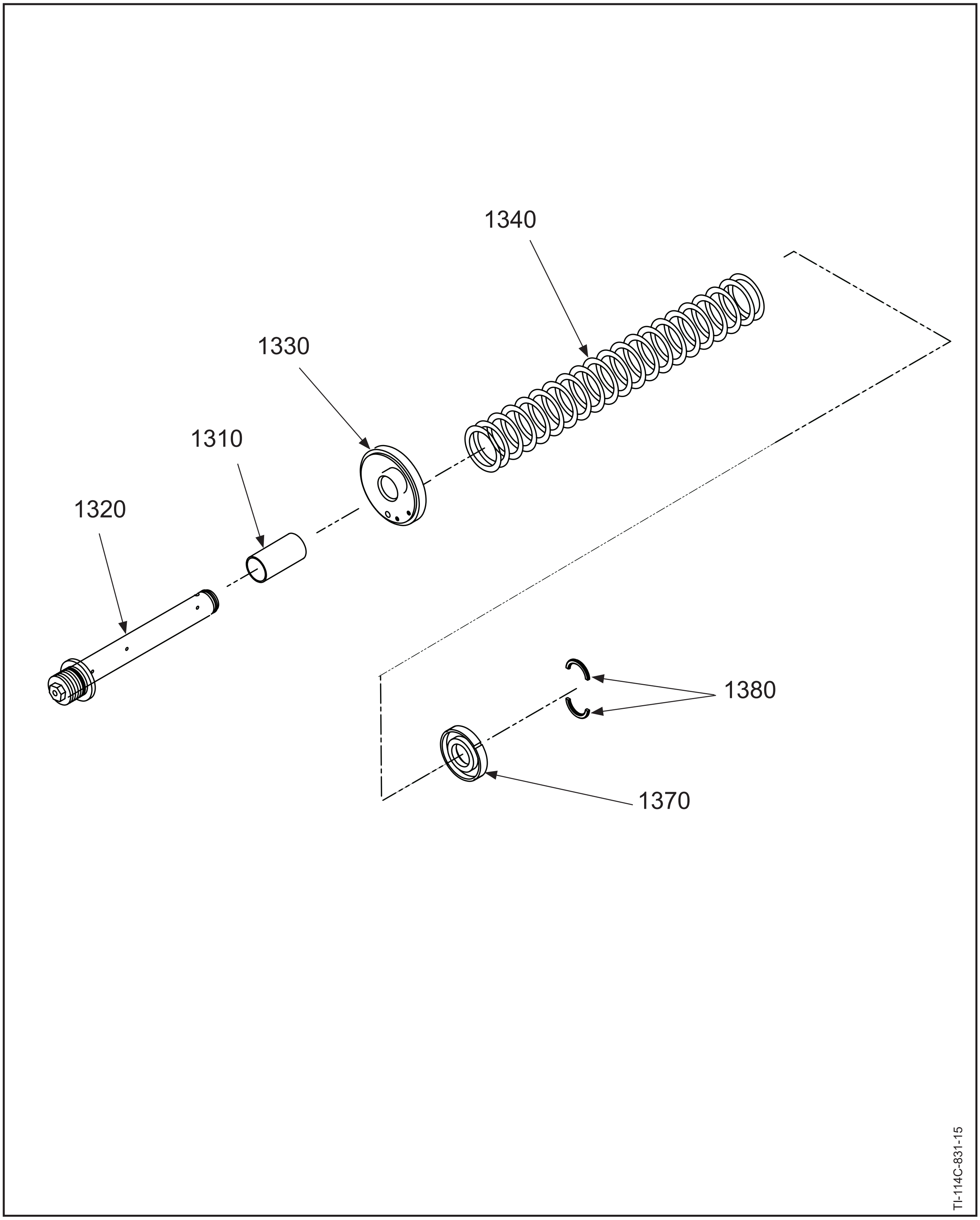
NOTE: Early drag and tightness is caused by the O-ring (200), which acts as a seal and safety.

(8) Torque the cylinder (190) against the shoulder of the hub unit (2300). Refer to the Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

CAUTION 1: VISUALLY EXAMINE THE INSIDE OF THE CYLINDER (190) TO MAKE SURE THAT THE O-RING (200) HAS NOT BEEN MOVED OUT OF PUT DURING THE CYLINDER INSTALLATION PROCEDURE.

CAUTION 2: VISUALLY EXAMINE THE SLOT IN THE TOP OF THE CYLINDER (190) TO MAKE SURE THE SQUARE-BAR WRENCH USED FOR TORQUING DID NOT RAISE ANY SHARP EDGES OR DAMAGE THE TURNS.

(9) Remove any sharp edges in the wrench slot on top of the cylinder (190).



831-15 Feathering Spring Assembly
Figure 7-33

E. Assembly of the Feathering Spring Assembly

(1) 831-15 Feathering Spring Assembly - Refer to Figure 7-33

(a) Move the spacer tube (1310) onto the pitch change rod (1320).

(b) Move the front spring retainer (1330) onto the pitch change rod (1320), with the flat plate facing the threaded end of the pitch change rod.

(c) Move the spring (1340) onto the pitch change rod (1320).

(d) Put the rear spring retainer (1370) on the spring (1340).

(e) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent.

(f) Compress the spring assembly (1300) enough to install the rear split keeper (1380) into the groove in the pitch change rod (1320).

(g) Apply oil or grease to each half of the rear split keeper (1380) to hold it in position until the spring (1340) is decompressed.

WARNING: WHEN COMPRESSED, THE SPRING ASSEMBLY (1300) IS LOADED TO APPROXIMATELY 1000 POUNDS (454 KG) FORCE. MAKE SURE OF THE SAFETY OF EVERYONE IN THE AREA DURING ASSEMBLY PROCEDURES.

(h) Carefully release the pressure on the spring assembly (1300).

(i) Before removing the spring assembly from the spring compressor fixture TE59, or equivalent, make sure that both rear split keeper halves (1380) are in the groove in the pitch change rod (1320), and installed by the rear spring retainer (1370).

F. Feathering Spring Assembly Installation

(1) 831-15 Feathering Spring Assembly Installation

(a) Install the shoulder of the front spring retainer (1330) approximately 0.25 inch (6.35 mm) into the cylinder.

(b) Install the split keepers (180) into the groove in the cylinder.

(c) Move the front spring retainer (1330) against the split keeper to hold it in position.

(d) Using two fillister head screws (170) to install each feathering pitch stop spacer (160).

(e) Torque each fillister head screw (170) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(f) Safety wire each fillister head screw (170) with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

(g) Install the pitch stop spacer (155) on the pitch change rod (1320).

G. Piston Installation

NOTE: Refer to Figure 7-20 for the installation and orientation of components installed in the piston (1500) and dust seal length.

(1) Using lubricant CM12, lubricate the pitch change rod O-ring (150).

(2) Carefully install the pitch change rod O-ring (150) in the groove provided for it in the pitch change rod (1320).

(3) Using lubricant CM12, lubricate the piston O-ring (1535).

(4) Carefully install the piston O-ring (1535) in the groove provided for it in the piston (1500).

CAUTION: MAKE SURE THAT THE FELT PISTON DUST SEAL (1530) IS FUZZ-FREE.

(5) Cut the piston dust seal material (1530) to length on a 30 degree diagonal so there is an overlap at the parting line with a smooth, fuzz-free surface.

(a) If the piston dust seal (1530) has fuzz or long strands that could interfere with the operation of the O-ring, replace the piston dust seal.

(6) Soak the piston dust seal (1530) in aviation grade engine oil until it is completely saturated.

(a) Squeeze the excess oil from the piston dust seal (1530).

CAUTION: MAKE SURE THAT THE DIAGONAL OVERLAP OF THE FELT PISTON DUST SEAL (1530) REMAINS VISIBLE AND DOES NOT ROTATE TO ITS SIDE AS IT IS INSTALLED IN THE GROOVE OF THE PISTON (1500).

(7) Install the thinnest section of the piston dust seal (1530) in the remaining piston OD groove.

(8) Move the piston (1500) into put over the cylinder (190) and through the holes in the guide collar (1550).

(9) Apply a thin layer of anti-seize compound CM118 in the hole of the free end of each link arm (140).

(10) Install the free end of each link arm (140) in the slot provided in the piston (1500).

CAUTION: MAKE SURE THAT THE CORRECT SAFETY SCREW (130) IS INSTALLED AND THAT SUFFICIENT TURNS ARE AVAILABLE IN THE PISTON UNIT (1500) TO HOLD THE SCREW IN POSITION. AT LEAST THREE TURNS MUST BE ENGAGED. DO NOT BIND THE LINK ARM.

(11) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(12) Push each link pin unit (120) flush with the piston (1500) ear.

(13) Install each link pin unit (120) with a fillister head screw (130).

(a) Torque the fillister head screw (130) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(14) Put the guide collar unit (1550) solidly against the cylinder (190) at the correct radial location to assist in aligning the guide rods in the piston unit (1500).

(15) When the necessary alignment is correct, use an Allen wrench with torque wrench adapter to tighten the socket head cap screw (1570) in the guide collar unit (1550). Refer to the Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(16) Install screw (1565), washer (1555), and nut (1575) in the threaded end of each guide rod.

(a) Torque the screw (1565) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

CAUTION: FOR SETUP PURPOSES ONLY, USE A NON-LOCKING NUT ON THE END OF THE PITCH CHANGE ROD AS AN ALTERNATIVE TO THE SELF-LOCKING HEX NUT (110). THE NON-LOCKING NUT MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110) AFTER FEATHER ANGLES ARE CORRECT.

(17) Move the piston (1500) into full feathered position (back against the hub assembly) so that the threaded end of the pitch change rod (1320) extends through the end of the piston (1500).

(18) Turn the self-locking hex nut (110) onto the end of the pitch change rod (1320).

(19) Use a wrench on the self-locking hex nut (110) and socket on the pitch change rod (1320) to torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

<u>WARNING</u>: THE COUNTERWEIGHT (1630) MUST HAVE A POSITIVE ANGLE WITH REFERENCE TO THE PROPELLER CENTERLINE WHEN THE PISTON IS IN FULL REVERSE POSITION TO PREVENT THE PROPELLER FROM "STICKING" IN REVERSE. REFER TO FIGURE 7-24.

<u>CAUTION 1</u>: AT THIS STAGE OF PROPELLER ASSEMBLY THE BOLTS (1710) HAVE NOT BEEN TIGHTENED, BECAUSE ADJUSTMENTS OF COUNTERWEIGHT ANGLE AND BLADE PITCH USUALLY INVOLVE SOME DISASSEMBLY PROCEDURE.

<u>CAUTION 2</u>: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

H. Setting Counterweight Angle

(1) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table to move the piston to full reverse position.

(2) Using a hand-held protractor TE97, or equivalent, measure the angle of counterweight relative to the axis of the piston. Refer to Figure 7-24.

(a) For the specific counterweight angle required, refer to the applicable aircraft specifications manual or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) As indicated in Figure 7-24, the positive angle, usually 2 degrees, is for reference only. Do not consider it for the prescribed angle.

<u>CAUTION</u>: THE LENGTH OF THE SPRING SPACER TUBE REQUIRED AT ASSEMBLY MAY BE THE SAME AS THE LENGTH OF THE SPACER REMOVED AT DISASSEMBLY. IF THE SPACER IS ADDED AT ASSEMBLY, USE THE CORRECT LENGTH SPECIFIED FOR THE REQUIRED CHANGE IN ANGLE.

(3) If it is necessary to adjust the counterweight angle, replace the spring spacer tube (1315) between the rear spring retainer (1370) and the spring retainer cup (1400) with a next-size-longer or shorter spacer to change the angle.

CAUTION: DO NOT CONFUSE REFERENCE BLADE RADIUS WITH BLADE STATION. REFERENCE BLADE RADIUS AND BLADE STATION OF THE SAME NUMBER MAY NOT ALWAYS INDICATE THE SAME LOCATION ON THE BLADE.

I. Establishing Reference Blade Radius

(1) Reference blade radius is measured from the center of the propeller hub to a predetermined reference location on the blade for blade angle measurement.

(2) Blade stations are used during the repair or overhaul process of a blade to define a blade span location for dimensional measurement.

(3) Establish a reference blade radius location.

(a) For the reference blade radius location specified for the applicable aircraft installation, refer to the Aircraft Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) Beginning with blade one, measure from the center of the propeller hub to the reference blade radius location specified. Refer to Figure 7-25.

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.

(c) Using a crayon or soft, non-graphite pencil CM162 or equivalent, mark a line perpendicular to the blade centerline.

(d) Repeat this procedure for each remaining blade.

J. Setting Reverse Blade Angles

CAUTION: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

(1) Apply air pressure to the piston through the rotatable fixture on the propeller assembly table to bring the propeller to reverse angle position.

(2) Using a hand held protractor TE97 or bench-top protractor TE96 and special riser fixture TE48, or equivalent, measure the reverse angle on blade one at the reference blade radius specified in the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59). Refer to Figure 7-26 for setup.

NOTE: For the specific requirements for reverse blade angle and blade-to-blade tolerance at reverse blade angle, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(3) Rotate the blade in the clamp to get the correct reverse blade angle.

(4) Using a clamp nut wrench TE142, or equivalent, hold the self-locking nut (820) and a standard 12-point socket to torque the bolts (1710) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(a) While torquing the bolts (1710), make sure that the position of the gasket (1700) is kept in order to provide a sufficient grease seal.

(b) Make sure a nearly equal gap between the two halves is kept after final torque is applied.

(5) Repeat this reverse angle setting procedure for each of the other blades.

(6) Measure the blade-to-blade reverse angle variance at the reference blade radius, and readjust the blade reverse angles if they are not within tolerance.

(a) A blade-to-blade tolerance is applicable when setting the reverse blade angle.

(b) A blade-to-blade tolerance is also applicable when setting the low pitch and feather blade angle.

(c) It is recommended that a minimum blade-to-blade tolerance be met in the reverse blade angle. This will make sure of the best opportunity to meet all blade angle tolerance requirements for each subsequent angle.

(7) To confirm the correct blade angle setting, cycle the propeller from reverse to feather, and back to reverse.

K. Setting Feather Blade Angles

(1) Release the air pressure to the rotatable fixture.

(2) Using a hand-held protractor TE97, or equivalent, measure the feathering angle on blade one at the reference blade radius specified in the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(a) For the specific feathering angle, blade-to-blade tolerance at feather blade angle, and reference blade radius required, refer to the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: BEFORE REMOVING THE PISTON, MARK A PISTON EAR WITH A GREASE PENCIL CM162, AND MATCH MARK THE GUIDE COLLAR TO MAKE SURE THAT THE PISTON IS REINSTALLED IN THE SAME POSITION.

(3) Adjust the feather angle, as necessary, by removing the piston and turning the fillister head screws (1540).

(a) Using a special wrench TE144-1 or equivalent, and a one inch (25.4 mm) socket wrench, remove the non-locking nut on the end of the pitch change rod (1320).

(b) Rotate the blades by hand from feather to reverse.

(c) Remove all of the link pin units (120).

(d) Disconnect the link arms (140) from the piston unit (1500).

(e) Remove the piston unit (1500).

(f) Adjust the feather angle as necessary.

NOTE: Turning the fillister head screw (1540) in one turn will increase the feathering angle approximately 1.5 degrees. Turning the fillister head screw out one turn will decrease the feathering angle approximately 1.5 degrees.

(g) Using 0.032 inch (0.82 mm) minimum diameter stainless steel wire CM131, safety the fillister head screws (1540).

(h) Move the piston (1500) into position over the cylinder (190).

(i) Align the piston installed guide rods with the bushings in the guide collar (1550).

(j) Install the free end of each link arm (140) in the slot provided for it in the piston (1500).

(k) Apply anti-seize compound CM118 to the pin shaft of the link pin unit (120).

(l) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(m) Push each link pin unit (120) flush with the piston (1500) ear.

CAUTION: THE NON-LOCKING NUT THAT WAS USED ON THE END OF THE PITCH CHANGE ROD DURING THE BUILDUP PROCESS MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110).

(4) Install the self-locking hex nut (110) on the end of the pitch change rod (1320).

(5) Measure the feather blade angle of all the blades, and adjust as necessary.

(6) Using a 1-13/16 inch crowfoot wrench on the self-locking hex nut (110), and a one inch (25.4 mm) socket on the pitch change rod (320), torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(7) Measure the blade-to-blade tolerance at the feather blade angle.

L. Measuring Blade Slippage in Clamp

(1) With the propeller still installed on the rotatable fixture of the propeller assembly bench, use the following procedure to detect slippage between the blade shank and the clamp assembly (1600).

CAUTION: DO NOT USE A PUNCH OR SCRIBE A LINE ON THE BLADE SHANK. THIS COULD START A CRACK IN THE BLADE.

(a) When the correct pitch has been established in each blade, apply a strip of red plastic tape down the shank and across the blade clamp of blade number one. Refer to Figure 7-28.

1 If the blade will later be removed to facilitate shipping the propeller, apply two strips of red tape across each mated blade shank and blade clamp assembly.

(b) Carefully cut the tape along the line where the blade and clamp (1600) assembly meet.

(c) Repeat this procedure on each remaining blade assembly.

1 Misalignment of the halves of tape on a blade assembly indicates slippage between the blade shank and blade clamp. Follow the repair procedure found in the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) to correct blade slippage.

CAUTION: DO NOT PUT THE PADDED BLADE BAR IN THE AREA OF THE DE-ICE BOOT WHEN TORQUING A BLADE ASSEMBLY. PUT THE BAR IN THE THICKEST AREA OF THE BLADE, JUST OUTBOARD OF THE DE-ICE BOOT. USE ONE BLADE BAR FOR EACH BLADE.

(d) Using a padded blade bar, as shown in Figure 7-29, apply torque to each blade assembly to move each blade toward low pitch in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(e) Measure blade angles in accordance with the instructions in this chapter.

(f) If it is necessary to correct blade slippage, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(g) After confirming that there is no slippage, spray each piece of tape with clear protective spray CM129 to provide a clear protective coating.

CAUTION 1: TO AVOID CAUSING PERMANENT DAMAGE TO THE BLADE RETENTION COMPONENTS BY TRAPPED CHEMICALS, THE FOLLOWING PROCEDURE MUST ONLY BE PERFORMED FOLLOWING ASSEMBLY OF A PROPELLER AFTER OVERHAUL OR OTHER PROCEDURE INVOLVING DISASSEMBLY AND CLEANING OF THE PROPELLER BLADE RETENTION COMPONENTS.

CAUTION 2: THIS PROCEDURE MUST ONLY BE PERFORMED ON PROPELLERS THAT HAVE EXPERIENCED DISASSEMBLY AND CLEANING OF BLADE RETENTION COMPONENTS.

M. Optional External Sealant CM93 Application

(1) The application of sealant CM93 to the blade/blade clamp interface is an optional procedure that may provide additional protection against corrosion of the blade retention components.

CAUTION: DO NOT GET SEALANT CM93 ONTO THE CLAMP, WHERE BALANCE WEIGHTS AND DE-ICE HARDWARE ARE INSTALLED.

(2) After doing an examination for blade slippage in the clamp, fill the external void at the blade/blade clamp interface with a 0.25 inch (6.3 mm) maximum bead of sealant CM93, around the entire circumference of blade, as shown in Figure 7-30.

(3) Let the sealant CM93 cure for a minimum of two hours, before returning the propeller to service.

N. Final Inspection of the Reassembled Propeller

(1) Use a Checklist, such as the appropriate Propeller Assembly Inspection Check-off Form, for final inspection of the reassembled propeller.

(a) Make sure that propeller static balance has been accomplished. Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(b) Measure the blade track. Refer to Figure 7-16.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

1 Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

2 If all blades do not track:

a Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

b A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(c) Measure each blade tip for end play (leading edge to trailing edge).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(d) Measure each blade tip for end play (fore-and-aft).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(e) Measure the radial play in each blade.

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(f) Measure blade pitch settings.

1 For the applicable blade pitch settings associated tolerance, and the reference blade radius specified for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

O. Label Replacement

(1) Refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) for information and label usage.

P. Reassembly of a Propeller Disassembled for Shipment

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

Q. Propeller Balance

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

R. Propeller Lubrication

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

5. Assembly of Propeller Models HC-A3(MV,V)F-5A(L)

A. Blade Installing Parts Assembly

(1) Install the spinner bulkhead around the rotatable fixture.

(2) Using washers (2450) and installing bolts (2440) install the hub unit (2300) on the rotatable fixture TE125 on the assembly table TE129.

CAUTION 1: BEARING RACES (240, 300) MUST BE MATCHED SETS.

CAUTION 2: THE INTERNAL RECESS OF THE BEARING RETAINING RING (280) MUST FACE OUTBOARD WHEN THE BEARING RETAINING RING IS SLIPPED OVER THE BLADE ARM FLANGE OF THE HUB UNIT (2300).

(3) Using a light mallet and Press Tool TE308, or equivalent, as shown in Figure 7-1, install a bearing retaining ring (280) onto one blade arm flange of the hub unit (2300).

(a) Install the bearing retaining ring (280) far enough onto the blade arm flange so that the bearing retaining ring forms a narrow channel on the inboard surface of the flange.

(4) Repeat this bearing retaining ring (280) installation procedure for all the other blade arm flanges on the hub unit.

(5) Using lubricant CM12, lightly grease the inboard surface of each blade arm flange.

(6) Put the halves of an outboard side race (300) (matched set) in position over one hub arm.

(7) Visually examine the fit of the outboard side race to the hub arm.

(a) The outboard side race (300) must rest tightly against the seating area on the hub arm, with no "rocking" action evident.

(b) The outboard side race (300) halves must fully contact each other at the parting surfaces.

(c) Replace the outboard side race (300) if it does not fit correctly.

NOTE: The break-line for the outboard side race (300) must be vertical to the table top.

(8) Using a combination of press tool TE308 and retention bearing puller TE108, or equivalent, press the bearing retaining ring (280) far enough onto the outboard side race (300) to position the wire ring retainer (290) in the groove in the blade arm flange. Refer to Figure 7-1.

(9) Install the wire ring retainer (290).

(10) Using a combination of press tool TE308 and retention bearing puller TE108, or equivalent, with bearing retaining ring A-972, pull the bearing retaining ring (280) outboard far enough to position the wire ring retainer (290) in the wire retention groove in the bearing retaining ring (280). Refer to Figure 7-1.

CAUTION: THE WIRE RING RETAINER (290) MUST BE FULLY ENCLOSED TO MAKE SURE IT IS NOT PINCHED.

(11) Visually examine to make sure that the wire ring retainer (290) is fully enclosed.

(12) Using lubricant CM12, lubricate the blade O-ring (270).

(13) Move the O-ring (270) over the blade arm flange of the hub unit (2300) to a location inboard of the outboard side race (300).

(a) Leave the O-ring position for use later in the reassembly.

(14) For the remaining hub arms, repeat steps (3) through (13) of this procedure.

CAUTION: DURING THE FOLLOWING PROCEDURES, THE BLADE ARM ON WHICH A RETENTION BEARING IS GOING TO BE ASSEMBLED MUST BE SUPPORTED VERTICALLY WITH THE PILOT TUBE FACING DOWN.

(15) Remove the hub unit (2300) from the rotatable fixture on the assembly table and use press tool TE308, or an appropriate fixture, to hold the unit vertical during the next stages of blade retention split-bearing assembly. Refer to Figure 7-5.

CAUTION 1: THE PARTING LINE OF THE INBOARD BEARING RACE (240) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE BLADE CLAMP HALVES (1610).

CAUTION 2: ANY GAP BETWEEN THE HALVES OF BEARING RACES (240 AND 300) MUST NOT BE GREATER THAN 0.001 INCH (0.02 mm).

CAUTION 3: ALL BEARING BALLS (250) INSTALLED IN A SINGLE OUTBOARD SIDE RACE (300) MUST BE OF THE SAME GAUGE. BEARING BALLS SUPPLIED BY HARTZELL PROPELLER INC. ARE OF THE SAME GAUGE.

(16) Install the ball bearing spacer (260) and the required number of bearing balls (250) onto the outboard bearing race (300).

CAUTION: EXCESSIVE USE OF SEALANT CM93 COULD CAUSE UNEVEN SEATING BETWEEN THE CLAMP ASSEMBLY (1600) AND BEARING RACE (240).

(17) Apply a slight amount of sealant CM93 to the chamfered edges (break point) of the matched set of inboard bearing races (240).

(18) Remove any excess sealant that may come out into the bearing area when the bearing race halves are joined.

(19) Put the inboard bearing race halves (240) around one blade arm of the hub unit (2300).

CAUTION: THE OPENING OF THE WIRE RING RETAINER (230) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE INBOARD BEARING RACE.

(20) Install the wire ring retainer (230) to hold the halves in position.

(21) Move the O-ring (270) outboard against the inboard bearing race (240).

(22) Using self-adhesive stretch wrap, wrap the outside diameter of the bearing assembly to hold the parts in position.

(23) For the remaining hub arms, repeat assembly procedure steps (16) through (22) of this procedure.

(24) Install the hub (2300) on the rotatable fixture of the propeller assembly table.

B. Clamp Assembly - Refer to Figure 7-11

(1) For clamp assembly procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) For information about the correct counterweight slugs and installing hardware, refer to the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59).

CAUTION: A LINK ARM (140) CANNOT BE INSTALLED AFTER THE CLAMP (1600) HAS BEEN INSTALLED ON THE HUB.

(3) After each clamp (1600) is assembled:

(a) Install the link screw sleeve (145) into the large hole of the link arm (140), from the side of the link arm that faces away from the clamp half (1600).

NOTE: The flange of the sleeve (145) faces inboard.

(b) Install the link arm bushing (210) onto the linkscrew (1640) between the link arm (140) and the blade clamp (1600).

NOTE: The raised shoulder of the link arm (140) must face the blade clamp (1600).

(c) Push the cotter pin (330) through the hole in the end of the linkscrew (1640) and open the cotter pin to install the link arm (140) to the clamp assembly (1600).

1 The link arm (140) must move freely on the linkscrew (1640).

(d) Open the cotter pin (330) to secure it in position.

NOTE: The link arm (140) must move freely on the link screw (1640).

(e) Repeat this procedure for each remaining clamp assembly (1600).

(4) When adjusting the pitch range of some propeller assemblies, the linkscrew may contact the hub. When this happens, the full blade angle range cannot be achieved. Refer to the section, "Repair of the A-304 Linkscrew" in the Repair chapter in this manual.

C. Blade and Clamp Installation

(1) Install the hub unit (2300) on the rotatable fixture TE125 on the assembly table TE129.

(2) For instructions about aluminum blade balancing and all other overhaul or repair procedures, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: IF POSSIBLE, EACH BLADE MUST BE REINSTALLED ON THE HUB ARM FROM WHICH IT WAS REMOVED AT DISASSEMBLY.

(3) As specified in the Disassembly Procedure, each blade must have an identifying number to make sure of correct assembly.

(4) Stand blade one in vertical position (shank up, tip down) and fill the pilot tube cavity with lubricant CM12 to the top of the bottom blade needle bearing.

WARNING: AIR TRAPPED IN THE GREASE CAN AFFECT PROPELLER BALANCE AFTER RUN-UP.

(5) After making sure that no air is trapped in the grease, move the blade onto the pilot tube (2310). Push the blade toward the center of the hub until the butt of the blade shank makes contact with the face of the blade arm.

NOTE: A slight amount of grease will be squeezed out around the pilot tube (2310) if the blade has been lubricated correctly.

(6) For the remaining blades, repeat steps (3) through (5) of this procedure.

CAUTION: USE HARDENING GASKET COMPOUND CM46 ON THE SHOULDER RADIUS OF THE BLADE SHANK, THE OUTER DIAMETER OF THE BLADE SHANK, AND THE OUTER CORNER OF THE BLADE BUTT. REFER TO FIGURE 7-12.

(7) Using an acid brush or finger, optionally wearing non-powdered latex gloves, apply a smooth even layer of gasket compound CM46 on the shoulder radius of the blade shank in the area where it touches the blade clamp, the outer diameter of the blade shank and the outer corner of the blade butt. Refer to Figure 7-12.

(a) Before installing a clamp, make sure the shoulder radius of the blade shank, the outer diameter of the blade shank and the outside corner of the blade butt are completely covered by a smooth even layer of gasket compound CM46. Refer to Figure 7-12.

(b) Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(8) Remove the self-adhesive stretch wrap that was used to temporarily hold the blade races (240, 300) together.

CAUTION: THE PARTING LINE OF THE BLADE CLAMP-HALVES (1610) MUST BE AT A 90 DEGREE ANGLE TO THE PARTING LINE OF THE INBOARD BLADE RACES (240) AND IN LINE WITH THE OUTBOARD BLADE RACE (300).

(9) Apply a small bead of sealant CM93 to both blade clamp halves (1610) on a part of the mating surface in the inboard bearing radius, as shown in Figure 7-14.

NOTE: Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(a) On the blade clamp mating surfaces, the sealant supplements the sealing of the inboard end of the blade clamp gaskets (1700).

(b) Between the blade clamp (1610) and inboard blade thrust split bearing (240), use the sealant to fill the void from the beveled edge of the bearing outside diameter.

(10) Optionally, put a small bead of sealant CM93 on a part of the mating surfaces Area "C" and Area "D" on both clamp halves. Refer to Figure 7-14 and Figure 7-15.

NOTE: The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is optional. This step is highly recommended for agricultural aircraft, and is recommended for other Hartzell Propeller Inc. steel hub propeller models.

(a) The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is an optional procedure. Application of CM93 to the clamp mating surfaces may cause the gasket to slip out of position. Refer to Figure 7-14 and Figure 7-15.

(11) Install the matching blade clamp half (1610) to which the counterweight (1630) is attached.

(12) Install the other blade clamp half.

CAUTION: A MAXIMUM OF 0.06 INCH (1.5 mm) OF GASKET MATERIAL MUST BE EVENLY EXPOSED THROUGH THE PARTING LINE ON EACH SIDE OF THE CLAMP ASSEMBLY (1600). THE GASKET (1700) MAY REQUIRE TRIMMING TO PROVIDE METAL-TO-METAL CONTACT WHERE THE CLAMP LUGS MEET.

(13) Put a new gasket (1700) between each of the blade clamp half parting surfaces.

(14) Install the bolts (1710) into the outboard clamp position.

CAUTION: DO NOT TORQUE THE BOLTS (1710) AT THIS TIME.

(15) Install the washers (1720) and attach them with self-locking nuts (1730) onto the bolts (1710).

(a) Finger tighten the self-locking nuts (1730).

NOTE: This step helps align the blade clamp gasket (1700), but the bolts (1710) must not be torqued at this time.

(16) Install the socket screws (1690) into the clamp holes that are in the inboard position.

CAUTION 1: THE SOCKET SCREWS (1690) MUST BE TORQUED IN THE SEQUENCE SPECIFIED.

CAUTION 2: DO NOT EXCEED THE RECOMMENDED TORQUE ON THE SOCKET SCREWS (1690).

(17) Using a 5/16 inch Allen wrench, torque the socket screws (1690) in 10 Ft-Lb (14 N·m) increments (10, 20, etc.) in accordance with Table 8-1, "Torque Values", alternating between screws at each increment.

(18) Measure the blade track.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

(a) Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

(b) If all blades do not track:

1 Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

2 A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: DO NOT CONTACT THE INNER BLADE CLAMP HALF (1610) WHILE DRILLING TO SAFETY THE SOCKET SCREWS (1690).

(19) Using a #42 (0.094 inch [2.37 mm]) size bit, drill the head of each socket screw (1690).

(20) Safety wire each socket screw (1690) with a cotter pin (1680) so that the cotter pin contacts the clamp half (1610) and prevents the socket screw from backing out of the clamp assembly (1600).

NOTE: Do not safety the socket screws (1690) if blades will be removed to facilitate shipment of the propeller.

(a) If an installed cotter pin (1680) causes interference, three loops of 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131 may be used to safety the socket screw (1690).

(21) For the remaining blades, repeat steps (7) through (20) of this procedure.

(22) Install weight slugs on the clamp counterweight arms, if applicable. Refer to Hartzell Propeller Inc. Application Guide 159 (61-02-59) for specific weight slug information.

(23) Using bolts (1110) and washers (1120) attach the start lock plate (1100) on the inboard side of each lower clamp half (1610).

(a) There must be clearance between the OD of the start lock plate (1100) and the spinner mounting plate (85) or bulkhead.

(b) There must also be clearance between the start lock (1200) and the head of the socket screw (1690).

(c) Washers may be installed between the start lock plate (1100) and clamp assembly (1600) to reposition the start lock plate and improve interface with the start lock.

(24) Torque the hex head bolts (1110) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(25) Safety the start lock plate hex head bolts (1110) with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

(26) For the remaining blades and clamps (1600), repeat assembly procedure steps (22) through (25) of this procedure.

D. Guide Collar and Cylinder Installation

(1) Using solvent CM106, clean the threads on the hub unit (2300) and cylinder (190).

CAUTION: THE CHAMFERED SIDE OF THE GUIDE COLLAR UNIT (1550) MUST SEAT AGAINST THE SHOULDER OF THE CYLINDER (190). TO GET PROPER HUB CLEARANCE, THE LARGER INSIDE DIAMETER OF THE GUIDE COLLAR MUST FACE THE HUB UNIT (2300).

(2) Install the cap screw (1570) into the guide collar unit (1550).

(3) Install the guide collar unit (1550) onto the smaller diameter shoulder of the cylinder (190).

(a) The chamfer in the guide collar (1550) must face the flange on the cylinder (190).

(b) Do not torque the guide collar socket screw (1570) at this time.

CAUTION 1: DO NOT APPLY HYDRAULIC SEALANT ADHESIVE COMPOUND CM134 TO THE THREADS OF THE CYLINDER (190).

CAUTION 2: DO NOT GET HYDRAULIC SEALANT CM134 IN THE CYLINDER (190). CONTAMINATION TO THE AIRCRAFT ENGINE OIL SYSTEM COULD OCCUR.

(4) Using hydraulic sealant CM134, apply a bead of sealant in the groove of the hub unit (2300) where the cylinder O-ring (200) fits.

(5) Install the O-ring (200) into the chamfer in the cylinder (190).

(6) Hand tighten the cylinder (190) and the guide collar unit (1550) if applicable, onto the hub unit (2300).

(7) Using a bar of appropriate size to fit the slot in the top of the cylinder (190), tighten the cylinder flush against the hub unit (2300).

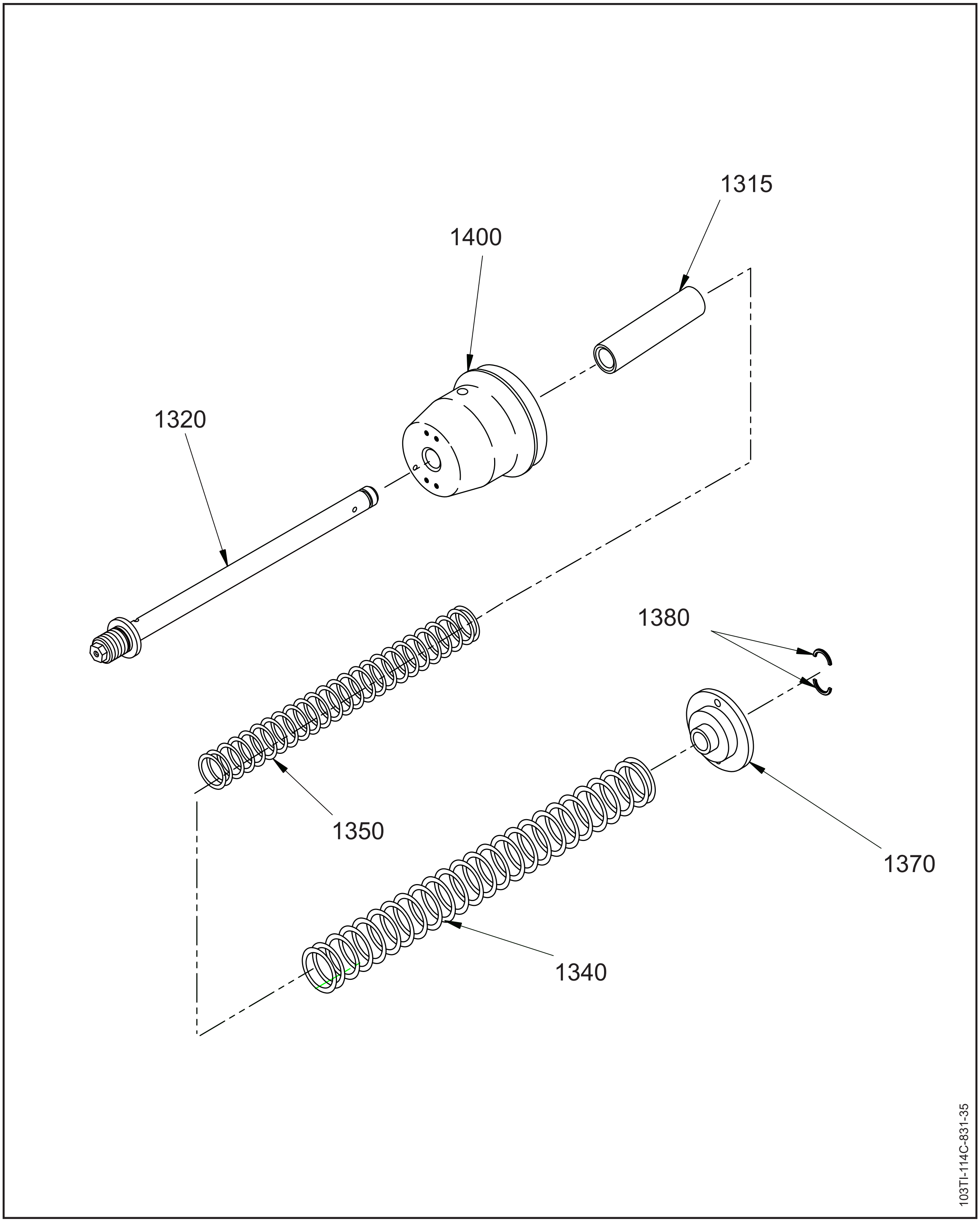
NOTE: Early drag and tightness is caused by the O-ring (200), which acts as a seal and safety.

(8) Torque the cylinder (190) against the shoulder of the hub unit (2300). Refer to the Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

CAUTION 1: VISUALLY EXAMINE THE INSIDE OF THE CYLINDER (190) TO MAKE SURE THAT THE O-RING (200) HAS NOT BEEN MOVED OUT OF PUT DURING THE CYLINDER INSTALLATION PROCEDURE.

CAUTION 2: VISUALLY EXAMINE THE SLOT IN THE TOP OF THE CYLINDER (190) TO MAKE SURE THE SQUARE-BAR WRENCH USED FOR TORQUING DID NOT RAISE ANY SHARP EDGES OR DAMAGE THE TURNS.

(9) Remove any sharp edges in the wrench slot on top of the cylinder (190).



831-35 Spring Assembly
Figure 7-34

E. Assembly of the 831-35 Spring Assembly - Refer to Figure 7-34

(1) Move the spring retainer cup (1400) onto the pitch change rod (1320).

(2) Move the spacer tube (1315) onto the pitch change rod (1320).

(3) Move the spring (1350) onto the pitch change rod (1320).

(4) Move the spring (1340) over the spring (1350) and onto the pitch change rod (1320).

(5) Put the rear spring retainer (1370) on the spring (1340, 350).

(6) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent.

(7) Compress the spring assembly (1300) enough to install the rear split keeper (1380) into the groove in the pitch change rod (1320).

(8) Apply oil or grease to each half of the rear split keeper (1380) to hold it in position until the spring (1340) is decompressed.

WARNING: WHEN COMPRESSED, THE SPRING ASSEMBLY (1300) IS LOADED TO APPROXIMATELY 1000 POUNDS (454 KG) FORCE. MAKE SURE OF THE SAFETY OF EVERYONE IN THE AREA DURING ASSEMBLY PROCEDURES.

(9) Carefully release the pressure on the spring assembly (1300).

(10) Before removing the spring assembly from the spring compressor fixture TE59, or equivalent, make sure that both rear split keeper halves (1380) are in the groove in the pitch change rod (1320), and installed by the rear spring retainer (1370).

F. Feathering Spring Assembly Installation

(1) Apply a layer of anti-seize compound CM118 to the Turns of the spring retainer cup (1400).

(2) Install the feathering spring assembly into the cylinder (190).

(3) Using the special spanner wrench TE148 or locally procured strap wrench, turn the feathering spring assembly (1300) into position in the cylinder (190).

(4) Tighten the assembly until it is snug.

(5) Put the retaining ring (165) on the spring retaining cup (1400) with the chamfer against the spring cup.

(6) Use four fillister head screws (170) to install the retaining ring (165).

(7) Safety wire each fillister head screw (170) with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

(8) Using a #42 size bit, drill through the flange of the spring retainer cup (1400) at the wrench slot in the cylinder (190).

(a) Drill in and down at an angle that exits on the other side of the flange.

(9) Install a 0.032 inch (0.81 mm) minimum diameter stainless steel wire CM131 through the drilled hole.

(a) Using three loops of wire, safety the feathering spring assembly (1300).

(b) Put the “pigtail” into the slotted area.

CAUTION: ENGINE OIL ENTERS THIS AREA OF THE ASSEMBLY. MAKE SURE ALL BITS OF METAL FROM DRILLING AND SAFETY WIRING ARE REMOVED.

(10) Install four feathering stop screws (1540) in the spring retainer cup (1440).

(a) Turn the feathering stop screws all the way in; then, back them out approximately three turns to an even height.

(11) Safety the feathering stop screws (1540) with 0.032 inch (0.81 mm) minimum diameter stainless steel wire CM131. Later in the build process, adjustment of the screws to obtain the correct feathering angle may be required.

G. Piston Installation

NOTE: Refer to Figure 7-20 for the installation and orientation of components installed in the piston (1500) and dust seal length.

(1) Using lubricant CM12, lubricate the pitch change rod O-ring (150).

(2) Carefully install the pitch change rod O-ring (150) in the groove provided for it in the pitch change rod (1320).

(3) Using lubricant CM12, lubricate the piston O-ring (1535).

(4) Carefully install the piston O-ring (1535) in the groove provided for it in the piston (1500).

CAUTION: MAKE SURE THAT THE FELT PISTON DUST SEAL (1530) IS FUZZ-FREE.

(5) Cut the piston dust seal material (1530) to length on a 30 degree diagonal so there is an overlap at the parting line with a smooth, fuzz-free surface.

(a) If the piston dust seal (1530) has fuzz or long strands that could interfere with the operation of the O-ring, replace the piston dust seal.

(6) Soak the piston dust seal (1530) in aviation grade engine oil until it is completely saturated.

(a) Squeeze the excess oil from the piston dust seal (1530).

CAUTION: MAKE SURE THAT THE DIAGONAL OVERLAP OF THE FELT PISTON DUST SEAL (1530) REMAINS VISIBLE AND DOES NOT ROTATE TO ITS SIDE AS IT IS INSTALLED IN THE GROOVE OF THE PISTON (1500).

(7) Install the thinnest section of the piston dust seal (1530) in the remaining piston OD groove.

(8) Move the piston (1500) into put over the cylinder (190) and through the holes in the guide collar (1550).

(9) Apply a thin layer of anti-seize compound CM118 in the hole of the free end of each link arm (140).

(10) Install the free end of each link arm (140) in the slot provided in the piston (1500).

CAUTION: MAKE SURE THAT THE CORRECT SAFETY SCREW (130) IS INSTALLED AND THAT SUFFICIENT TURNS ARE AVAILABLE IN THE PISTON UNIT (1500) TO HOLD THE SCREW IN POSITION. AT LEAST THREE TURN LENGTHS MUST BE ENGAGED. DO NOT BIND THE LINK ARM.

(11) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(12) Push each link pin unit (120) flush with the piston (1500) ear.

(13) Install each link pin unit (120) with a fillister head screw (130).

(a) Torque the fillister head screw (130) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(14) Put the guide collar unit (1550) solidly against the cylinder (190) at the correct radial location to align the guide rods (1520).

(15) When the necessary alignment is correct, use an Allen wrench with torque wrench adapter to tighten the socket head cap screw (1570) in the guide collar unit (1550). Refer to the Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(16) Install screw (1565), washer (1555), and nut (1575) in the threaded end of each guide rod.

(a) Torque the screw (1565) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

CAUTION: FOR SETUP PURPOSES ONLY, USE A NON-LOCKING NUT ON THE END OF THE PITCH CHANGE ROD AS AN ALTERNATIVE TO THE SELF-LOCKING HEX NUT (110). THE NON-LOCKING NUT MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110) AFTER FEATHER ANGLES ARE CORRECT.

(17) Move the piston (1500) into full feathered position (back against the hub assembly) so that the threaded end of the pitch change rod (1320) extends through the end of the piston (1500).

(18) Turn the self-locking hex nut (110) onto the end of the pitch change rod (1320).

(19) Use a wrench on the self-locking hex nut (110) and socket on the pitch change rod (1320) to torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

WARNING: THE COUNTERWEIGHT (1630) MUST HAVE A POSITIVE ANGLE WITH REFERENCE TO THE PROPELLER CENTERLINE WHEN THE PISTON IS IN FULL REVERSE POSITION TO PREVENT THE PROPELLER FROM “STICKING” IN REVERSE. REFER TO FIGURE 7-26.

CAUTION 1: AT THIS STAGE OF PROPELLER ASSEMBLY THE BOLTS (1710) HAVE NOT BEEN TIGHTENED, BECAUSE ADJUSTMENTS OF COUNTERWEIGHT ANGLE AND BLADE PITCH USUALLY INVOLVE SOME DISASSEMBLY PROCEDURE.

CAUTION 2: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

H. Setting Counterweight Angle

(1) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table to move the piston to full reverse position.

(2) Using a hand-held protractor TE97, or equivalent, measure the angle of counterweight relative to the axis of the piston. Refer to Figure 7-24.

(a) For the specific counterweight angle required, refer to the applicable aircraft specifications manual or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) As indicated in Figure 7-24, the positive angle, usually 2 degrees, is for reference only. Do not consider it for the prescribed angle.

CAUTION: THE LENGTH OF THE SPRING SPACER TUBE REQUIRED AT ASSEMBLY MAY BE THE SAME AS THE LENGTH OF THE SPACER REMOVED AT DISASSEMBLY. IF THE SPACER IS ADDED AT ASSEMBLY, USE THE CORRECT LENGTH SPECIFIED FOR THE REQUIRED CHANGE IN ANGLE.

(3) If it is necessary to adjust the counterweight angle, replace the spring spacer tube (1315) between the rear spring retainer (1370) and the spring retainer cup (1400) with a next-size-longer or shorter spacer to change the angle.

CAUTION: DO NOT CONFUSE BLADE STATION WITH REFERENCE BLADE RADIUS. BLADE STATION AND REFERENCE BLADE RADIUS OF THE SAME NUMBER MAY NOT ALWAYS INDICATE THE SAME LOCATION ON THE BLADE.

I. Establishing Reference Blade Radius

(1) Reference blade radius is measured from the center of the propeller hub to a predetermined reference location on the blade for blade angle measurement.

(2) Blade stations are used during the repair or overhaul process of a blade to define a blade span location for dimensional measurement.

(3) Establish a reference blade radius location.

(a) For the reference blade radius location specified for the applicable aircraft installation, refer to the Aircraft Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) Beginning with blade one, measure from the center of the propeller hub to the reference blade radius location specified. Refer to Figure 7-25.

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.

(c) Using a crayon or soft, non-graphite pencil CM162 or equivalent, mark a line perpendicular to the blade centerline.

(d) Repeat this procedure for each remaining blade.

J. Setting Reverse Angle of Blades

CAUTION: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

(1) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table to move the propeller to reverse pitch position.

(2) Using a bench-top protractor TE96 and special riser fixture TE48, or equivalent, measure the reverse angle on blade one at the reference blade radius specified in the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59). Refer to Figure 7-26.

NOTE: For the specific requirements for reverse blade angle tolerance at reverse blade angle, refer to the applicable Refer to the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(3) Rotate the blade in the clamp (1600) to obtain the correct reverse blade angle.

(4) Use a clamp nut wrench TE142, or equivalent, to hold the self-locking nut (1730) and a standard 12-point socket to torque the bolts (1710) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(a) While torquing the bolts (1710), make sure gasket (1700) position is kept in order to provide a sufficient grease seal.

(b) Make sure a nearly equal gap between the two halves is kept after final torque is applied.

(5) Repeat this reverse angle setting procedure for each of the other blades.

(6) Measure the blade-to-blade reverse angle variance at the reference blade radius, and readjust the blade reverse angles if they are not within tolerance.

(a) A blade-to-blade tolerance is applicable when setting the reverse blade angle.

(b) A blade-to-blade tolerance is also applicable when setting the low pitch and feather blade angle.

(c) It is recommended that a minimum blade-to-blade tolerance be met in the reverse blade angle. This will make sure of the best opportunity to meet all blade angle tolerance requirements for each propeller.

(7) Cycle the propeller from reverse to feather, and back to reverse to confirm the correct blade angle setting and counterweight angle.

(8) Confirm that the reverse blade angle settings and counterweight angle are correct.

(9) If the counterweight angle is incorrect, remove and disassemble the spring assembly (1300) in order to add or remove the spring spacer tube (1315) as needed to achieve the correct counterweight angle.

(a) If necessary, reset the reverse and feather angles after adjusting the counterweight angle.

K. Setting Feathering Angle of Blades

(1) Release the air pressure to the rotatable fixture.

(2) Using a hand-held protractor TE97, or equivalent, measure the feathering angle on blade one at the reference blade radius specified in the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(a) For the specific feathering angle, blade-to-blade tolerance at feather blade angle, and reference blade radius required, refer to the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: BEFORE REMOVING THE PISTON, MARK A PISTON EAR WITH A GREASE PENCIL CM162, AND MATCH MARK THE GUIDE COLLAR TO MAKE SURE THAT THE PISTON IS REINSTALLED IN THE SAME POSITION.

(3) Adjust the feather angle, as necessary, by removing the piston and turning the fillister head screws (1540).

(a) Using a special wrench TE144-1 or equivalent, and a one inch (25.4 mm) socket wrench, remove the non-locking nut on the end of the pitch change rod (1320).

(b) Rotate the blades by hand from feather to reverse.

(c) Remove all of the link pin units (120).

(d) Disconnect the link arms (140) from the piston unit (1500).

(e) Remove the piston unit (1500).

(f) Adjust the feather angle as necessary.

NOTE: Turning the fillister head screw (1540) in one turn will increase the feathering angle approximately 1.5 degrees. Turning the fillister head screw out one turn will decrease the feathering angle approximately 1.5 degrees.

(g) Using 0.032 inch (0.82 mm) minimum diameter stainless steel wire CM131, safety the fillister head screws (1540).

(h) Move the piston (1500) into position over the cylinder (190).

(i) Align the piston installed guide rods with the bushings in the guide collar (1550).

(j) Install the free end of each link arm (140) in the slot provided for it in the piston (1500).

(k) Apply anti-seize compound CM118 to the pin shaft of the link pin unit (120).

(l) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(m) Push each link pin unit (120) flush with the piston (1500) ear.

CAUTION: THE NON-LOCKING NUT THAT WAS USED ON THE END OF THE PITCH CHANGE ROD DURING THE BUILDUP PROCESS MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110).

(4) Install the self-locking hex nut (110) on the end of the pitch change rod (1320).

(5) Measure the feather blade angle of all the blades, and adjust as necessary.

(6) Using a 1-13/16 inch crowfoot wrench on the self-locking hex nut (110), and a one inch (25.4 mm) socket on the pitch change rod (320), torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(7) Measure the blade-to-blade tolerance at the feather blade angle and correct as needed.

L. Measuring Blade-to-Blade Angle Tolerance

CAUTION: THE ANGLE OF ALL BLADES AT FLOATING PITCH MUST BE WITHIN A TOLERANCE OF 0.2 DEGREE TOTAL.

(1) After the feathering angle of all blades is set, Measure to make sure the blade-to-blade angle tolerance at a floating pitch angle is established within tolerance.

(2) With the propeller assembly still installed on the rotatable fixture of the assembly table, apply air pressure to the piston until blade number one attains a floating pitch position between 20 degrees - 25 degrees.

(3) Measure the pitch angle of each of the other four blades.

(4) If necessary to attain tolerance, follow the reverse pitch angle setting procedure.

(a) After resetting any blade angle:

1 Measure the blade-to-blade angle tolerance

2 Measure the reverse blade angle and tolerance

3 Measure the feather angles and tolerance

M. Start Lock Units

(1) Start Lock Unit Reassembly

(a) Install the pin (1240) into the start lock bracket (1250).

(b) Install the spring (1230) into the start lock bracket (1250) against the pin (1240).

(c) Compress the spring (1230), install the washer (1220) on top of the spring (1230), and install the cotter pin (1210) into the bracket (1250) to retain the washer, spring, and pin in the bracket.

(d) Install the cotter pin (1210).

(e) Retract the pin (1210) and hold in position with wire installed in the hole in the bracket (1250) body.

NOTE: The pins will be released later for adjustment of the start lock angle. The pins are now retracted to aid assembly.

(2) Spinner Bulkhead Installation

(a) Using a suitable sling and overhead hoist, lift the propeller assembly from the rotatable fixture to a vertical position.

(b) Using bolts (1080) and washers (1040) attach spinner bulkhead to the hub unit (2300).

(c) Torque the bolt (1020) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(d) Return the propeller assembly to the rotatable fixture on the assembly table.

(3) Start Lock Installation

(a) Position each start lock unit (1200) over the installing holes in the spinner bulkhead.

(b) Using bolts (1020), washers (1040) and nuts (1090) attach the start lock unit (1200) to the bulkhead. Do not tighten at this time.

N. Measuring Start Lock Angle

(1) Install the start lock unit (1200), attaching the hex head bolts (1080, 1020).

(2) Torque the hex head bolts (1080, 1020) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(3) Apply air pressure to position the propeller to full reverse.

(4) Release the pressure and let the blades turn to the start lock position.

(5) Measure the start lock angle.

(a) For the specified start lock angle specifications and tolerances, refer to the Hartzell Propeller Inc. Application Guide.

(6) Measure all blades to make sure they are within 0.2 degree of each other.

(7) At this time, if adjustments are required for the start lock angle, do the following:

(a) Remove material from the notched area of the start lock plate(s) (1100), as necessary, to obtain the correct blade angle.

(b) Paint the notched area of the start lock plate (1100), where material was removed, using paint CM67 to protect that area from corrosion.

(8) Make sure there is correct contact between the start lock plate (1100) and start lock pin (1240).

(9) Make sure there is no contact between the start lock bracket (1250) and the clamp (1600).

(10) If contact is found between the start lock bracket (1250) and the clamp (1600):

(a) Using an abrasive pad CM47 or equivalent, polish the contact area to remove no more than 0.020 inch (0.50 mm) of material.

(b) Chemical conversion coat in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

CAUTION 1: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS SECTION.

CAUTION 2: WHEN A BLADE ANGLE IS SET OR MEASURED, MANUALLY ACTIVATE THE ASSEMBLY AWAY FROM THE REVERSE PITCH POSITION TO SEAT THE BLADE AND BLADE CLAMP PARTS AND TO REMOVE PLAY FROM THE ASSEMBLY.

O. Setting Start Lock Blade Angle

(1) Release each pin (1240) in the start lock bracket (1250) to get engagement with the start lock plates (1100) on the inboard side of each clamp (1600).

(2) Use bench-top protractor at the reference blade radius specified in the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59), to adjust start lock blade angle.

NOTE: Refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59), for the specific angle required.

(3) Filing a start lock plate (1100) to adjust the start lock angle is permitted. Zinc Chromate Primer CM67 must be applied to the area of the start lock where material was removed.

P. Providing for Visual Detection of Blade Slippage in Clamp

(1) With the propeller still installed on the rotatable fixture of the propeller assembly bench, use the following procedure to detect slippage between the blade shank and the clamp assembly (1600).

CAUTION: DO NOT USE A PUNCH OR SCRIBE A LINE ON THE BLADE SHANK. THIS COULD START A CRACK IN THE BLADE.

(a) Put a strip of red plastic tape down the shank and across the clamp (1600) of blade number one as shown in Figure 7-28.

(b) Carefully cut the tape along the line where the blade and clamp (1600) assembly meet.

(c) Repeat this procedure on each remaining blade assembly.

CAUTION: DO NOT PUT THE PADDED BLADE BAR IN THE AREA OF THE DE-ICE BOOT WHEN TORQUING A BLADE ASSEMBLY. PUT THE BAR IN THE THICKEST AREA OF THE BLADE, JUST OUTBOARD OF THE DE-ICE BOOT. USE ONE BLADE BAR FOR EACH BLADE.

(d) Using a padded blade bar, as shown in Figure 7-29, apply torque to each blade assembly to move each blade toward low pitch in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(e) Measure blade angles in accordance with the instructions in this chapter.

(f) If it is necessary to correct blade slippage, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(g) After confirming that there is no slippage, spray each piece of tape with clear protective spray CM129 to provide a clear protective coating.

CAUTION 1: TO AVOID CAUSING PERMANENT DAMAGE TO THE BLADE RETENTION COMPONENTS BY TRAPPED CHEMICALS, THE FOLLOWING PROCEDURE MUST ONLY BE PERFORMED FOLLOWING ASSEMBLY OF A PROPELLER AFTER OVERHAUL OR OTHER PROCEDURE INVOLVING DISASSEMBLY AND CLEANING OF THE PROPELLER BLADE RETENTION COMPONENTS.

CAUTION 2: THIS PROCEDURE MUST ONLY BE PERFORMED ON PROPELLERS THAT HAVE EXPERIENCED DISASSEMBLY AND CLEANING OF BLADE RETENTION COMPONENTS.

Q. External Sealant CM93 Application

(1) The application of sealant CM93 to the blade/blade clamp interface is an optional procedure that may provide additional protection against corrosion of the blade retention components.

CAUTION: DO NOT GET SEALANT CM93 ONTO THE SURFACE OF THE CLAMP, WHERE BALANCE WEIGHTS AND DE-ICE HARDWARE ARE INSTALLED.

(2) After doing an examination for blade slippage in the clamp, fill the external void at the blade/blade clamp interface with a 0.25 inch (6.3 mm) maximum bead of sealant CM93, around the entire circumference of blade, as shown in Figure 7-30.

(3) Let the sealant CM93 cure for a minimum of two hours, before returning the propeller to service.

R. Final Inspection of the Reassembled Propeller

(1) Use a Checklist, such as the appropriate Propeller Assembly Inspection Check-off Form, for final inspection of the reassembled propeller.

(a) Make sure that propeller static balance has been accomplished. Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(b) Measure the blade track. Refer to Figure 7-16.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

1 Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

2 If all blades do not track:

a Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

b A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(c) Measure each blade tip for end play (leading edge to trailing edge).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(d) Measure each blade tip for end play (fore-and-aft).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(e) Measure the radial play in each blade.

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(f) Measure the blade pitch settings.

1 For the applicable blade pitch settings associated tolerance, and the reference blade radius specified for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

S. Label Replacement

(1) Refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) for information and label usage.

T. Reassembly of a Propeller Disassembled for Shipment

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

U. Propeller Balance

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

V. Propeller Lubrication

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

6. Assembly of Propeller Models (P)HC-A3(MV,V)F-5R

A. Blade Installing Parts Assembly

(1) Install the beta ring (50) around the rotatable fixture and lay it on the propeller assembly table with the threaded bosses facing away from the table.

(2) Using studs (2445), washers (2450) and nuts (2455) install the hub unit (2300) on the rotatable fixture TE125 on the assembly table TE129.

CAUTION 1: BEARING RACES (240 AND 300) MUST BE MATCHED SETS.

CAUTION 2: THE INTERNAL RECESS OF THE BEARING RETAINING RING (280) MUST FACE OUTBOARD WHEN THE BEARING RETAINING RING IS SLIPPED OVER THE BLADE ARM FLANGE OF THE HUB UNIT (2300).

(3) Using a light mallet and Press Tool TE308, or equivalent, as shown in Figure 7-1, install a bearing retaining ring (280) onto one blade arm flange of the hub unit (2300).

(a) Install the bearing retaining ring (280) far enough onto the blade arm flange so that the bearing retaining ring forms a narrow channel on the inboard surface of the flange.

(4) Repeat this bearing retaining ring (280) installation procedure for all the other blade arm flanges on the hub unit.

(5) Using lubricant CM12, lightly grease the inboard surface of each blade arm flange.

(6) Put the halves of an outboard side race (300) (matched set) in position over one hub arm.

(7) Visually examine the fit of the outboard side race to the hub arm.

(a) The outboard side race (300) must rest tightly against the seating area on the hub arm, with no "rocking" action evident.

(b) The outboard side race (300) halves must fully contact each other at the parting surfaces.

(c) Replace the outboard side race (300) if it does not fit correctly.

NOTE: The break-line for the outboard side race (300) must be vertical to the table top.

(8) Using a combination of press tool TE308 and retention bearing puller TE108, or equivalents, press the bearing retaining ring (280) far enough onto the outboard side race (300) to position the wire ring retainer (290) in the groove in the blade arm flange. Refer to Figure 7-1.

(9) Install the wire ring retainer (290).

(10) Using a combination of press tool TE308 and retention bearing puller TE108, or equivalent, with bearing retaining ring A-972, pull the bearing retaining ring (280) outboard far enough to position the wire ring retainer (290) in the wire retention groove in the bearing retaining ring (280). Refer to Figure 7-1.

CAUTION: THE WIRE RING RETAINER (290) MUST BE FULLY ENCLOSED TO MAKE SURE IT IS NOT PINCHED.

(11) Visually examine to make sure that the wire ring retainer (290) is fully enclosed.

(12) Using lubricant CM12, lubricate the blade O-ring (270).

(13) Move the O-ring (270) over the blade arm flange of the hub unit (2300) to a location inboard of the outboard side race (300).

(a) Leave the O-ring in position for use later in the reassembly.

(14) For the remaining hub arms, repeat steps (3) through (13) of this procedure.

B. Spinner Mounting Plate Assembly

(1) For information about the applicable spinner assembly and spinner bulkhead, refer to the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: MAKE SURE EACH HALF OF THE SPLIT SPINNER MOUNTING PLATE (85) HAS THE SAME SERIAL NUMBER.

(2) Attach the spinner mounting plate (85) to the blade arm side of the hub installing flange with hex head bolts (1030).

NOTE: Do not torque the hex head bolts (1300) at this step of assembly. If applicable, using bolts (1110) and washers (1120) attach the start lock plate (1100) on the inboard side of each lower clamp half (1610).

(3) Install each guide lug (100) into the spinner mounting plate (85) and with a snap ring (90) in the groove of the guide lug.

NOTE: Snap rings (90) must be on the engine side of the spinner mounting plate (85).

C. Installation of Blade Bearing

CAUTION: DURING THE FOLLOWING PROCEDURES, THE BLADE ARM ON WHICH A RETENTION BEARING IS GOING TO BE ASSEMBLED MUST BE SUPPORTED VERTICALLY WITH THE PILOT TUBE FACING DOWN.

(1) Remove the hub unit (2300) from the rotatable fixture on the assembly table and use press tool TE308, or an appropriate fixture, to hold the unit vertical during the next stages of blade retention split-bearing assembly. Refer to Figure 7-5.

CAUTION 1: THE PARTING LINE OF THE INBOARD BEARING RACE (240) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE BLADE CLAMP HALVES (1610).

CAUTION 2: ANY GAP BETWEEN THE HALVES OF BEARING RACES (240, 300) MUST NOT BE GREATER THAN 0.001 INCH (0.02 mm).

CAUTION 3: ALL BEARING BALLS (250) INSTALLED IN A SINGLE OUTBOARD SIDE RACE (300) MUST BE OF THE SAME GAUGE. BEARING BALLS SUPPLIED BY HARTZELL PROPELLER INC. ARE OF THE SAME GAUGE.

(2) Install the ball bearing spacer (260) and the required number of bearing balls (250) onto the outboard bearing race (300).

CAUTION: TOO MUCH USE OF SEALANT CM93 COULD CAUSE UNEVEN POSITIONING BETWEEN THE CLAMP ASSEMBLY (1600) AND BEARING RACE (240).

(3) Apply a small amount of sealant CM93 to the chamfered edges (break point) of the matched set of inboard bearing races (240).

(4) Remove the sealant that comes out into the bearing area when the bearing race halves are joined.

(5) Put the inboard bearing race halves (240) around one blade arm of the hub unit (2300).

CAUTION: THE OPENING OF THE WIRE RING RETAINER (230) MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE INBOARD BEARING RACE.

(6) Install the wire ring retainer (230) to hold the halves in position.

(7) Move the O-ring (270) outboard against the inboard bearing race (240).

(8) Using self-adhesive stretch wrap, wrap the outside diameter of the bearing assembly to hold the parts in position.

(9) For the remaining hub arms, repeat steps (17) through (22) of this procedure.

(10) Install the hub (2300) on the rotatable fixture of the propeller assembly table.

D. Clamp Assembly - Refer to Figure 7-11

(1) For clamp assembly procedures, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(2) For information about the correct counterweight slugs and installing hardware, refer to the Hartzell Propeller Inc. Application Guide, Manual 159 (61-02-59).

CAUTION: A LINK ARM (140) CANNOT BE INSTALLED AFTER THE CLAMP (1600) HAS BEEN INSTALLED ON THE HUB.

(3) After each clamp (1600) is assembled:

(a) Install the link screw sleeve (145) into the large hole of the link arm (140), from the side of the link arm that faces away from the clamp half (1600).

NOTE: The flange of the sleeve (145) faces inboard.

(b) Install the link arm bushing (210) onto the linkscrew (1640) between the link arm (140) and the blade clamp (1600).

NOTE: The raised shoulder of the link arm (140) must face the blade clamp (1600).

(c) Push the cotter pin (330) through the hole in the end of the linkscrew (1640) and open the cotter pin to install the link arm (140) to the clamp assembly (1600).

1 The link arm (140) must move freely on the linkscrew (1640).

(d) Open the cotter pin (330) to secure it in position.

NOTE: The link arm (140) must move freely on the link screw (1640).

(e) Repeat this procedure for each remaining clamp assembly (1600).

(4) When adjusting the pitch range of some propeller assemblies, the linkscrew may contact the hub. When this happens, the full blade angle range cannot be achieved. Refer to the section, "Repair of the A-304 Linkscrew" in the Repair chapter in this manual.

(5) Using bolts (1110) and washers (1120) attach the start lock plate (1100) on the inboard side of each lower clamp half (1610).

(a) There must be clearance between the OD of the start lock plate (1100) and the spinner mounting plate (85) or bulkhead.

(b) There must also be clearance between the start lock (1200) and the head of the socket screw (1690).

(c) Washers may be installed between the start lock plate (1100) and clamp assembly (1600) to reposition the start lock plate and improve interface with the start lock.

(6) Torque the hex head bolts (1110) in accordance with Table 8-1, "Torque Values", in the Fits and Clearances chapter of this manual.

(7) Safety the start lock plate hex head bolts (1110) with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

E. Blade and Clamp Installation

(1) Install the hub unit (2300) on the rotatable fixture TE125 on the assembly table TE129.

(2) For instructions about aluminum blade balancing and all other overhaul or repair procedures, refer to the Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: IF POSSIBLE, EACH BLADE MUST BE REINSTALLED ON THE HUB ARM FROM WHICH IT WAS REMOVED AT DISASSEMBLY.

(3) As specified in the Disassembly Procedure, each blade must have an identifying number to make sure of correct assembly.

(4) Stand blade one in vertical position (shank up, tip down) and fill the pilot tube cavity with Lubricant CM12 to the top of the bottom blade needle bearing.

WARNING: AIR TRAPPED IN THE GREASE CAN AFFECT PROPELLER BALANCE AFTER RUN-UP.

(5) After making sure that no air is trapped in the grease, move the blade onto the pilot tube (2310). Push the blade toward the center of the hub until the butt of the blade shank makes contact with the face of the blade arm.

NOTE: A slight amount of grease will be squeezed out around the pilot tube (2310) if the blade has been lubricated correctly.

(6) Repeat this procedure for each remaining blade.

CAUTION: USE HARDENING GASKET COMPOUND CM46 ON THE SHOULDER RADIUS OF THE BLADE SHANK, THE OUTER DIAMETER OF THE BLADE SHANK, AND THE OUTER CORNER OF THE BLADE BUTT. REFER TO FIGURE 7-12.

(7) Using an acid brush or finger, optionally wearing non-powdered latex gloves, apply a smooth even layer of gasket compound CM46 on the shoulder radius of the blade shank in the area where it touches the blade clamp, the outer diameter of the blade shank, and the outer corner of the blade butt. Refer to Figure 7-12.

(a) Before installing a clamp, make sure the shoulder radius of the blade shank, the outer diameter of the blade shank, and the outside corner of the blade butt are completely covered by a smooth even layer of gasket compound CM46. Refer to Figure 7-12.

(b) Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(8) Remove the self-adhesive stretch wrap that was used to temporarily hold the blade races (240, 300) together.

CAUTION: THE PARTING LINE OF THE BLADE CLAMP-HALVES (1610) MUST BE AT A 90 DEGREE ANGLE TO THE PARTING LINE OF THE INBOARD BLADE RACES (240) AND IN LINE WITH THE OUTBOARD BLADE RACE (300).

(9) Apply a small bead of sealant CM93 to both blade clamp halves (1610) on a part of the mating surface in the inboard bearing radius, as shown in Figure 7-14.

NOTE: Do not apply gasket compound CM46 if the blades will be removed to facilitate shipment of the propeller.

(a) On the blade clamp mating surfaces, the sealant supplements the sealing of the inboard end of the blade clamp gaskets (1700).

(b) Between the blade clamp (1610) and inboard blade thrust split bearing (240), use the sealant to fill the void from the beveled edge of the bearing outside diameter.

(10) Optionally, put a small bead of sealant CM93 on a part of the mating surfaces Area "C" and Area "D" on both clamp halves. Refer to Figure 7-14 and Figure 7-15.

NOTE: The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is optional. This step is highly recommended for agricultural aircraft, and is recommended for other Hartzell Propeller Inc. steel hub propeller models.

(a) The application of sealant CM93 to the clamp mating surfaces Area "C" and Area "D" is an optional procedure. Application of sealant CM93 to the clamp mating surfaces may cause the gasket to slip out of position.

(11) Install the matching clamp-half (1610) with the counterweight to the blade/hub.

(12) Install the matching blade clamp half (1610) to which the counterweight (1630) is attached.

(13) Install the other blade clamp half.

CAUTION: A MAXIMUM OF 0.06 INCH (1.5 MM) OF GASKET (1700) MATERIAL MUST BE EVENLY EXPOSED THROUGH THE PARTING LINE ON EACH SIDE OF THE CLAMP ASSEMBLY (1600). THE GASKET (1700) MAY REQUIRE TRIMMING TO PROVIDE METAL-TO-METAL CONTACT WHERE THE CLAMP LUGS MEET.

(14) Install a new gasket (1700) between each of the blade clamp half parting surfaces.

(15) Install the bolts (1710) into the outboard clamp position.

CAUTION: DO NOT TORQUE THE BOLTS (1710) AT THIS TIME.

(16) Install the washers (1720) and attach them with self-locking nuts (1730) onto the bolts (1710).

(a) Finger tighten the self-locking nuts (1730).

NOTE: This step helps align the blade clamp gasket (1700), but the bolts (1710) must not be torqued at this time.

(17) Install the socket screws (1690) into the clamp holes that are in the inboard position.

CAUTION 1: TORQUE THE SOCKET SCREWS (1690) IN THE SEQUENCE SPECIFIED.

CAUTION 2: DO NOT GO MORE THAN THE RECOMMENDED TORQUE ON THE SOCKET SCREWS (1690).

(18) Using a 5/16 inch Allen wrench, torque the socket screws (1690) in 10 Ft-Lb (14 N·m) increments (10, 20, etc.) in accordance with Table 8-1, "Torque Values", alternating between screws at each increment.

(19) Measure the blade track.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

(a) Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

(b) If all blades do not track:

1 Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

2 A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

CAUTION: DO NOT CONTACT THE INNER BLADE CLAMP HALF (1610) WHILE DRILLING TO SAFETY THE SOCKET SCREWS (1690).

(20) Using a #42 (0.094 inch [2.37 mm]) size bit, drill the head of each socket screw (1690).

(21) Safety wire each socket screw (1690) with a cotter pin (1680) so that the cotter pin contacts the clamp half (1610) and prevents the socket screw from backing out of the clamp assembly (1600).

NOTE: Do not safety the socket screws (1690) if blades will be removed to facilitate shipment of the propeller.

(a) If an installed cotter pin (1680) causes interference, three loops of 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131 may be used to safety the socket screw (1690).

(22) For the remaining blades and clamps (1600), repeat steps (7) through (21) of this procedure.

(23) Install weight slugs on the clamp counterweight arms, if applicable. Refer to Hartzell Propeller Inc. Application Guide 159 (61-02-59) for specific weight slug information.

F. Beta System Installation (Part 1 of 2)

CAUTION: THE BETA SPRING RETAINERS (42), CRIMPED RETAINING RING (43), MUST BE ASSEMBLED WITH THEIR SHARP EDGES AGAINST EACH OTHER.

(1) Move two crimped retaining ring (42) over the inboard end of one propeller beta rod (41) and into the groove provided for them in the rod.

(a) The rounded edges of the crimped retaining ring (42) must face away from each other.

(2) Using the beta rod installation tool TE65, crimp the crimped retaining ring (42) together by compressing them to a maximum OD of 0.550 inch (13.97 mm).

(3) Move a beta spring retainer (43) over the outboard end of each propeller beta rod (41) and down onto the crimped retaining rings (42).

(a) This retainer will later support a spring.

(b) The crimped retaining rings (42) fit down inside the ID recess of the spring retainer (43).

(4) Move a beta compression spring (65) onto the outboard end of the beta rod (41).

(5) Using the spring compressor tool TE29, or equivalent, to compress the beta spring (65) by hand to approximately half its length.

(a) Leave the spring compressor tool on the beta spring (65) to make the following assembly procedures easier.

(6) For each remaining propeller beta rod unit (41), repeat steps (1) through (5) of this procedure.

(7) Install each assembled beta rod unit (40) through the guide lug (100) in the spinner mounting plate (85).

G. Guide Collar and Cylinder Installation

(1) Using solvent CM106, clean the threads on the hub unit (2300) and cylinder (190).

CAUTION: THE CHAMFERED SIDE OF THE GUIDE COLLAR UNIT (1550) MUST SEAT AGAINST THE SHOULDER OF THE CYLINDER (190). TO GET PROPER HUB CLEARANCE, THE LARGER INSIDE DIAMETER OF THE GUIDE COLLAR MUST FACE THE HUB UNIT (2300).

(2) Install the cap screw (1570) into the guide collar unit (1550).

(3) Install the guide collar unit (1550) onto the smaller diameter shoulder of the cylinder (190).

(a) The chamfer in the guide collar (1550) must face the flange on the cylinder (190).

(b) Do not torque the guide collar socket screw (1570) at this time.

CAUTION 1: DO NOT APPLY HYDRAULIC SEALANT ADHESIVE COMPOUND CM134 TO THE THREADS OF THE CYLINDER (190).

CAUTION 2: DO NOT GET HYDRAULIC SEALANT CM134 IN THE CYLINDER (190). CONTAMINATION TO THE AIRCRAFT ENGINE OIL SYSTEM COULD OCCUR.

(4) Using hydraulic sealant CM134, apply a bead of sealant in the groove of the hub unit (2300) where the cylinder O-ring (200) fits.

(5) Install the O-ring (200) into the chamfer in the cylinder (190).

(6) Move the assembled guide collar (1550) and cylinder (190) down over the propeller beta rod units (40).

(a) Each beta rod unit (40) must move through a guide collar bushing (1560) when the cylinder (190) is installed onto the hub (2300).

(7) Hand tighten the cylinder (190) and the guide collar unit (1550) if applicable, onto the hub unit (2300).

(8) Using a bar of appropriate size to fit the slot in the top of the cylinder (190), tighten the cylinder flush against the hub unit (2300).

NOTE: Early drag and tightness is caused by the O-ring (200), which acts as a seal and safety.

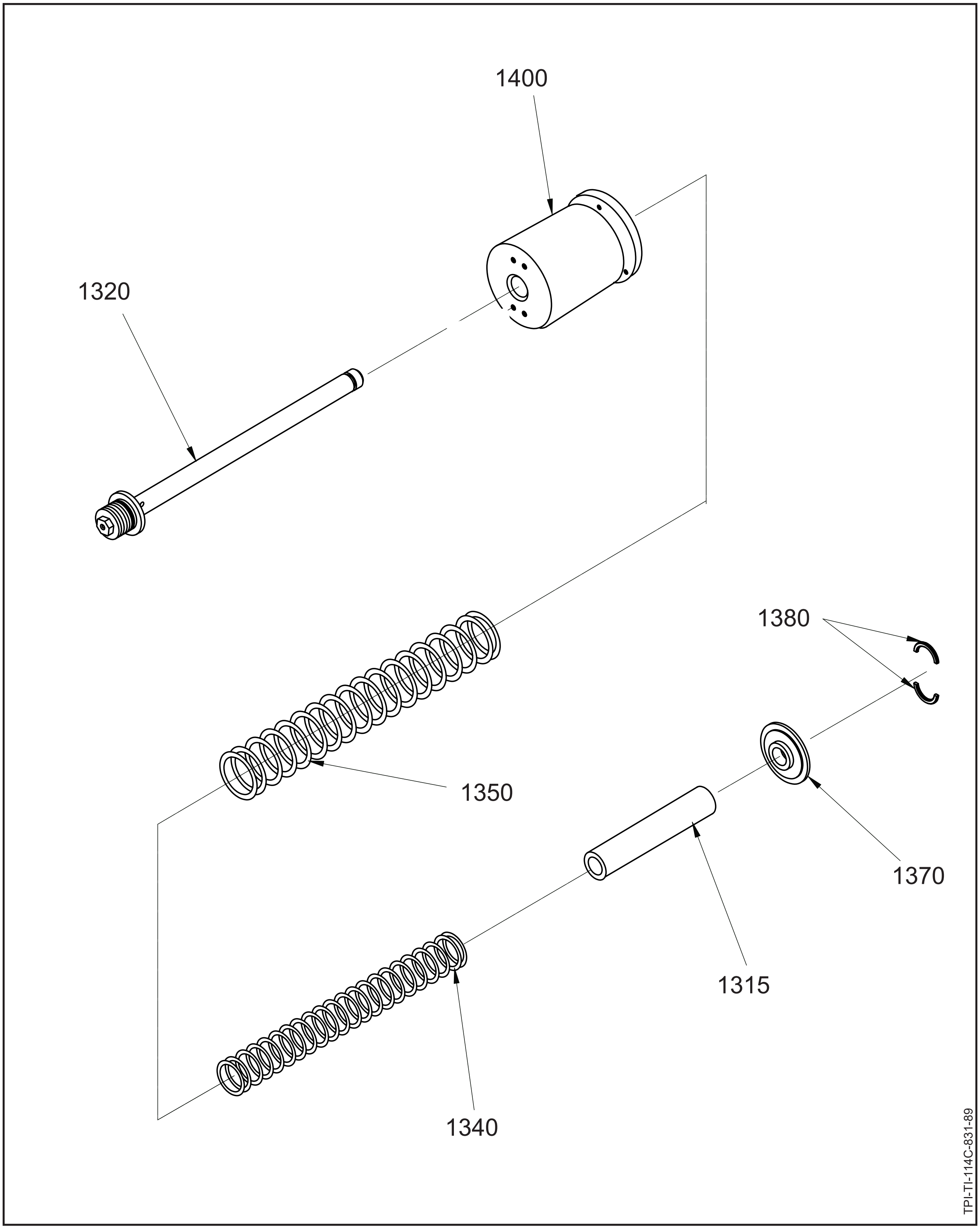
(9) Torque the cylinder (190) against the shoulder of the hub unit (2300). Refer to the Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

CAUTION 1: VISUALLY EXAMINE THE INSIDE OF THE CYLINDER (190) TO MAKE SURE THAT THE O-RING (200) HAS NOT BEEN MOVED OUT OF PUT DURING THE CYLINDER INSTALLATION PROCEDURE.

CAUTION 2: VISUALLY EXAMINE THE SLOT IN THE TOP OF THE CYLINDER (190) TO MAKE SURE THE SQUARE-BAR WRENCH USED FOR TORQUING DID NOT RAISE ANY SHARP EDGES OR DAMAGE THE TURNS.

(10) Remove any sharp edges in the wrench slot on top of the cylinder (190).

(11) Loosen and remove the special tools used to compress the beta compression springs.



831-89 Spring Assembly
Figure 7-35

H. Assembly of the 831-89 Feathering Spring Assembly - Refer to Figure 7-35

(1) Move the spring retainer cup (1400) onto the pitch change rod (1320).

(2) Move the spacer tube (1315) onto the pitch change rod (1320).

(3) Move the spring (1350) onto the pitch change rod (1320).

(4) Move the spring (1340) over the spring (1350) and onto the pitch change rod (1320).

(5) Put the rear spring retainer (1370) on the spring (1340 and 1350).

(6) Put the threaded end of the pitch change rod (1320) into the spring compressor fixture TE59, or equivalent.

(7) Compress the spring assembly (1300) enough to install the rear split keeper (1380) into the groove in the pitch change rod (1320).

(8) Apply oil or grease to each half of the rear split keeper (1380) to hold it in position until the spring (1340) is decompressed.

WARNING: WHEN COMPRESSED, THE SPRING ASSEMBLY (1300) IS LOADED TO APPROXIMATELY 1000 POUNDS (454 KG) FORCE. MAKE SURE OF THE SAFETY OF EVERYONE IN THE AREA DURING ASSEMBLY PROCEDURES.

(9) Carefully release the pressure on the spring assembly (1300).

(10) Before removing the spring assembly from the special tool, make sure that both rear split keeper halves (1380) are in the groove in the pitch change rod (1320), and installed by the rear spring retainer (1370).

I. Feathering Spring Assembly Installation

(1) Apply a layer of anti-seize compound CM118 to the Turns of the spring retainer cup (1400).

(2) Install the feathering spring assembly into the cylinder (190).

(3) Using the special spanner wrench TE148 or locally procured strap wrench, turn the feathering spring assembly (1300) into position in the cylinder (190).

(4) Tighten the assembly until it is snug.

(5) Using a #42 size bit, drill through the flange of the spring retainer cup (1400) at the wrench slot in the cylinder (190).

(a) Drill in and down at an angle that exits on the other side of the flange.

(6) Install 0.032 inch (0.81 mm) minimum diameter stainless steel wire CM131 through the drilled hole.

(a) Using three loops of wire, safety the feathering spring assembly (1300).

(b) Put the “pigtail” into the slotted area.

CAUTION: ENGINE OIL ENTERS THIS AREA OF THE ASSEMBLY. MAKE SURE ALL BITS OF METAL FROM DRILLING AND SAFETY WIRING ARE REMOVED.

(7) Install four feathering stop screws (1540) in the spring retainer cup (1440).

(a) Turn the feathering stop screws all the way in; then, back them out to an even The height of approximately three Turns.

(8) Safety the feathering stop screws (1540) with 0.032 inch (0.81 mm) minimum diameter stainless steel wire CM131. These screws might need to be adjusted later to obtain the correct feathering angle.

(9) Using two fillister head screws (170) to install each feathering pitch stop spacer (160) and retaining ring (165), if applicable.

(10) Safety wire each fillister head screw (170) with 0.032 inch (0.81 mm) diameter stainless steel safety wire CM131.

J. Piston Installation

NOTE: Refer to Figure 7-20 for the installation and orientation of components installed in the piston (1500) and dust seal length.

(1) Using lubricant CM12, lubricate the pitch change rod O-ring (150).

(2) Carefully install the pitch change rod O-ring (150) in the groove provided for it in the pitch change rod (1320).

(3) Using lubricant CM12, lubricate the piston O-ring (1535).

(4) Carefully install the piston O-ring (1535) in the groove provided for it in the piston (1500).

CAUTION: MAKE SURE THAT THE FELT PISTON DUST SEAL (1530) IS FUZZ-FREE.

(5) Cut the piston dust seal material (1530) to length on a 30 degree diagonal so there is an overlap at the parting line with a smooth, fuzz-free surface.

(a) If the piston dust seal (1530) has fuzz or long strands that could interfere with the operation of the O-ring, replace the piston dust seal.

(6) Soak the piston dust seal (1530) in aviation grade engine oil until it is completely saturated.

(a) Squeeze the excess oil from the piston dust seal (1530).

CAUTION: MAKE SURE THAT THE DIAGONAL OVERLAP OF THE FELT PISTON DUST SEAL (1530) REMAINS VISIBLE AND DOES NOT ROTATE TO ITS SIDE AS IT IS INSTALLED IN THE GROOVE OF THE PISTON (1500).

(7) Install the thinnest section of the piston dust seal (1530) in the remaining piston OD groove.

(8) Align the propeller beta rod units (40) with the holes provided for them in the piston (1500).

(9) Apply a thin layer of anti-seize compound CM118 in the hole of the free end of each link arm (140).

(10) Install the free end of each link arm (140) in the slot provided in the piston (1500).

CAUTION: MAKE SURE THAT THE CORRECT SAFETY SCREW (130) IS INSTALLED AND THAT SUFFICIENT TURNS ARE AVAILABLE IN THE PISTON UNIT (1500) TO HOLD THE SCREW IN POSITION. AT LEAST THREE TURN LENGTHS MUST BE ENGAGED. DO NOT BIND THE LINK ARM.

(11) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(12) Push each link pin unit (120) flush with the piston (1500) ear.

(13) Install each link pin unit (120) with a fillister head screw (130).

(a) Torque the fillister head screw (130) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

(14) Put the guide collar unit (1550) solidly against the cylinder (190) at the correct radial location to align the guide rods (1520) or the beta rod units (40).

(15) When the necessary alignment is correct, use an Allen wrench with torque wrench adapter to tighten the socket head cap screw (1570) in the guide collar unit (1550). Refer to the Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

CAUTION: FOR SETUP PURPOSES ONLY, USE A NON-LOCKING NUT ON THE END OF THE PITCH CHANGE ROD AS AN ALTERNATIVE TO THE SELF-LOCKING HEX NUT (110). THE NON-LOCKING NUT MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110) AFTER FEATHER ANGLES ARE CORRECT.

(16) Move the piston (1500) into full feathered position (back against the hub assembly) so that the threaded end of the pitch change rod (1320) extends through the end of the piston (1500).

(17) Turn the self-locking hex nut (110) onto the end of the pitch change rod (1320).

(18) Use a wrench on the self-locking hex nut (110) and socket on the pitch change rod (1320) to torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

WARNING: THE COUNTERWEIGHT (1630) MUST HAVE A POSITIVE ANGLE WITH REFERENCE TO THE PROPELLER CENTERLINE WHEN THE PISTON IS IN FULL REVERSE POSITION TO PREVENT THE PROPELLER FROM “STICKING” IN REVERSE. REFER TO FIGURE 7-24.

CAUTION 1: AT THIS STAGE OF PROPELLER ASSEMBLY THE BOLTS (1710) HAVE NOT BEEN TIGHTENED, BECAUSE ADJUSTMENTS OF COUNTERWEIGHT ANGLE AND BLADE PITCH USUALLY INVOLVE SOME DISASSEMBLY PROCEDURE.

CAUTION 2: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

K. Setting Counterweight Angle

(1) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table to move the piston to full reverse position.

(2) Using a hand-held protractor TE97, or equivalent, measure the angle of the counterweight relative to the axis of the piston. Refer to Figure 7-24.

(a) For the specific counterweight angle required, refer to the applicable aircraft specifications manual or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) As indicated in Figure 7-24, the positive angle, usually 2 degrees, is for reference only. Do not consider it for the prescribed angle.

CAUTION: THE LENGTH OF THE SPRING SPACER TUBE REQUIRED AT ASSEMBLY MAY BE THE SAME AS THE LENGTH OF THE SPACER REMOVED AT DISASSEMBLY. IF THE SPACER IS ADDED AT ASSEMBLY, USE THE CORRECT LENGTH SPECIFIED FOR THE REQUIRED CHANGE IN ANGLE.

(3) If it is necessary to adjust the counterweight angle, replace the spring spacer tube (1315) between the rear spring retainer (1370) and the spring retainer cup (1400) with a next-size-longer or shorter spacer to change the angle.

L. Establishing Reference Blade Radius

CAUTION: DO NOT CONFUSE BLADE STATION WITH REFERENCE BLADE RADIUS. BLADE STATION AND REFERENCE BLADE RADIUS OF THE SAME NUMBER MAY NOT ALWAYS INDICATE THE SAME LOCATION ON THE BLADE.

(1) Reference blade radius is measured from the center of the propeller hub to a predetermined reference location on the blade for blade angle measurement.

(2) Blade stations are used during the repair or overhaul process of a blade to define a blade span location for dimensional measurement.

(3) Establish a reference blade radius location.

(a) For the reference blade radius location specified for the applicable aircraft installation, refer to the Aircraft Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(b) Beginning with blade one, measure from the center of the propeller hub to the reference blade radius location specified. Refer to Figure 7-25.

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.

(c) Using a crayon or soft, non-graphite pencil CM162 or equivalent, mark a line perpendicular to the blade centerline.

(d) Repeat this procedure for each remaining blade.

M. Setting Reverse Blade Angles

CAUTION: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS MANUAL.

(1) Apply air pressure to the piston through the rotatable fixture on the propeller assembly table to bring the propeller to reverse angle position.

(2) Using a hand held protractor TE97 or bench-top protractor TE96 and special riser fixture TE48, or equivalent, measure the reverse angle on blade one at the reference blade radius specified in the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59). Refer to Figure 7-26.

NOTE: For the specific requirements for reverse blade angle and blade-to-blade tolerance at reverse blade angle, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(3) Rotate the blade in the clamp to obtain the correct reverse blade angle.

(4) Using a clamp nut wrench TE142, or equivalent, hold the self-locking nut (820) and a standard 12-point socket to torque the bolts (1710) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(a) While torquing the bolts (1710), make sure that the position of the gasket (1700) is kept in order to provide a sufficient grease seal.

(b) Make sure a nearly equal gap between the two halves is kept after final torque is applied.

(5) Repeat this reverse angle setting procedure for each of the other blades.

(6) Measure the blade-to-blade reverse angle variance at the reference blade radius, and readjust the blade reverse angles if they are not within tolerance.

(a) A blade-to-blade tolerance is applicable when setting the reverse blade angle.

(b) A blade-to-blade tolerance is also applicable when setting the low pitch and feather blade angle. It is recommended that a minimum blade-to-blade tolerance be met in the reverse blade angle.

(c) This will make sure of the best opportunity to meet all blade angle tolerance requirements for each subsequent angle.

(7) Cycle the propeller from reverse to feather, and back to reverse to confirm the correct blade angle setting by.

N. Setting Feather Blade Angles

(1) Release the air pressure to the rotatable fixture.

(2) Using a hand-held protractor TE97, or equivalent, measure the feathering angle on blade one at the reference blade radius specified in the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

(a) For the specific feathering angle, blade-to-blade tolerance at feather blade angle, and reference blade radius required, refer to the applicable Type Certificate Data Sheet, Supplemental Type Certificate Data sheet, or the Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

CAUTION: BEFORE REMOVING THE PISTON, MARK A PISTON EAR WITH A GREASE PENCIL CM162, AND MATCH MARK THE GUIDE COLLAR TO MAKE SURE THAT THE PISTON IS REINSTALLED IN THE SAME POSITION.

(3) Adjust the feather angle, as necessary, by removing the piston and turning the fillister head screws (1540).

(a) Using a special wrench TE144-1 or equivalent, and a one inch (25.4 mm) socket wrench, remove the non-locking nut on the end of the pitch change rod (1320).

(b) Rotate the blades by hand from feather to reverse.

(c) Remove all of the link pin units (120).

(d) Disconnect the link arms (140) from the piston unit (1500).

(e) Remove the piston unit (1500).

(f) Adjust the feather angle as necessary.

NOTE: Turning the fillister head screw (1540) in one turn will increase the feathering angle approximately 1.5 degrees. Turning the fillister head screw out one turn will decrease the feathering angle approximately 1.5 degrees.

(g) Using 0.032 inch (0.82 mm) minimum diameter stainless steel wire CM131, safety the fillister head screws (1540).

(h) Move the piston (1500) into position over the cylinder (190).

(i) Align the piston installed guide rods with the bushings in the guide collar (1550).

(j) Install the free end of each link arm (140) in the slot provided for it in the piston (1500).

(k) Apply anti-seize compound CM118 to the pin shaft of the link pin unit (120).

(l) Install each link pin unit (120) through the large hole in each piston (1500) ear, and through the hole in each link arm (140).

(m) Push each link pin unit (120) flush with the piston (1500) ear.

CAUTION: THE NON-LOCKING NUT THAT WAS USED ON THE END OF THE PITCH CHANGE ROD DURING THE BUILDUP PROCESS MUST BE REPLACED WITH A SELF-LOCKING HEX NUT (110).

(4) Install the self-locking hex nut (110) on the end of the pitch change rod (1320).

(5) Measure the feather blade angle of all the blades, and adjust as necessary.

(6) Using a 1-13/16 inch crowfoot wrench on the self-locking hex nut (110), and a one inch (25.4 mm) socket on the pitch change rod (320), torque the nut in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(7) Measure the blade-to-blade tolerance at the feather blade angle.

O. Beta System Installation (Part 2 of 2)

(1) Install a hex nut (55) onto the engine side of each beta rod unit (40).

CAUTION: DO NOT FORCE THE BETA ROD UNITS (40) INTO THE BETA RING (50). FORCING THE BETA ROD UNITS COULD CAUSE IRREPARABLE DAMAGE THE GROOVE IN THE BETA RING.

(2) Turn one beta rod unit (40) at a time into the threaded holes in the beta ring (50) to a depth of two Turns each time. Use an open end wrench on the flats of the beta rod unit (40) to turn the beta rod unit (40).

(3) Repeat the above process with each beta rod unit (40) in succession several times until each beta rod is completely threaded into the beta ring (50).

(4) Turn each beta rod unit (40) out of the beta ring (50) one full Turn and then tighten the self-locking hex nuts (55) while holding the beta rod units (40) position with an open end wrench.

(5) Using a depth micrometer, measure the height of the beta ring (50).

(a) Adjust the height by rotating the beta rod units (40) clockwise to decrease or counterclockwise to increase.

(6) Using a dial indicator to measure the run-out of the beta ring (50) at full feather. Refer to Figure 7-26 for setup.

CAUTION: BETA RING (50) RUN-OUT MUST BE KEPT WITHIN 0.010 INCH TOTAL.

(7) Adjust each beta rod unit (40) and hex nut (55) to correct run-out.

(8) When beta ring run-out is correct, torque each hex nut (55) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

CAUTION 1: USE AIR PRESSURE THAT IS LESS THAN 200 P.S.I. (13.8 BARS) WHEN ACTUATING PROPELLERS INCLUDED IN THIS SECTION.

CAUTION 2: WHEN A BLADE ANGLE IS SET OR MEASURED, ACTIVATE THE ASSEMBLY AWAY FROM THE REVERSE PITCH POSITION BY HAND TO SEAT THE BLADE AND BLADE CLAMP PARTS AND TO REMOVE PLAY FROM THE ASSEMBLY.

P. Setting Low Pitch Blade Angle

(1) If applicable, put the spacer (30) on each beta rod unit (40).

(2) Install the self-locking hex nut (20) on each beta rod unit (40).

(3) Setting the low pitch angle of the blades establishes hydraulic low pitch for the propeller.

(a) Apply air pressure to the piston (1500) through the rotatable fixture on the propeller assembly table, until blade one reaches the correct low pitch blade angle.

1 For the specific low pitch angle, tolerance at low pitch blade angle, and reference blade radius required for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Applications Guide Manual 159 (61-02-59).

(b) Trap the air at this position of blade one, and measure for correct low pitch angle.

1 The low pitch angle of all blades must be within a blade-to-blade tolerance of 0.2 degree from the maximum to the minimum blade angle at low pitch.

(c) Turn the self-locking hex nuts (20) on the propeller beta rod units (40) so that the nuts are against the bosses on the piston at low stop position.

(d) Apply air pressure to the rotatable fixture, forcing until the propeller is against the reverse pitch stop.

(e) Select a blade with a beta rod adjacent to it.

1 "Zero" the dial indicator on the beta ring (50) at a position close to the selected beta rod unit (40).

CAUTION: ADJUSTING THE BETA RING RUN-OUT IN REVERSE PITCH WILL AFFECT THE LOW PITCH ANGLE.

(f) Adjust the other self-locking nuts (20) to correct the beta ring (50) run-out to within 0.010 inch (0.25 mm) maximum movement for one revolution of the propeller.

(g) Release pressure from the rotatable fixture, allowing the propeller blade angle to move to feather or to a blade pitch higher than low pitch.

(h) Apply air pressure to the rotatable fixture to move the propeller from a higher blade angle to low pitch blade angle.

NOTE: Make sure that the self-locking nuts (20) are just barely engaged by the piston (1500).

CAUTION: THE BETA ROD UNITS (40) AND THE BETA RING (500) MUST NOT MOVE WHEN VERIFYING CONTACT BETWEEN THE PISTON (1500) AND THE SELF-LOCKING NUTS (20).

(i) Move the assembly away from the reverse pitch position by hand to seat the blade and clamp parts, and to remove play from the assembly.

(j) Measure the blade-to-blade low pitch angle variance at the reference blade radius, and readjust the blade low pitch angles if they are not within tolerance.

NOTE: A blade-to-blade tolerance is applicable when setting the low pitch blade angle. This will make sure of the best opportunity to meet all blade angle tolerance requirements.

(k) If the blade-to-blade tolerance is excessive, then one or more blades must be threaded in the blade clamp(s).

(l) With air pressure applied to the piston, and with the propeller assembly in full reverse position, measure the beta ring run-out. Total maximum permitted run-out is 0.010 inch (0.25 mm).

Q. Final Beta Ring Run-out Measure

CAUTION: BETA RING (50) RUN-OUT MUST BE KEPT WITHIN 0.010 INCH TOTAL. ADJUST AS NECESSARY.

(1) With the propeller at low pitch and each self-locking hex nut (20) providing a positive stop for the piston (1500), measure the beta ring (50) run-out.

(2) Actuate the propeller to reverse blade angle and measure the beta ring (50) run-out. Refer to Figure 7-27.

R. Start Lock Units

(1) Start Lock Unit Reassembly

(a) Install the pin (1240) into the start lock bracket (1250).

(b) Install the spring (1230) into the start lock bracket (1250) against the pin (1240).

(c) Compress the spring (1230), install the washer (1220) on top of the spring (1230).

(d) Install the cotter pin (1210) into the bracket (1250) to retain the washer, spring, and pin in the bracket.

(e) Install the cotter pin (1210).

(f) Retract the pin (1210) and hold in position with the wire installed in the hole in the bracket (1250) body.

NOTE: The pins will be released later for adjustment of the start lock angle. The pins are now retracted to aid assembly.

(2) Start Lock Installation

(a) Put each start lock spacer (1130) and the start lock unit (1200) over the installing holes in the spinner mounting plate (85).

(b) Using screws (1020 and 1080), washers (1040) and nuts (1090) attach the start lock spacer (1130) and the start lock unit (1200) to the spinner mounting plate (85).

(c) Torque the screws (1020 and 1080) in accordance with Table 8-1, "Torque Values" in the Fits and Clearance chapter of this manual.

S. Measuring Start Lock Angle

(1) Install the start lock unit (1200), attaching the hex head bolts (1080, 1020).

(2) Torque the hex head bolts (1080, 1020) in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(3) Apply air pressure to position the propeller to full reverse.

(4) Release the pressure and allow the blades to turn into the start lock position.

(5) Measure the start lock angle.

(a) For the specified start lock angle specifications and tolerances, refer to the Hartzell Propeller Inc. Application Guide.

(6) Measure all blades to make sure they are within 0.2 degree of each other.

(7) At this time, if adjustments are required for the start lock angle, do the following:

(a) Remove material from the notched area of the start lock plate(s) (1100), as necessary, to obtain the correct blade angle.

(b) Paint the notched area of the start lock plate (1100), where material was removed, using paint CM67 to protect that area from corrosion.

(8) Make sure that there is correct contact between the start lock plate (1100) and start lock pin (1240).

(9) Make sure there is no contact between the start lock bracket (1250) and the clamp (1600).

(10) If contact is found between the start lock bracket (1250) and the clamp (1600):

(a) Using an abrasive pad CM47 or equivalent, polish the contact area to remove no more than 0.020 inch (0.50 mm) of material.

(b) Chemical conversion coat in accordance with the Chromic Acid Anodizing chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

T. Measuring for Blade Slippage in Blade Clamp

(1) With the propeller still installed on the rotatable fixture of the assembly table, proceed as follows to provide visual detection of slippage between the blade shank and the blade clamp.

CAUTION: DO NOT USE A PUNCH OR SCRIBE A LINE ON THE BLADE SHANK. THIS COULD START A CRACK IN THE BLADE.

(a) When the correct pitch has been established in each blade, apply a strip of red plastic tape down the shank and across the blade clamp of blade number one. Refer to Figure 7-28.

1 If the blades will later be removed to facilitate shipping the propeller, apply two strips of red tape across each mated blade shank and blade clamp assembly.

(b) Carefully cut the tape along the line where the blade shank and blade clamp meet.

(c) Repeat this procedure on the other blade assemblies.

1 Misalignment of the halves of tape on a blade assembly indicates slippage between the blade shank and blade clamp. Follow the repair procedure found in the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) to correct blade slippage.

CAUTION: DO NOT PUT THE PADDED BAR IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BAR IN THE THICKEST AREA OF THE BLADE, JUST OUTBOARD OF THE DE-ICE BOOT. USE ONE BLADE PADDLE FOR EACH BLADE.

(d) Using a padded blade bar, as shown in Figure 7-29, apply torque to each blade assembly to move each blade toward low pitch in accordance with Table 8-1, "Torque Values" in the Fits and Clearances chapter of this manual.

(e) Measure blade angles in accordance with the instructions in this chapter.

(f) If it is necessary to correct blade slippage, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(g) After confirming that there is no slippage, spray each piece of tape with clear protective spray CM129 to provide a clear protective coating.

CAUTION 1: TO AVOID CAUSING PERMANENT DAMAGE TO THE BLADE RETENTION COMPONENTS BY TRAPPED CHEMICALS, THE FOLLOWING PROCEDURE MUST ONLY BE PERFORMED FOLLOWING ASSEMBLY OF A PROPELLER AFTER OVERHAUL OR OTHER PROCEDURE INVOLVING DISASSEMBLY AND CLEANING OF THE PROPELLER BLADE RETENTION COMPONENTS.

CAUTION 2: THIS PROCEDURE MUST ONLY BE PERFORMED ON PROPELLERS THAT HAVE EXPERIENCED DISASSEMBLY AND CLEANING OF BLADE RETENTION COMPONENTS.

U. External Sealant CM93 Application

(1) The application of sealant CM93 to the blade/blade clamp interface is an optional procedure that may provide additional protection against corrosion of the blade retention components.

CAUTION: DO NOT ALLOW SEALANT CM93 TO EXTEND ONTO THE SURFACE OF THE CLAMP, WHERE BALANCE WEIGHTS AND DE-ICE HARDWARE ARE INSTALLED.

(2) After doing an examination for blade slippage in the clamp, fill the external void at the blade/blade clamp interface with a 0.25 inch (6.3 mm) maximum bead of sealant CM93, around the entire circumference of blade, as shown in Figure 7-30.

(3) Let the sealant CM93 cure for a minimum of two hours, before returning the propeller to service.

V. Bulkhead Installation

(1) Using the appropriate hardware, install the spinner bulkhead in accordance with the applicable owner's manual.

W. Final Inspection of the Reassembled Propeller

(1) Use a Checklist, such as the appropriate Propeller Assembly Inspection Check-off Form, for final inspection of the reassembled propeller.

(a) Make sure that propeller static balance has been accomplished. Refer to the Static and Dynamic Balance chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

(b) Measure the blade track. Refer to Figure 7-16.

CAUTION: BLADE HEIGHTS AT THE TIP MUST NOT VARY MORE THAN 0.125 INCH (3.17 MM).

1 Turn the propeller on the rotatable fixture, and measure the height at the tip of each blade using a gauge and adjustable pointer as shown in Figure 7-16.

2 If all blades do not track:

a Make sure that there is no debris between the rotatable fixture flange and the propeller hub flange.

b A blade or blades that are not in tolerance must be removed and reinspected for blade face alignment in accordance with Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(c) Measure each blade tip for end play (leading edge to trailing edge).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(d) Measure each blade tip for end play (fore-and-aft).

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(e) Measure the radial play in each blade.

1 For permitted limits, refer to Figure 1-2 in the Testing and Fault Isolation chapter, and Table 8-2, "Blade Tolerances" in the Fits and Clearances chapter of this manual.

(f) Measure blade pitch settings.

1 For the applicable blade pitch settings associated tolerance, and the reference blade radius specified for measurement, refer to the applicable Type Certificate Data sheet, Supplemental Type Certificate Data sheet, or Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59).

X. Label Replacement

(1) Refer to the Parts Identification and Marking chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02) for information and label usage.

Y. Reassembly of a Propeller Disassembled for Shipment

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

Z. Propeller Balance

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

AA. Propeller Lubrication

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

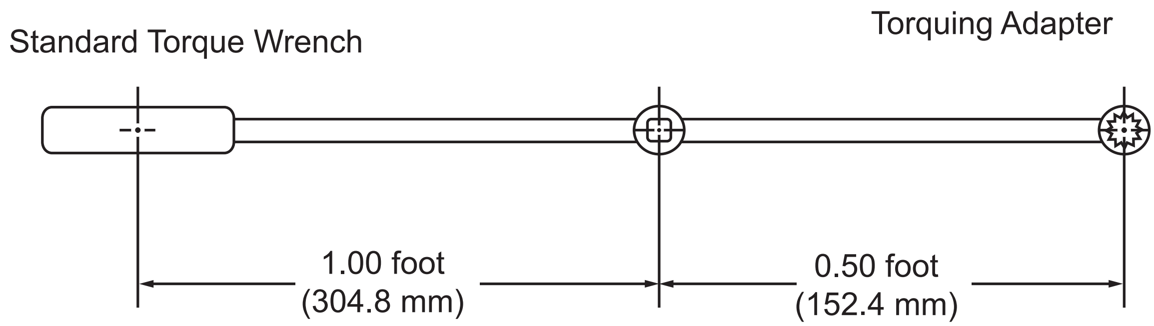
(Blank Page)

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. 1)

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.

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.

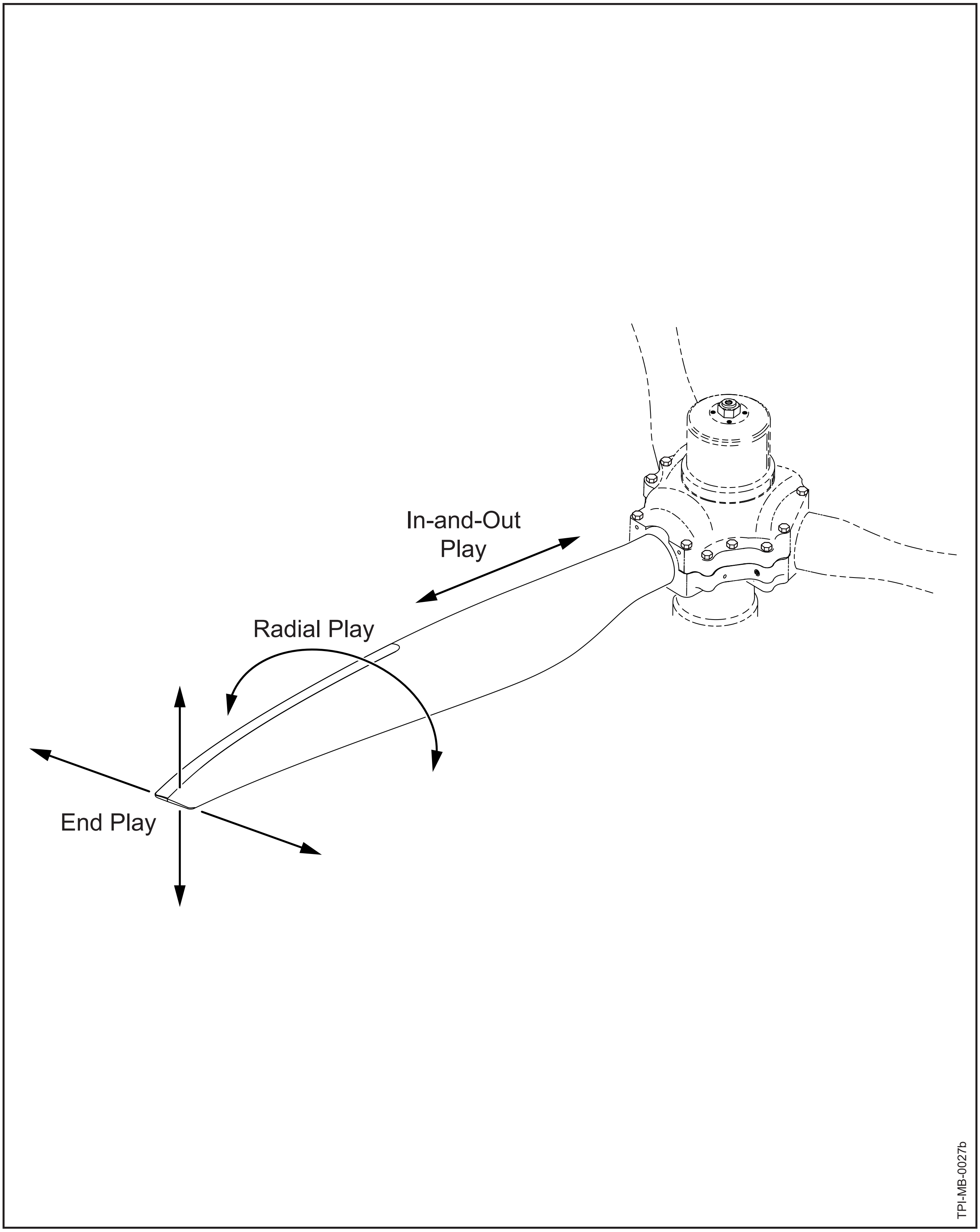
NOTE: Torque tolerance is ±10% unless otherwise noted.

Item No.	Part Number	Description/Location	Torque		
			Ft-Lb	In-Lb	N·m
10	B-3359	Nut, 3/8-24, Hex, Self-locking/ Ring, Rod End	12	144	16
	B-3599	Nut, 3/8-24, Hex, Self-locking/ Ring, Rod End	12	144	16
	A-2043-1	Nut, 3/8-24, Self-locking/ Ring, Rod End	12	144	16
20	A-3439	Nut, 3/8-24, Self-locking/ Ring, Rod End	12	144	16
	A-2043-1	Nut, 3/8-24, Self-locking/ Ring, Rod End	12	144	16
55	A-3439-( )	Nut, 3/8-24, Hex, Thin/ Ring, Rod End	12	144	16
	B-3382	Nut, 3/8-24, Self-locking/ Ring, Rod End	12	144	16
110	A-880-( )	Nut, Hex, Self-locking/ Piston	120	1440	162
130	B-3840-( )	Screw, 10-32, Fillister Head/ Link Pin	---	27	2.7
170	B-3840-( )	Screw, 10-32, Fillister Head/ Pitch Stop Spacer	---	27	2.7
190	B-854-( )	Cylinder	125 - 150	---	169 - 203
320	B-3840-( )	Screw, 10-32, Fillister Head/ Balance Weight	---	27	3.0

Torque Values
Table 8-1, page 1 of 2

Item No.	Part Number	Description/Location	Torque		
			Ft-Lb	In-Lb	N·m
1020	B-3384-( )	Screw, 10-32, Fillister Head/ Spinner Support Plate	---	96 - 120	10.8 - 13.5
1030	B-3384-( )	Screw, 1/4-28, Hex Head/ Spinner Support Plate	---	96 - 120	10.8 - 13.5
1030	B-3875-2H	Bolt 5/16-24 Hex Head/ Spinner Support Plate	---	96 - 120	10.8 - 13.5
1140	B-3384-( )	Screw, 1/4-28, Hex Head/ Guide Lug Plate	---	40 - 120	4.6 - 13.5
1080	B-3384-( )	Screw, 1/4-28, Hex Head/ Spinner Support Plate	---	96 - 120	10.8 - 13.5
1110	A-2016	Bolt, 10-32, Hex Head/ Stop Plate, Clamp	---	48 - 72	5.5-8.1
1565	A-2037	Screw, 5-16-24, Cap/ Piston Guide Rod	---	120	13.5
1570	A-2038-( )	Screw, 1/4-28, Cap/ Guide Collar	Tighten Until Secure		
1690	A-321	Screw, 3/8-24/ Blade Clamp	40	480	54
1710	A-2017	Bolt, 3/8-24, 12 Point/ Clamp Outer	35	420	47
2490	A-2038-12	Screw, 1/4-28, Cap/ Guide Lug Plate Collar	Tighten Until Secure		
Aluminum Blade, mounted in blade clamp			167	2004	226

Torque Values
Table 8-1, page 2 of 2



Blade Play
Figure 8-2

2. Blade Tolerances (Rev. 1)

Tolerances Affecting the Blades - Refer to Figure 8-2

In-and-Out Play	0.032 inch (0.81 mm)
End Play:	
Leading Edge to Trailing Edge	0.125 inch (3.17 mm) total
Fore-and-Aft (face to camber)	0.125 inch (3.17 mm) total
Radial Play (pitch change)	±0.5 degree (1 degree total) - measured at reference station
Blade Track	0.125 inch (3.17 mm) total
Blade Pitch Setting Tolerance Between Blades at Low Pitch	0.2 degree

NOTE: Blades are intended to be tight in the propeller; however, slight play is acceptable if the blade returns to its original position when released. Blades with too much play or blades that do not return to their original position when released may indicate internal wear or damage that should be referred to a certified propeller repair station with the appropriate rating.

Blade Tolerances
Table 8-2

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 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) 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 LIST AND FIGURES

Clamp Assemblies

Spring Assemblies

Beta Feedback Block Assemblies

SUB-ASSEMBLY PARTS LIST AND FIGURES, CONTINUED

Beta Valve Assemblies

Valve Assemblies

Start Lock Assemblies

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

(2) 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

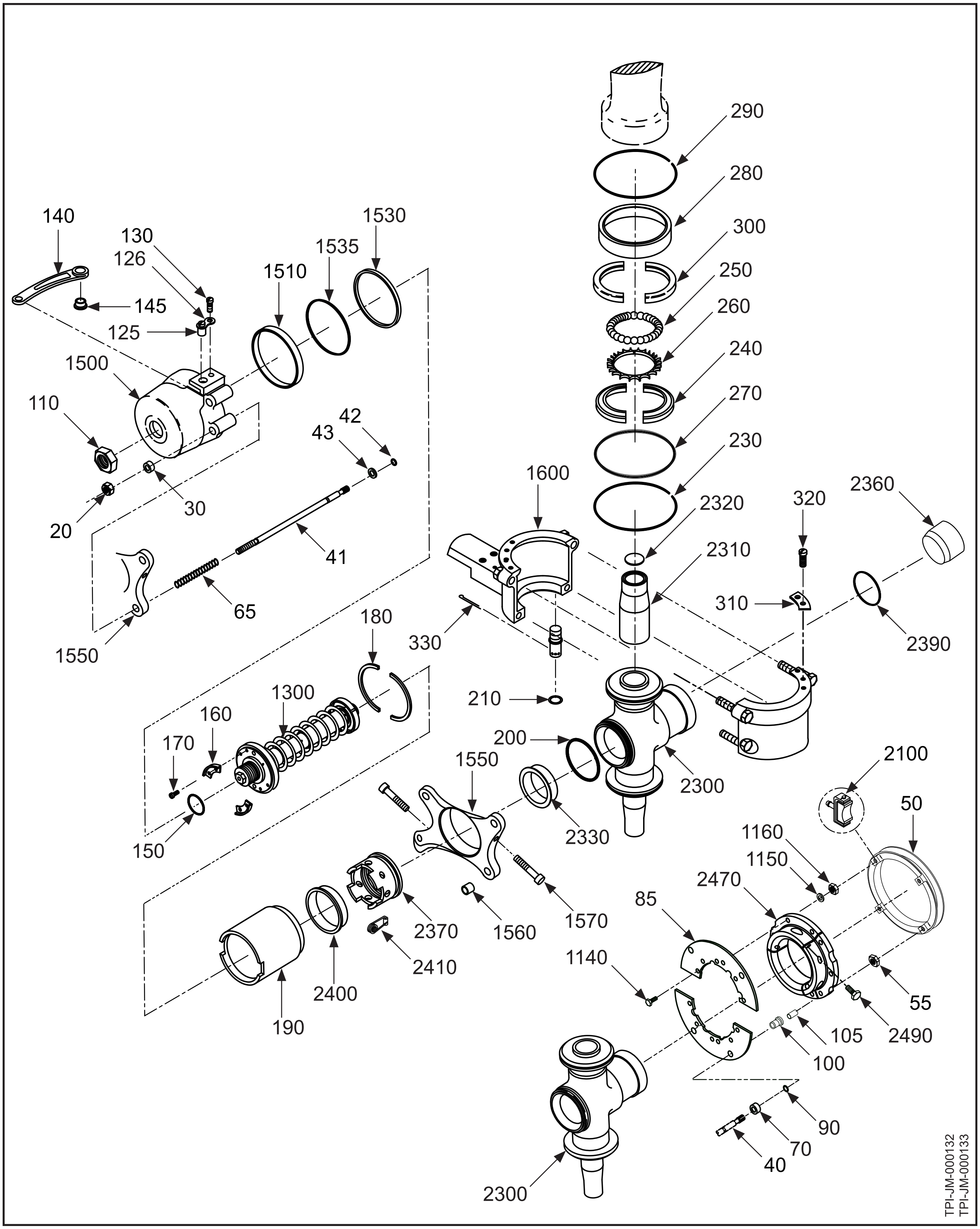
(1) Many O-rings, fasteners, and other vendor supplied hardware listed in Hartzell Propeller Inc. manuals have previously been specified with AN, MS, NAS or vendor part number. To provide internal controls and procurement flexibility, Hartzell part numbers have been assigned to all O-rings, fasteners,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



HC-A2(MV,V)20-3L Propeller Assembly
Figure 10-1

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-1		**PROPELLER ASSEMBLY - HC-A2(MV,V)20-3L**				
20	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		8	Y	
30	A-2246-10	SPACER, ALUMINUM		4		
40	B-3475A-2	ROD, BETA - UNIT		4		
41	B-3476A-2	• ROD, BETA		1		
42	A-3482	• RING, RETAINING, CRIMPED		2	Y	
43	A-3478-1	• SPRING RETAINER, BETA		1	Y	
50	B-2952	RING, BETA		1		
55	A-3439	NUT, 3/8-24, HEX, THIN		4	Y	
65	A-3008	SPRING, COMPRESSION, BETA		4	Y	
70	A-2246-9	SPACER, ALUMINUM, REPLACED BY ITEM 70A		4		
70A	B-3834-0632	WASHER, REPLACES ITEM 70		AR		
85	C-1981	SUPPORT PLATE, GUIDE LUG		1		
90	B-3843-56ZD	SNAP RING, EXTERNAL		4	Y	
100	A-1983	LUG, GUIDE		4		
105	A-3023-2	• BUSHING, PLASTIC		4		
110	A-880-1	NUT, HEX, SELF-LOCKING, THIN		1	Y	
-120	A-1464	LINK PIN UNIT		2	Y	
125	A-872-1	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	A-861-3L	LINK ARM		2		
145	A-944	SLEEVE, LINKSCREW		2	Y	
150	C-3317-020	O-RING, PITCH CHANGE ROD		1	Y	
160	A-899-( )	SPACER, STOP, PITCH		2		
170	B-3840-6	SCREW, 10-32, FILLISTER HEAD		4	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854-1	CYLINDER		1		
200	C-3317-235	O-RING		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		AR	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-1		**PROPELLER ASSEMBLY - HC-A2(MV,V)20-3L**				
230	A-2027	RETAINER, BEARING, WIRE		2	Y	
240	A-971-B	RACE, INBOARD SIDE		2		
250	B-6144-2 B-6144-2-450	BALL, BEARING, 9/16" DIA BALL, BEARING, 9/16" DIA (450 PCS)		34 RF	Y Y	
260	A-311	BALL SPACER		2	Y	
270	C-3317-230	O-RING		2	Y	
280	A-972	RING, RETAINING, BEARING		2		
290	A-974	RETAINER, RING, WIRE		2	Y	
300	A-971-A	RACE, OUTBOARD SIDE		2		
310	A-48	BALANCE WEIGHT		AR		
320	B-3840-( )	SCREW, 10-32, FILLISTER HEAD		AR	Y	
330	B-3838-3-3	COTTER PIN		2	Y	
1140	B-3384-5H	BOLT, 1/4-28, HEX HEAD, SUPERSEDED BY ITEM 1140A		9	Y	
1140A	B-3384-7H	BOLT, 1/4-28, HEX HEAD, SUPERSEDES ITEM 1140		9	Y	
1150	B-3851-0432	WASHER		9	Y	
1160	B-3808-4	NUTS		9	Y	
1300	831-52	SPRING ASSEMBLY, SUPERSEDED BY ITEM 1300A		1		
1300A	831-85	SPRING ASSEMBLY, SUPERSEDES ITEM 1300 (REFER TO "831-85 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
1500	C-2951-1L	PISTON UNIT		1		
1510	A-862	• BUSHING, PLASTIC		1		
1530	A-863	SEAL, DUST, PISTON, SUPERSEDED BY ITEM 1530A		1	Y	
1530A	B-1843	SEAL, DUST, PISTON, SUPERSEDES ITEM 1530		1	Y	
1535	C-3317-343-1	O-RING, PISTON		1	Y	
1550	834-14	GUIDE COLLAR UNIT		1		
1560	A-3023	• BUSHING, PLASTIC		4		
1570	A-2038-10	• SCREW, 1/4-28, CAP		2	Y	
-1580	A-114-C	• DOWEL PIN		2		
1600	838-70L	PCP: CLAMP UNIT (REFER TO "838-70L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	V	2		PCP
1600A	838-1070L	PCP: CLAMP UNIT (REFER TO "838-1070L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	MV	2		PCP

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
MV	HC-A2MV20-3L		
V	HC-A2V20-3L		

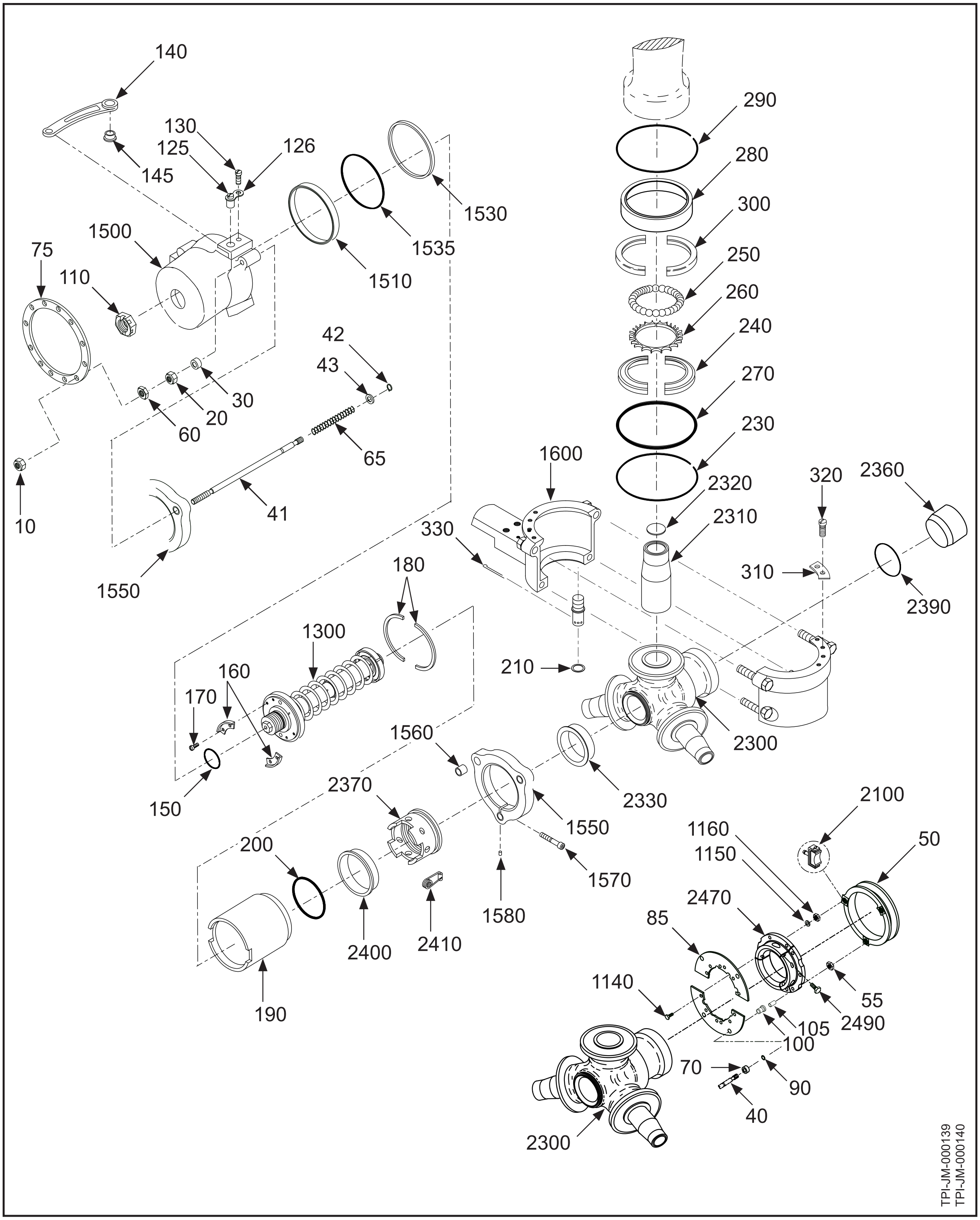
- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-1		**PROPELLER ASSEMBLY - HC-A2(MV,V)20-3L**				
-1800	B-2372	BETA VALVE ASSEMBLY (REFER TO "B-2372 BETA VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	A	1		
-1800A	A-4117	BETA VALVE ASSEMBLY (REFER TO "A-4117 BETA VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	B	1		
2100	A-3044	BLOCK, BETA FEEDBACK - ASSEMBLY (REFER TO "A-3044 BETA FEEDBACK BLOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2300	840-94	PCP: HUB UNIT		1		PCP
2310	A-1496	• PILOT TUBE, SUPERSEDED BY ITEM 2310A		2		
2310A	C-7080	• PILOT TUBE SUPERSEDES ITEM 2310, POST HC-SL-61-211		2		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USED WITH ITEM 2310A		2	Y	
2330	A-155	• HUB BUSHING, SHAFT		1		
2360	A-50-3	CONE, MOUNTING, REAR, 20 SPLINE		1		
2370	A-63-B	PCP: NUT, SHAFT, 20 SPLINE, USE WITH ITEM 2400		1		PCP
2370A	B-2063	PCP: NUT, SHAFT, 20 SPLINE, ALTERNATE FOR ITEM 2370		1		PCP
2370B	A-63B	PCP: NUT, SHAFT, 20 SPLINE, USE WITH ITEM 2400 ALTERNATE FOR ITEMS 2370 AND 2370A		1		PCP
2390	C-3317-229	O-RING		1	Y	
2400	A-870	RING, PULLER, HUB USED WITH ITEMS 2370 AND 2370B ONLY		1		
2410	A-847	SAFETY PIN, SHAFT NUT		1		
2470	B-1952	COLLAR, PLATE, GUIDE LUG		1		
2490	A-2038-12	SCREW, 1/4-28, CAP		3	Y	
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
A	USED WITH GO-435-( ) AIRCRAFT ENGINE		
B	USED WITH GO-480-( ) AIRCRAFT ENGINE		

- ITEM NOT ILLUSTRATED

HC-A2(MV,V)20-3L



HC-A3(MV,V)20-3L Propeller Assembly
Figure 10-2

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-2		**PROPELLER ASSEMBLY - HC-A3(MV,V)20-3L**				
10	B-3359	NUT, 3/8-24, HEX, SELF-LOCKING		3	Y	
10A	B-3599	NUT, 3/8-24, HEX, SELF-LOCKING, ALTERNATE FOR ITEM 10		3	Y	
20	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		9	Y	
30	A-2246-4	SPACER, ALUMINUM		3	Y	
40	B-3475A-2	ROD, BETA - UNIT		3		
41	B-3476A-2	• ROD, BETA		1		
42	A-3482	• RING, RETAINING, CRIMPED		2	Y	
43	A-3478-1	• SPRING RETAINER, BETA		1	Y	
50	B-3001-2	RING, BETA - UNIT		1		
55	B-3382	NUT, 3/8-24, HEX, THIN		3	Y	
55A	A-3439	NUT, 3/8-24, HEX, THIN, ALTERNATE FOR ITEM 55		3	Y	
60	B-3382	NUT, 3/8-24, HEX, THIN		3	Y	
60A	A-3439	NUT, 3/8-24, HEX, THIN, ALTERNATE FOR ITEM 60		3	Y	
65	A-3099	SPRING, COMPRESSION, BETA		3	Y	
70	B-3834-0632	WASHER, USED WITH ITEM 100B		AR	Y	
75	B-3049	RING, SUPPORT, ROD, BETA		1	Y	
85	C-1958	PLATE, GUIDE LUG		1		
90	B-3843-56ZD	SNAP RING, EXTERNAL		3	Y	
-95	A-2246-9	SPACER, USED WITH ITEM 100 ONLY		3	Y	
100	A-1983	LUG, GUIDE, USED WITH ITEM 95 ONLY SUPERSEDED BY ITEM 100A		3		
100A	A-3067-6	LUG, GUIDE, SUPERSEDES ITEM 100, POST HC-SL-61-214 REPLACED BY ITEM 100B		3		
105A	A-3023-5	• BUSHING, PLASTIC		1		
100B	A-1983	LUG, GUIDE, REPLACES ITEM 100A		3		
105B	A-3023-2	• BUSHING, PLASTIC		3		
110	A-880-1	NUT, HEX, SELF-LOCKING, THIN		1	Y	
120A	A-1464	LINK PIN UNIT		3	Y	
125	A-872-1	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1		
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	A-861-3L	LINK ARM		3		
145	A-944	SLEEVE, LINKSCREW		3	Y	
150	C-3317-020	O-RING, PITCH CHANGE ROD		1	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-2		**PROPELLER ASSEMBLY - HC-A3(MV,V)20-3L**				
160	A-899-( )	SPACER, STOP, PITCH		3		
170	B-3840-6	SCREW, 10-32, FILLISTER HEAD		4	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854-1	CYLINDER		1		
200	C-3317-235	O-RING		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		AR	Y	
230	A-2027	RETAINER, BEARING, WIRE		3	Y	
240	A-971-B	RACE, INBOARD SIDE		3		
250	B-6144-2 B-6144-2-450	BALL, BEARING, 9/16" DIA BALL, BEARING, 9/16" DIA. 450 PCS.		51 RF	Y Y	
260	A-311	BALL SPACER		3	Y	
270	C-3317-230	O-RING		3	Y	
280	A-972	RING, RETAINING, BEARING		3		
290	A-974	RETAINER, RING, WIRE		3	Y	
300	A-971-A	RACE, OUTBOARD SIDE		3		
310	A-48	BALANCE WEIGHT		AR	Y	
320	B-3840-( )	SCREW, 10-32, FILLISTER HEAD		AR	Y	
330	B-3838-3-3	COTTER PIN		3	Y	
1140	B-3384-7H	BOLT, 1/4-28, HEX HEAD		9	Y	
1150	B-3851-0463	WASHER		9	Y	
1160	B-3808-4	NUT		9	Y	
1300	831-85	SPRING ASSEMBLY (REFER TO "831-85 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
1500	C-1992L	PISTON UNIT		1		
1510	A-862	• BUSHING, PLASTIC		1		
1530	B-1843	SEAL, DUST, PISTON		1	Y	
1535	C-3317-343-1	O-RING, PISTON		1	Y	
1550	834-18L	GUIDE COLLAR UNIT		1		
1560	A-3023	• BUSHING, PLASTIC		3		
1570	A-2038-12	• SCREW, 1/4-28, CAP		1	Y	
1580	A-114-6	• DOWEL PIN		1		
1600	838-1070L	PCP: CLAMP ASSEMBLY (REFER TO "838-1070L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	MV	3		PCP
1600A	838-70L	PCP: CLAMP ASSEMBLY (REFER TO "838-70L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	V	3		PCP

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
MV	HC-A3MV20-3L		
V	HC-A3V20-3L		

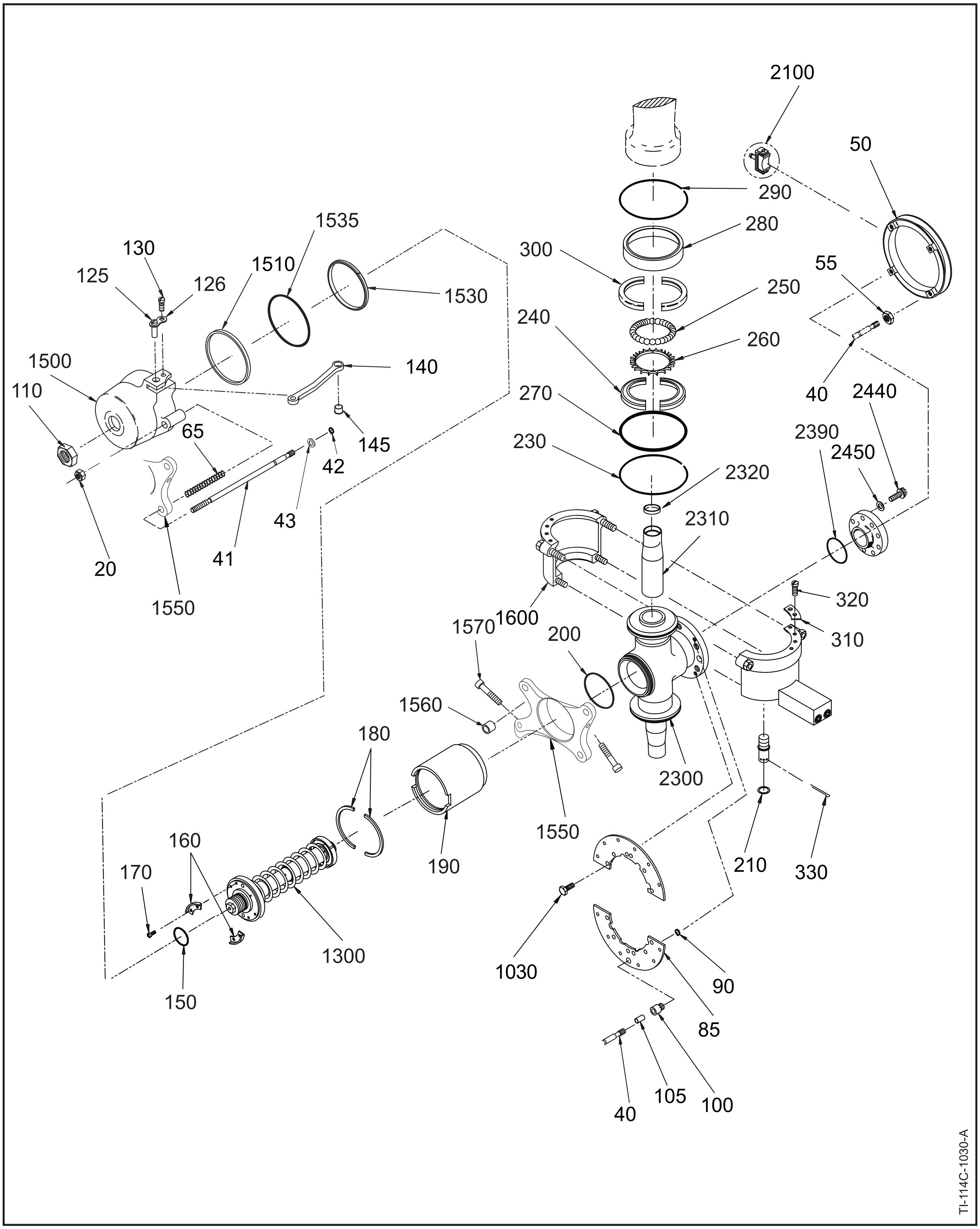
- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-2		**PROPELLER ASSEMBLY - HC-A3(MV,V)20-3L**				
-1800	A-4117	BETA VALVE ASSEMBLY (REFER TO "A-4117 BETA VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2100	A-3044	BLOCK, BETA FEEDBACK - ASSEMBLY (REFER TO "A-3044 BETA FEEDBACK BLOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2300	840-85	PCP: HUB UNIT		1		PCP
2310	A-1496	• PILOT TUBE, SUPERSEDED BY ITEM 2310A		3		
2310A	C-7080	• PILOT TUBE, SUPERSEDES ITEM 2310, POST HC-SL-61-211		3		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USED WITH ITEM 2310A		3	Y	
2330	A-155	• HUB SHAFT BUSHING		1		
2360	A-50-3	CONE, MOUNTING, REAR, 20 SPLINE		1		
2370	A-63-B	PCP: NUT, SHAFT, 20 SPLINE (REQUIRES ITEM 2400)		1		PCP
-2370A	B-2063	PCP: NUT, SHAFT, 20 SPLINE, ALTERNATE FOR ITEM 2370		1		PCP
-2370B	A-63B	PCP: NUT, SHAFT, 20 SPLINE, ALTERNATE FOR ITEM 2370 (REQUIRES ITEM 2400)		1		PCP
2390	C-3317-229	O-RING		1	Y	
2400	A-870	RING, PULLER, HUB, USED WITH ITEMS 2370 AND 2370B ONLY		1		
2410	A-847	SAFETY PIN, SHAFT NUT		1		
2470	B-1957	COLLAR, PLATE, GUIDE LUG		1		
2490	A-2038-12	SCREW, 1/4-28, CAP		3	Y	
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-A3(MV,V)20-3L



BHC-A2(MV,V)F-3 Propeller Assembly
Figure 10-3

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-3		**PROPELLER ASSEMBLY - BHC-A2(MV,V)F-3**				
20	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		4	Y	
40	B-3475A-6	ROD, BETA - UNIT		4		
41	B-3002-4	• ROD, BETA, SUPERSEDED BY ITEM 41A		1		
41A	B-3002-9	• ROD, BETA, SUPERSEDES ITEM 41 SUPERSEDED BY ITEM 41B		1		
41B	B-3476A-6	• ROD, BETA, SUPERSEDES ITEM 41A		1		
42	A-3482	• RING, RETAINING, CRIMPED		2	Y	
43	A-3478-1	• SPRING RETAINER, BETA		1	Y	
50	B-2952	RING, BETA		1		
55	A-2977	NUT, 3/8-24, HEX, THIN, SUPERSEDED BY ITEM 55A		4	Y	
55A	A-3439-1	NUT, 3/8-24, HEX, THIN, SUPERSEDES ITEM 55		4	Y	
65	A-3008	SPRING, COMPRESSION, BETA		4	Y	
85	C-2954	PLATE, MOUNTING, SPINNER		1		
90	B-3843-56ZD	SNAP RING, EXTERNAL		4	Y	
100	A-3067-2	LUG, GUIDE		4		
105	A-3023-2	• BUSHING, PLASTIC		1		
110	A-880-2	NUT, HEX, SELF-LOCKING, THIN		1	Y	
120	A-1464	LINK PIN UNIT		2	Y	
125	A-872-1	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1		
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	A-861-3	LINK ARM		2		
145	A-944	SLEEVE, LINKSCREW		2	Y	
150	C-3317-024	O-RING, PITCH CHANGE ROD		1	Y	
160	A-899-( )	SPACER, STOP, PITCH		2		
170	B-3840-6	SCREW, 10-32, FILLISTER HEAD		4	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854-1	CYLINDER		1		
200	C-3317-235	O-RING, CYLINDER		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		AR	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

BHC-A2(MV,V)F-3

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-3		**PROPELLER ASSEMBLY - BHC-A2(MV,V)F-3**				
230	A-2027	RETAINER, BEARING, WIRE		2	Y	
240	A-971-B	RACE, INBOARD SIDE		2		
250	B-6144-2 B-6144-2-450	BALL, BEARING, 9/16" DIA BALL, BEARING, 9/16" DIA. (450 PCS)		34 RF	Y Y	
260	A-311	BALL SPACER		2	Y	
270	C-3317-230	O-RING		2	Y	
280	A-972	RING, RETAINING, BEARING		2		
290	A-974	RETAINER, RING, WIRE		2	Y	
300	A-971-A	RACE, OUTBOARD SIDE		2		
310	A-48	BALANCE WEIGHT		AR		
320	B-3840-( )	SCREW, 10-32, FILLISTER HEAD		AR	Y	
330	B-3838-3-3	COTTER PIN		2	Y	
1030	B-3875-4H	BOLT, 5/16-24, HEX HEAD, SUPERSEDED BY ITEM 1030A		4	Y	
1030A	B-3875-2H	BOLT, 5/16-24, HEX HEAD, SUPERSEDES ITEM 1030		4	Y	
1300	831-5B	FEATHERING SPRING ASSEMBLY (REFER TO "831-5B FEATHERING SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
1500	C-2951	PISTON UNIT		1		
1510	A-862	• BUSHING, PLASTIC		1		
1530	B-1843	SEAL, DUST, PISTON		1	Y	
1535	C-3317-343-1	O-RING, PISTON		1	Y	
1550	834-14	GUIDE COLLAR UNIT		1		
1560	A-3023	• BUSHING, PLASTIC		4		
1570	A-2038-10	• SCREW, 1/4-28, CAP		2	Y	
-1580	A-114-C	• DOWEL PIN		2		
1600	838-36	PCP: CLAMP ASSEMBLY, SUPERSEDED BY 1600A	V	2		PCP
1600A	838-70	PCP: CLAMP ASSEMBLY, SUPERSEDES ITEM 1600 (REFER TO "838-70 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	V	2		PCP
1600B	838-1070	PCP: CLAMP ASSEMBLY (REFER TO "838-1070 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	MV	2		PCP

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
MV	BHC-A2MVF-3		
V	BHC-A2VF-3		

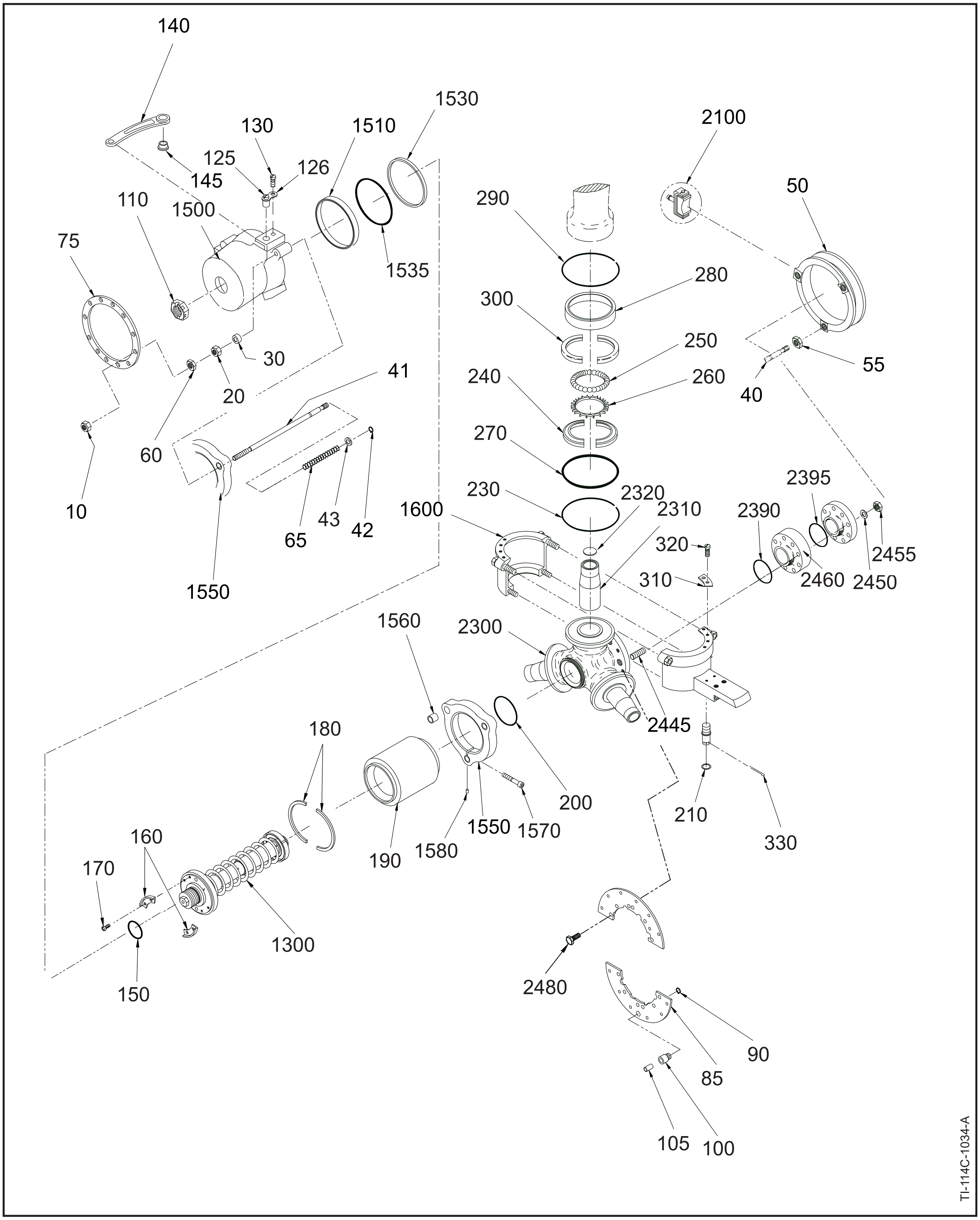
- ITEM NOT ILLUSTRATED

BHC-A2(MV,V)F-3

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-3		**PROPELLER ASSEMBLY - BHC-A2(MV,V)F-3**				
-1800	A-3031	BETA VALVE ASSEMBLY, REFER TO FIGURE 10-16 (REFER TO "A-3031 BETA VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		OBS		
2100	A-3044	BLOCK, BETA FEEDBACK, ASSEMBLY (REFER TO "A-3044 BETA FEEDBACK BLOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2300	840-81	PCP: HUB UNIT, SUPERSEDED BY ITEM 2300A		1		PCP
2300A	840-107	PCP: HUB UNIT, SUPERSEDES ITEM 2300		1		PCP
2310	A-1496	• PILOT TUBE, SUPERSEDED BY ITEM 2310A		2		
2310A	C-7080	• PILOT TUBE SUPERSEDES ITEM 2310, POST HC-SL-61-211		2		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USED WITH ITEM 2310A		2	Y	
-2350	A-957-2	• PIN, 1/2", ALUMINUM		2	Y	
2390	C-3317-228	O-RING		1	Y	
-2420	B-6138-8-8	DOWEL PIN		2	Y	
2440	A-1328-1	BOLT, MOUNTING, 1/2-20, 12 POINT		6	Y	
2440A	A-2040	BOLT, MOUNTING, 1/2-20, ALTERNATE FOR ITEM 2440		6	Y	
2450	A-1381	WASHER, 1/2" CRES		6	Y	
2450A	B-3851-0863	WASHER, ALTERNATE FOR ITEM 2450		6	Y	
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED



HC-A3(MV,V)F-3L Propeller Assembly
Figure 10-4

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-4		**PROPELLER ASSEMBLY - HC-A3(MV,V)F-3L**				
10	B-3359	NUT, 3/8-24, HEX, SELF-LOCKING		3	Y	
10A	B-3599	NUT, 3/8-24, HEX, SELF-LOCKING, ALTERNATE FOR ITEM 10		3	Y	
20	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
30	A-2246-4	SPACER, ALUMINUM		3	Y	
-40	B-3475A-2	ROD, BETA - UNIT		3		
41	B-3476A-2	• ROD, BETA		1		
42	A-3482	• RING, RETAINING, CRIMPED		2	Y	
43	A-3478-1	• SPRING RETAINER, BETA		1	Y	
50	B-3001-2	RING, BETA		1		
55	B-3382	NUT, 3/8-24, HEX, THIN		3	Y	
55A	A-3439	NUT, 3/8-24, HEX, THIN, ALTERNATE FOR ITEM 55		3	Y	
60	B-3382	NUT, 3/8-24, HEX, THIN		3	Y	
60A	A-3439	NUT, 3/8-24, HEX, THIN, ALTERNATE FOR ITEM 60		3	Y	
65	A-3099	SPRING, COMPRESSION, BETA		3	Y	
75	B-3049	RING, SUPPORT, ROD , BETA		6		
85	C-3675	PLATE, MOUNTING, SPINNER, SUPERSEDED BY ITEM 85A		1		
85A	C-3675-1	PLATE, MOUNTING, SPINNER, SUPERSEDES ITEM 85		1		
90	B-3843-56ZD	SNAP RING, EXTERNAL		3	Y	
100	A-3067-2	LUG, GUIDE		3		
105	A-3023-2	• BUSHING, PLASTIC		1		
110	A-880-2	NUT, HEX, SELF-LOCKING, THIN		1	Y	
120	A-1464	LINK PIN UNIT		3	Y	
125	A-872-1	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1		
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	A-861-3L	LINK ARM		3	Y	
145	A-944	SLEEVE, LINKSCREW		3	Y	
150	C-3317-024	O-RING, PITCH CHANGE ROD		1	Y	
160	A-899-( )	SPACER, STOP, PITCH		2		
170	B-3840-6	SCREW, 10-32, FILLISTER HEAD		1	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854-1	CYLINDER		1		
200	C-3317-235	O-RING		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		AR	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-A3(MV,V)F-3L

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-4		**PROPELLER ASSEMBLY - HC-A3(MV,V)F-3L**				
230	A-2027	RETAINER, BEARING, WIRE		3	Y	
240	A-971-B	RACE, INBOARD SIDE		3		
250	B-6144-2 B-6144-2-450	BALL, BEARING, 9/16" DIA BALL, BEARING, 9/16" DIA (450 PCS)		51 RF	Y Y	
260	A-311	BALL SPACER		3	Y	
270	C-3317-230	O-RING		3	Y	
280	A-972	RING, RETAINING, BEARING		3	Y	
290	A-974	RETAINER, RING, WIRE		3	Y	
300	A-971-A	RACE, OUTBOARD SIDE		3		
310	A-48	BALANCE WEIGHT		AR		
320	B-3840-6	SCREW, 10-32, FILLISTER HEAD		AR	Y	
330	B-3838-3-3	COTTER PIN		3	Y	
1300	831-53	SPRING ASSEMBLY (REFER TO "831-53 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
1500	C-1992-2L	PISTON UNIT		1		
1510	A-862	• BUSHING, PLASTIC		1		
1530	A-863	SEAL, DUST, PISTON, SUPERSEDED BY ITEM 1530A		1	Y	
1530A	B-1843	SEAL, DUST, PISTON, SUPERSEDES ITEM 1530		1	Y	
1535	C-3317-343-1	O-RING, PISTON		1	Y	
1550	834-18L	GUIDE COLLAR UNIT		1		
1560	A-3023	• BUSHING, PLASTIC		3		
1570	A-2038-12	• SCREW, 1/4-28, CAP		1	Y	
1580	A-114-6	• DOWEL PIN		1	Y	
1600	838-70L	PCP: CLAMP ASSEMBLY (REFER TO "838-70L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	V	3		PCP
1600A	838-1070L	PCP: CLAMP ASSEMBLY (REFER TO "838-1070L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	MV	3		PCP

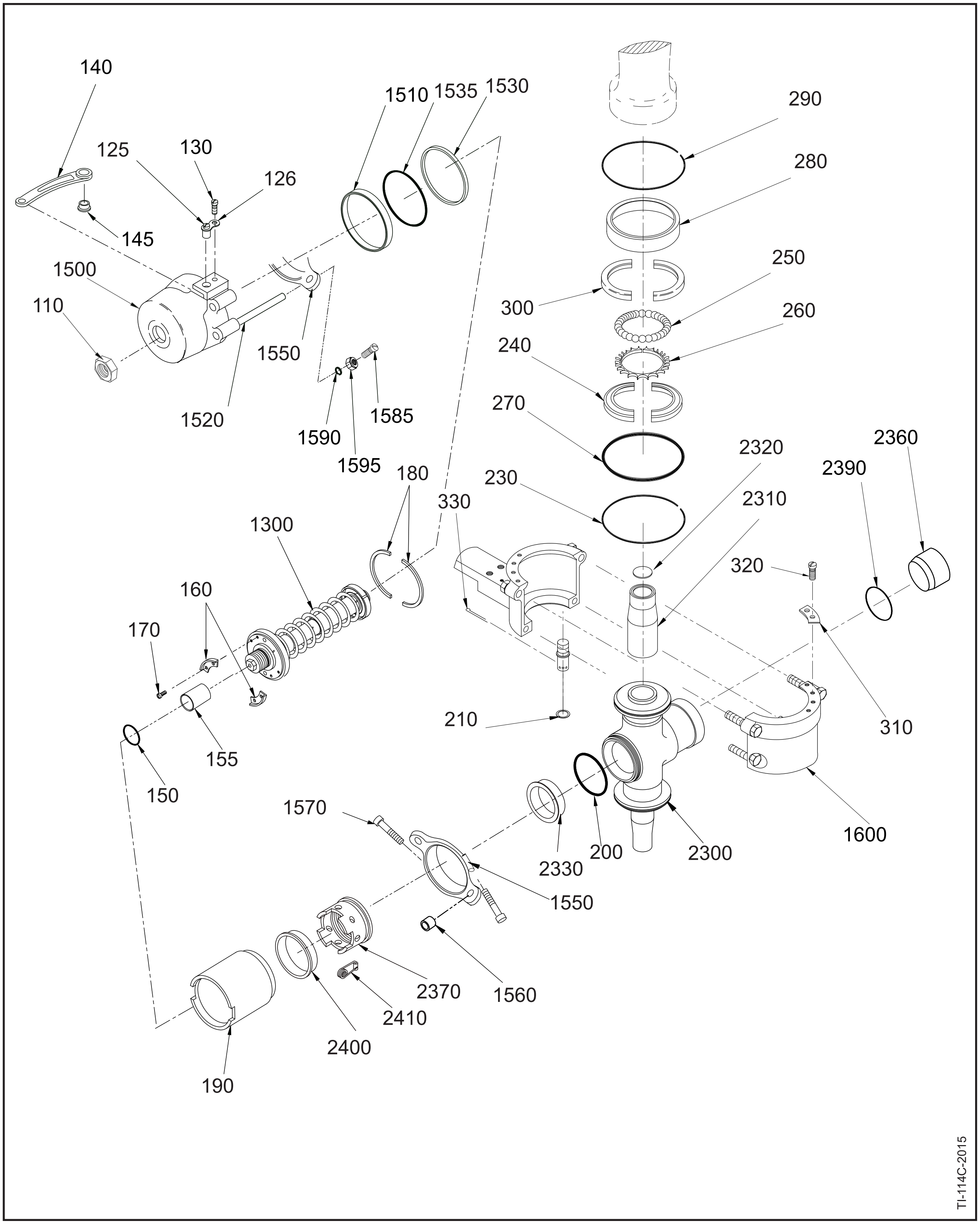
EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
MV	HC-A3MVF-3L		
V	HC-A3VF-3L		

- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-4		**PROPELLER ASSEMBLY - HC-A3(MV,V)F-3L**				
-1800	A-4117	BETA VALVE ASSEMBLY, REFER TO FIGURE 10-20 (REFER TO "A-4117 BETA VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2100	A-3044	BLOCK, BETA FEEDBACK - ASSEMBLY (REFER TO "A-3044 BETA FEEDBACK BLOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2300	840-82	PCP: HUB UNIT		1		PCP
2310	A-1496	• PILOT TUBE, SUPERSEDED BY ITEM 2310A		3		
2310A	C-7080	• PILOT TUBE, SUPERSEDES ITEM 2310, POST HC-SL-61-211		3		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USED WITH ITEM 2310A		3	Y	
2390	C-3317-228	O-RING		1	Y	
2395	C-3317-228	O-RING		1	Y	
-2420	B-6138-8-8	DOWEL PIN		4	Y	
2445	A-2983	STUD, MOUNTING, 1/2-20		6	Y	
2450	A-1381	WASHER, 1/2" CRES		6	Y	
2455	A-2044	NUT, 1/2-20, HEX, SELF-LOCKING		6	Y	
2460	B-2982	SPACER, "F" FLANGE		1		
2480	B-3384-1H	BOLT, 1/4-28, HEX HEAD		6	Y	
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED



HC-A2(MV,V)20-5L Propeller Assembly
Figure 10-5

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-5		**PROPELLER ASSEMBLY - HC-A2(MV,V)20-5L**				
110	A-880-1	NUT, HEX, SELF-LOCKING, THIN		1	Y	
-120	A-1464	LINK PIN UNIT, POST HC-SB-61-280		2	Y	
125	A-872-1	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1		
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	A-2008	LINK ARM		2		
145	A-944	SLEEVE, LINKSCREW		2	Y	
150	C-3317-020	O-RING, PITCH CHANGE ROD		1	Y	
155	A-2010	SPACER, STOP, PITCH, SUPERSEDED BY ITEM 155A		2		
155A	B-6027	SPACER, STOP, PITCH, SUPERSEDES ITEM 155		2		
160	A-899-1	SPACER, STOP, PITCH		2		
170	B-3840-6	SCREW, 10-32, FILLISTER HEAD		4	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854	CYLINDER		1		
200	C-3317-235	O-RING		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		2	Y	
230	A-2027	RETAINER, BEARING, WIRE		2	Y	
240	A-971-B	RACE, INBOARD SIDE		2		
250	B-6144-2 B-6144-2-450	BALL, BEARING, 9/16" DIA BALL, BEARING, 9/16" DIA (450 PCS)		34 RF	Y Y	
260	A-311	BALL SPACER		2	Y	
270	C-3317-228	O-RING, SUPERSEDED BY ITEM 270A		2	Y	
270A	C-3317-230	O-RING, SUPERSEDES ITEM 270		2	Y	
280	A-972	RING, RETAINING, BEARING		2		
290	A-974	RETAINER, RING, WIRE		2	Y	
300	A-971-A	RACE, OUTBOARD SIDE		2		
310	A-48	BALANCE WEIGHT		4		
320	B-3840-( )	SCREW, 10-32, FILLISTER HEAD		AR	Y	
330	B-3838-3-3	COTTER PIN		4	Y	
1300	831-15	SPRING ASSEMBLY (REFER TO "831-15 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-A2(MV,V)20-5L

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-5		**PROPELLER ASSEMBLY - HC-A2(MV,V)20-5L**				
1500	C-852-8	PISTON UNIT		1		
1510	A-862	• BUSHING, PLASTIC		1		
1520	A-817-2	• ROD, GUIDE, PISTON, SUPERSEDED BY ITEM 1520A		2		
1520A	A-817-5	• ROD, GUIDE, PISTON, SUPERSEDES ITEM 1520		2		
1525	A-114-B	• DOWEL PIN		2		
1530	A-863	SEAL, DUST, PISTON, SUPERSEDED BY ITEM 1530A		1	Y	
1530A	B-1843	SEAL, DUST, PISTON, SUPERSEDES ITEM 1530		1	Y	
1535	C-3317-343-1	O-RING, PISTON		1	Y	
1550	834-2	GUIDE COLLAR UNIT		1		
1560	A-116-D1	• BUSHING, PLASTIC		2		
1570	A-2038-12	• SCREW, 1/4-28, CAP		2	Y	
1585	A-2037	SCREW, 5/16, CAP		2	Y	
1590	A-1444	WASHER, 5/16 INCH		2	Y	
1595	B-3368	NUT, 5/16-24, HEX THIN		2	Y	
1600	838-36	PCP: CLAMP ASSEMBLY (REFER TO "838-36 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	V	2		PCP
1600A	838-1036	PCP: CLAMP ASSEMBLY (REFER TO "838-1036 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	MV	2		PCP
-1800	D-2006	VALVE ASSEMBLY (REFER TO "D-2006 VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		

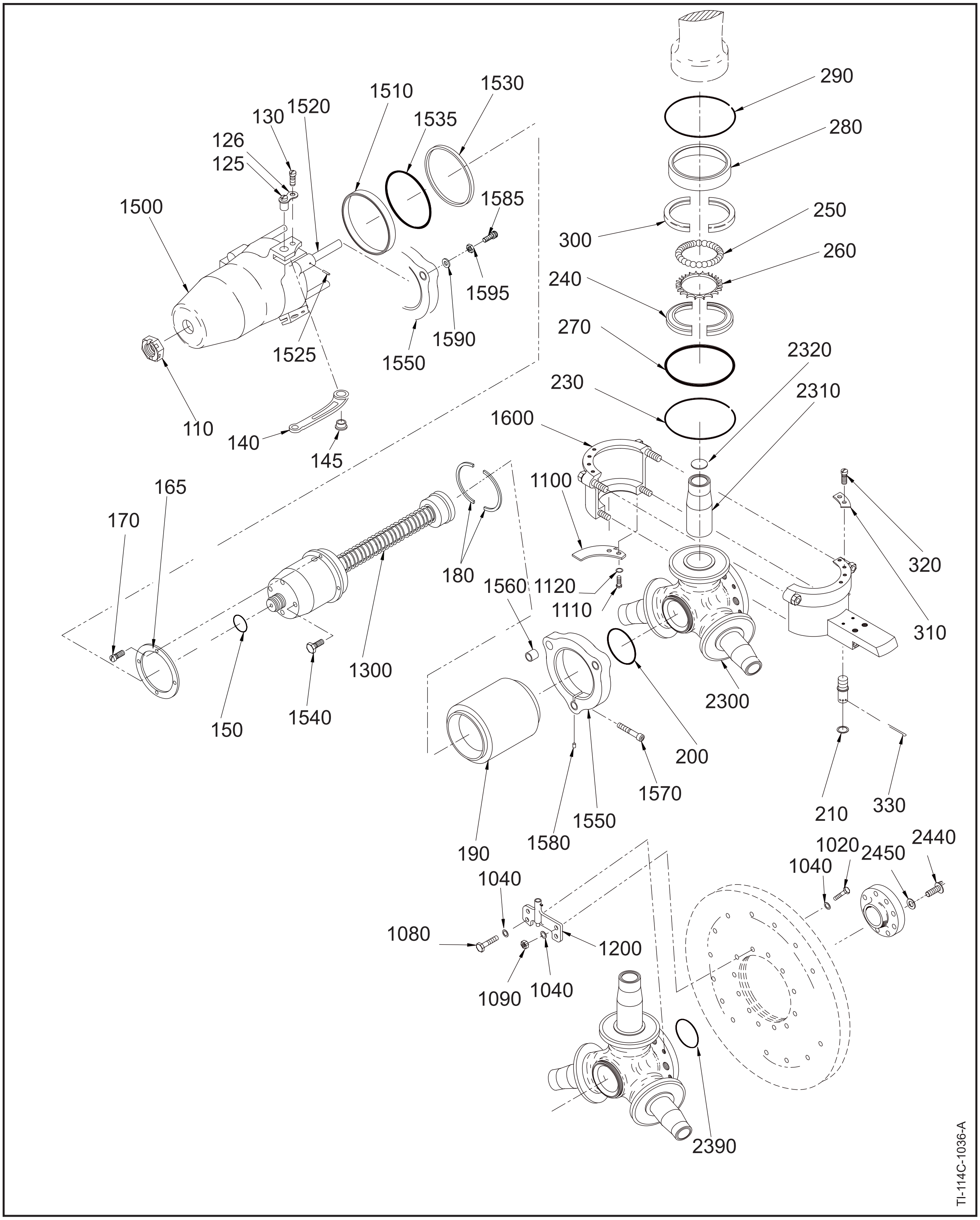
EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
MV	HC-A2MV20-5L		
V	HC-A2VF20-5L		

- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-5		**PROPELLER ASSEMBLY - HC-A2(MV,V)20-5L**				
2300	840-94	PCP: HUB UNIT		1		PCP
2310	A-1496	• PILOT TUBE, SUPERSEDED BY ITEM 2310A		2		
2310A	C-7080	• PILOT TUBE, SUPERSEDES ITEM 2310, POST HC-SL-61-211		2		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USED WITH ITEM 2310A		2	Y	
2330	A-155	• HUB BUSHING, SHAFT		1		
2360	A-50-3	CONE, MOUNTING, REAR, 20 SPLINE		1		
2370	A-63-B	PCP: NUT, SHAFT, 20 SPLINE (REQUIRES ITEM 2400)		1		PCP
-2370A	B-2063	PCP: NUT, SHAFT, 20 SPLINE, ALTERNATE FOR ITEM 2370		1		PCP
-2370B	A-63B	PCP: NUT, SHAFT, 20 SPLINE, ALTERNATE FOR ITEM 2370 (REQUIRES ITEM 2400)		1		PCP
2390	C-3317-229	O-RING		1	Y	
2400	A-870	RING, PULLER, HUB, USE WITH ITEMS 2370 AND 2370B ONLY		1		
2410	A-847	SAFETY PIN, SHAFT NUT		1		
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED



HC-A3(MV,V)F-5A(L) Propeller Assembly
Figure 10-6

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-6		**PROPELLER ASSEMBLY - HC-A3(MV,V)F-5A(L)**				
110	A-880-1	NUT, HEX, SELF-LOCKING, THIN		1	Y	
-120	A-1464	LINK PIN UNIT, POST HC-SB-61-280		3	Y	
125	A-872-1	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1		
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	B-4016 B-4016L	LINK ARM LINK ARM	-5A -5AL	3 3		
145	A-944	SLEEVE, LINK PIN		3		
150	C-3317-020	O-RING, PITCH CHANGE ROD		1	Y	
165	A-1467	RING, RETAINING		1		
170	B-3840-6	SCREW, 10-32, FILLISTER HEAD		4	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854-1	CYLINDER		1		
200	C-3317-235	O-RING		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		3	Y	
230	A-2027	RETAINER, BEARING, WIRE		3	Y	
240	A-971-B	RACE, INBOARD SIDE		3		
250	B-6144-2 B-6144-2-450	BALL, BEARING, 9/16" DIA BALL, BEARING, 9/16" DIA (450 PCS)		51 RF	Y Y	
260	A-311	BALL SPACER		3	Y	
270	C-3317-230	O-RING		3	Y	
280	A-972	RING, RETAINING, BEARING		3		
290	A-974	RETAINER, RING, WIRE		3	Y	
300	A-971-A	RACE, OUTBOARD SIDE		3		
310	A-48	BALANCE WEIGHT		6		
320	B-3840-( )	SCREW, 10-32, FILLISTER HEAD		AR	Y	
330	B-3838-3-3	COTTER PIN		3	Y	
1020	B-3384-18	BOLT, 1/4-28, HEX HEAD		6	Y	
1040	B-3851-0432	WASHER		18	Y	
1080	B-3384-4H	BOLT, 1/4-28, HEX HEAD		6	Y	
1090	B-3808-4	NUT, HEX, SELF-LOCKING		6	Y	
1100	A-881	PLATE, START LOCK		3		
1110	A-2016	BOLT, 10-32, HEX HEAD		6	Y	
1120	B-3851-0363	WASHER		6	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5A	HC-A3(MV,V)F-5A		
-5AL	HC-A3(MV,V)F-5AL		

- ITEM NOT ILLUSTRATED

HC-A3(MV,V)F-5A(L)

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-6		**PROPELLER ASSEMBLY - HC-A3(MV,V)F-5A(L)**				
1200	830-4	START LOCK, ASSEMBLY (REFER TO "830-4(L) START LOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	-5A	3		
	830-4L	START LOCK, LH ASSEMBLY (REFER TO "830-4(L) START LOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	-5AL	3		
1300	831-35	SPRING ASSEMBLY (REFER TO "831-35 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
1500	C-1451-2	PISTON UNIT	-5A	1		
	C-1451-2L	PISTON UNIT	-5AL	1		
1510	A-862	• BUSHING, PLASTIC		1		
1520	A-817-1	• ROD, GUIDE, PISTON		3		
1525	B-6582-0815	• SPRING PIN, 3/16 INCH, CRES		3	Y	
1530	B-1843	SEAL, DUST, PISTON		1	Y	
1535	C-3317-343-1	O-RING (PISTON)		1	Y	
1540	B-3720	BOLT, 10-32, HEX HEAD		4	Y	
1550	834-1B	GUIDE COLLAR UNIT	-5A	1		
	834-1BL	GUIDE COLLAR UNIT	-5AL	1		
1550A	834-1A	GUIDE COLLAR UNIT, ALTERNATE FOR ITEM 1550	-5A	1		
	834-1AL	GUIDE COLLAR UNIT, ALTERNATE FOR ITEM 1550	-5AL	1		
1560	A-116-D1	• BUSHING PLASTIC		1		
1570	A-2038-10	• SCREW, 1/4-28, CAP		2	Y	
1580	A-114-C	• DOWEL PIN		1		
1585	A-2037	SCREW, 5/16, CAP		3	Y	
1590	A-1444	WASHER, 5/16 INCH		3	Y	
1595	B-3368	NUT, 5/16-24, HEX THIN		3	Y	
1600	838-1077	PCP: CLAMP ASSEMBLY (REFER TO "838-1077 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	-5A	3		PCP
	838-1077L	PCP: CLAMP ASSEMBLY (REFER TO "838-1077L CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	-5AL	3		PCP
-1800	B-1457	VALVE ASSEMBLY (REFER TO "B-1457 VLAVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5A	HC-A3(MV,V)F-5A		
-5AL	HC-A3(MV,V)F-5AL		

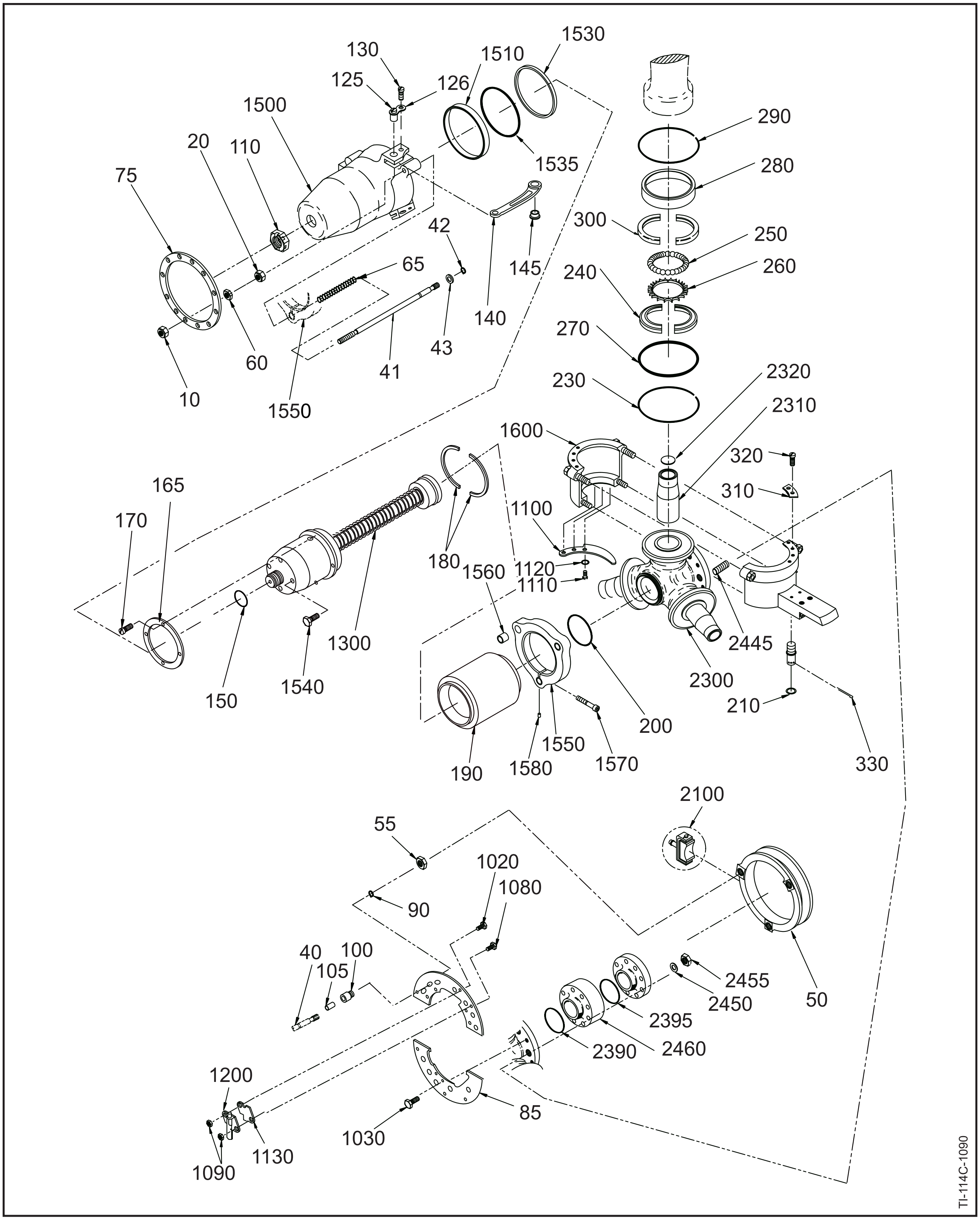
- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-6		**PROPELLER ASSEMBLY - HC-A3(MV,V)F-5A(L)**				
2300	840-82	PCP: HUB UNIT		1		PCP
2300A	840-159	PCP: HUB UNIT, ALTERNATE FOR ITEM 2300		1		PCP
2310	A-1496	• PILOT TUBE SUPERSEDED BY ITEM 2310A		3		
2310A	C-7080	• PILOT TUBE SUPERSEDES ITEM 2310, POST HC-SL-61-211		3		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USED WITH ITEM 2310A		3	Y	
2390	C-3317-228	O-RING		1	Y	
-2420	B-6138-8-8	DOWEL PIN		3		
2440	A-1328-1	BOLT, MOUNTING, 1/2-20, 12 POINT		3	Y	
2450	A-1381	• WASHER, 1/2" CRES		3	Y	
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-A3(MV,V)F-5A(L)



(P)HC-A3(MV,V)F-5R Propeller Assembly
Figure 10-7

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-7		**PROPELLER ASSEMBLY - (P)HC-A3(MV,V)F-5R**				
10	B-3359	NUT, 3/8-24, HEX, SELF-LOCKING	-P5R	3	Y	
10A	B-3599	NUT, 3/8-24, HEX, SELF-LOCKING ALTERNATE FOR ITEM 10	-P5R	3	Y	
20	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		3	Y	
-40	B-3575A-2	ROD, BETA		3		
41	B-3476A-2	• ROD, BETA		1		
42	A-3482	• RING, RETAINING, CRIMPED		2	Y	
43	A-3478-1	• SPRING RETAINER, BETA		1	Y	
50	B-3001-2	RING, BETA - UNIT		1		
55	A-3439	NUT, 3/8-24, HEX, SELF-LOCKING		3	Y	
55A	B-3382	NUT, 3/8-24, HEX, SELF-LOCKING, ALTERNATE FOR ITEM 55		3	Y	
60	A-3439	NUT, 3/8-24, HEX, SELF-LOCKING	-P5R	3	Y	
60A	B-3382	NUT, 3/8-24, HEX, SELF-LOCKING, ALTERNATE FOR ITEM 60	-P5R	3	Y	
65	A-3099	SPRING, COMPRESSION, BETA		3	Y	
75	B-3049	RING, SUPPORT, ROD, BETA	-P5R	1		
85	C-3673 C-3676	PLATE, MOUNTING, SPINNER PLATE, MOUNTING, SPINNER	-5R -P5R	1 1		
90	B-3843-56ZD	SNAP RING, EXTERNAL		3	Y	
100	A-3067-2 A-3067-5	LUG, GUIDE LUG, GUIDE	-5R -P5R	3 3		
105	A-3023-2 A-3023-5	• BUSHING, PLASTIC • BUSHING, PLASTIC	-5R -P5R	1 1		
110	A-880-1	NUT, HEX, SELF-LOCKING, THIN		1	Y	
120	A-1464	LINK PIN UNIT		3	Y	
125	A-872-( )	• LINK PIN		1		
126	A-979	• LINK		1		
130	B-3840-18	• SCREW, 10-32, FILLISTER HEAD		OBS		
130A	B-3840-6	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1		
130B	B-3840-8	• SCREW, 10-32, FILLISTER HEAD ALTERNATE FOR ITEM 130, POST HC-SB-61-280		1	Y	
140	B-1901	LINK ARM		3		
145	A-944	SLEEVE, LINK PIN		3		
150	C-3317-020	O-RING, PITCH CHANGE ROD		1	Y	
165	A-1467	RING, RETAINING		1		
170	B-3840-8	SCREW, 10-32, FILLISTER HEAD		4	Y	
180	A-859	KEEPER, SPLIT, SUPERSEDED BY ITEM 180A		1		
180A	106411	KEEPER, SPLIT, SUPERSEDES ITEM 180, POST HC-SB-61-370		1		
190	B-854-1	CYLINDER		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5R	HC-A3(MV,V)F-5R		
-P5R	PHC-A3(MV,V)F-5R		

- ITEM NOT ILLUSTRATED

(P)HC-A3(MV,V)F-5R

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-7		**PROPELLER ASSEMBLY - (P)HC-A3(MV,V)F-5R**				
200	C-3317-235	O-RING		1	Y	
210	A-6119	BUSHING, LINK ARM, POST HC-SL-61-167		3	Y	
230	A-2027	RETAINER, BEARING, WIRE		3	Y	
240	A-971-B	RACE, INBOARD SIDE		3		
250	B-6144-2	BALL, BEARING, 9/16" DIA		51	Y	
	B-6144-2-450	BALL, BEARING, 9/16" DIA (450 PCS)		RF	Y	
260	A-311	BALL SPACER		3	Y	
270	C-3317-230	O-RING		3	Y	
280	A-972	RING, RETAINING, BEARING		3		
290	A-974	RETAINER, RING, WIRE		3	Y	
300	A-971-A	RACE, OUTBOARD SIDE		3		
310	A-48	BALANCE WEIGHT		6		
320	B-3840-( )	SCREW, 10-32, FILLISTER HEAD		12	Y	
330	B-3838-3-3	COTTER PIN		3	Y	
1020	B-3384-2H	BOLT, 1/4-28, HEX HEAD		3	Y	
1030	B-3384-1H	BOLT, 1/4-28, HEX HEAD		6	Y	
1080	B-3384-1H	BOLT, 1/4-28, HEX HEAD		3	Y	
1090	B-3808-4	NUT, HEX, SELF-LOCKING		6	Y	
1100	A-3419-2	PLATE, START LOCK	-5R	3		
	A-3419-5	PLATE, START LOCK	-P5R	3		
1110	A-2016	BOLT, 10-32, HEX HEAD		6	Y	
1120	B-3851-0363	WASHER		6	Y	
1130	A-4593	SPACER, START LOCK	-P5R	3		
1200	830-27	START LOCK, ASSEMBLY, REFER TO FIGURE 10-25 (REFER TO "830-27 START LOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		3		
1300	831-89	SPRING ASSEMBLY (REFER TO "831-89 SPRING ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
1500	D-3672	PISTON UNIT		1		
1510	A-862	• BUSHING, PLASTIC		1		
1530	B-1843	SEAL, DUST, PISTON		1	Y	
1535	C-3317-343-1	O-RING (PISTON)		1	Y	
1540	B-3720	BOLT, 10-32, HEX HEAD		4	Y	
1550	834-18	GUIDE COLLAR UNIT		1		
1560	A-3023	• BUSHING PLASTIC		1		
1570	A-2038-10	• SCREW, 1/4-28, CAP		1	Y	
1580	A-114-6	• DOWEL PIN		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5R	HC-A3(MV,V)F-5R		
-P5R	PHC-A3(MV,V)F-5R		

- ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-7		**PROPELLER ASSEMBLY - (P)HC-A3(MV,V)F-5R**				
1600	838-108	PCP: CLAMP ASSEMBLY (REFER TO "838-108 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	V	3		PCP
	838-1108	PCP: CLAMP ASSEMBLY (REFER TO "838-1108 CLAMP ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)	MV	3		PCP
-1800	A-4117	VALVE ASSEMBLY (REFER TO "A-4117 VALVE ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2100	A-3044	BLOCK, BETA FEEDBACK - ASSEMBLY (REFER TO "A-3044 BETA FEEDBACK BLOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		
2300	840-82	PCP: HUB UNIT	-5R	1		PCP
	840-83	PCP: HUB UNIT	-P5R	1		PCP
2310	A-1496	• PILOT TUBE, SUPERSEDED BY ITEM 2310A	-5R	3		
2310A	C-7080	• PILOT TUBE, SUPERSEDES ITEM 2310, POST HC-SL-61-211	-5R, -P5R	3		
2320	B-7070-17	• PLUG, CUPPED, STEEL, USE WITH ITEM 2310A ONLY	-5R, -P5R	3	Y	
2390	C-3317-228	O-RING	1	Y		
2395	C-3317-228	O-RING	1	Y		
-2420	B-6138-8-8	DOWEL PIN		3		
2445	A-2983	STUD, MOUNTING, 1/2-20	-5R	6	Y	
	A-2983-2	STUD, MOUNTING, 1/2-20	-P5R	6	Y	
2450	A-1381	WASHER, 1/2" CRES		6	Y	
2455	A-2044	NUT, 1/2-30, HEX, SELF-LOCKING		6	Y	
2460	B-2982	SPACER	-5R	1		
	B-2984-3	SPACER	-P5R	1		
		COUNTERWEIGHT SLUGS/MOUNTING HARDWARE				
-9040		COUNTERWEIGHT SLUGS AND SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC, REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) FOR PART NUMBER AND PROPELLER CRITICAL PART (PCP) IDENTIFICATION			Y	
		SPINNER PARTS				
		APPLICATION SPECIFIC REFER TO HARTZELL PROPELLER INC. APPLICATION GUIDE MANUAL 159 (61-02-59) AND THE APPLICABLE HARTZELL PROPELLER INC. SPINNER MAINTENANCE MANUAL: MANUAL 127 (61-16-27) - METAL SPINNER ASSEMBLIES MANUAL 148 (61-16-48) - COMPOSITE SPINNER ASSEMBLIES				

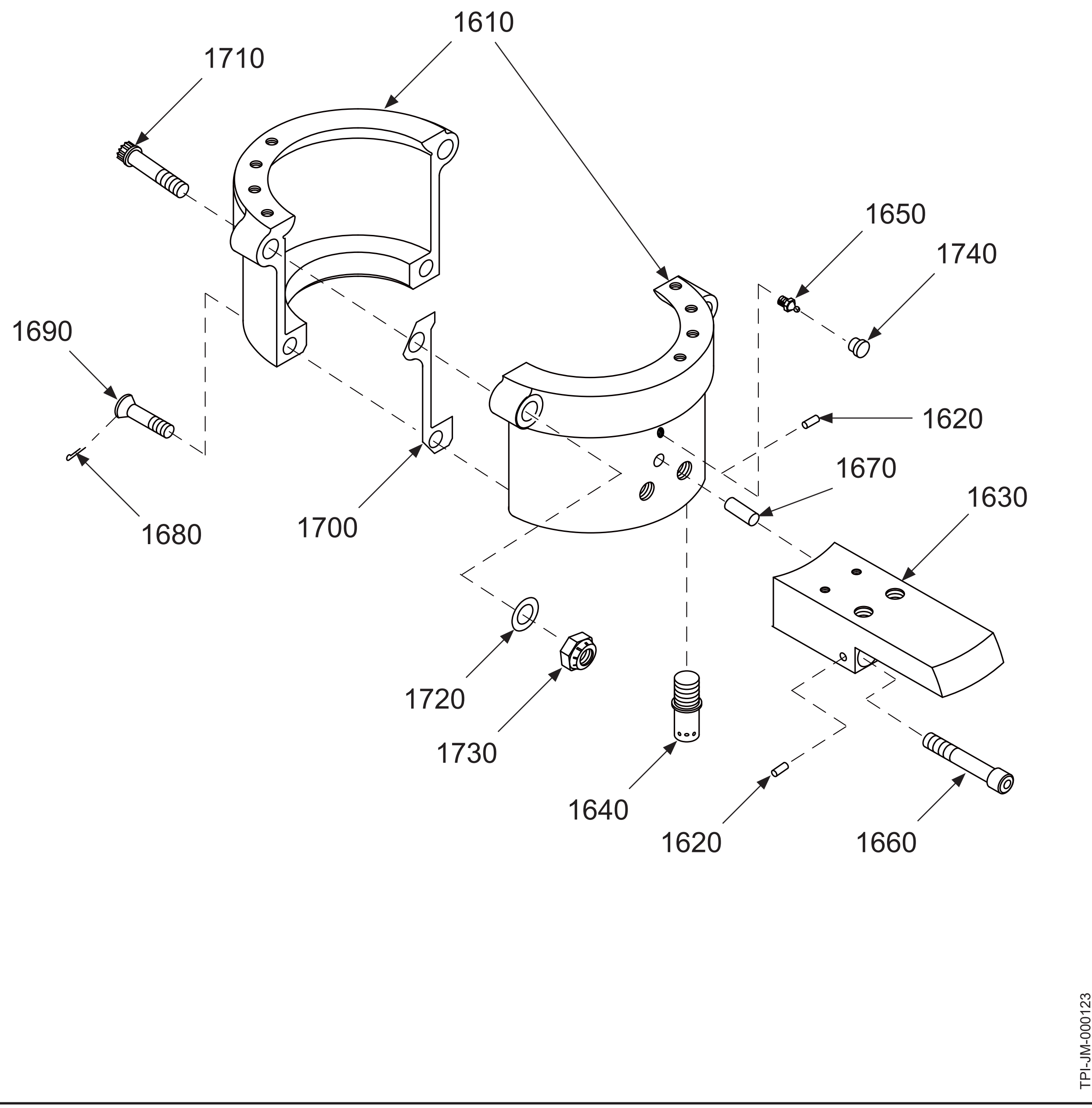
EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
V	(P)HC-A3VF-5R	-5R	HC-A3(MV,V)F-5R
MV	(P)HC-A3MVF-5R	-P5R	PHC-A3(MV,V)F-5R

- ITEM NOT ILLUSTRATED

(P)HC-A3(MV,V)F-5R

(Blank Page)

SUB-ASSEMBLY
PARTS LISTS and FIGURES



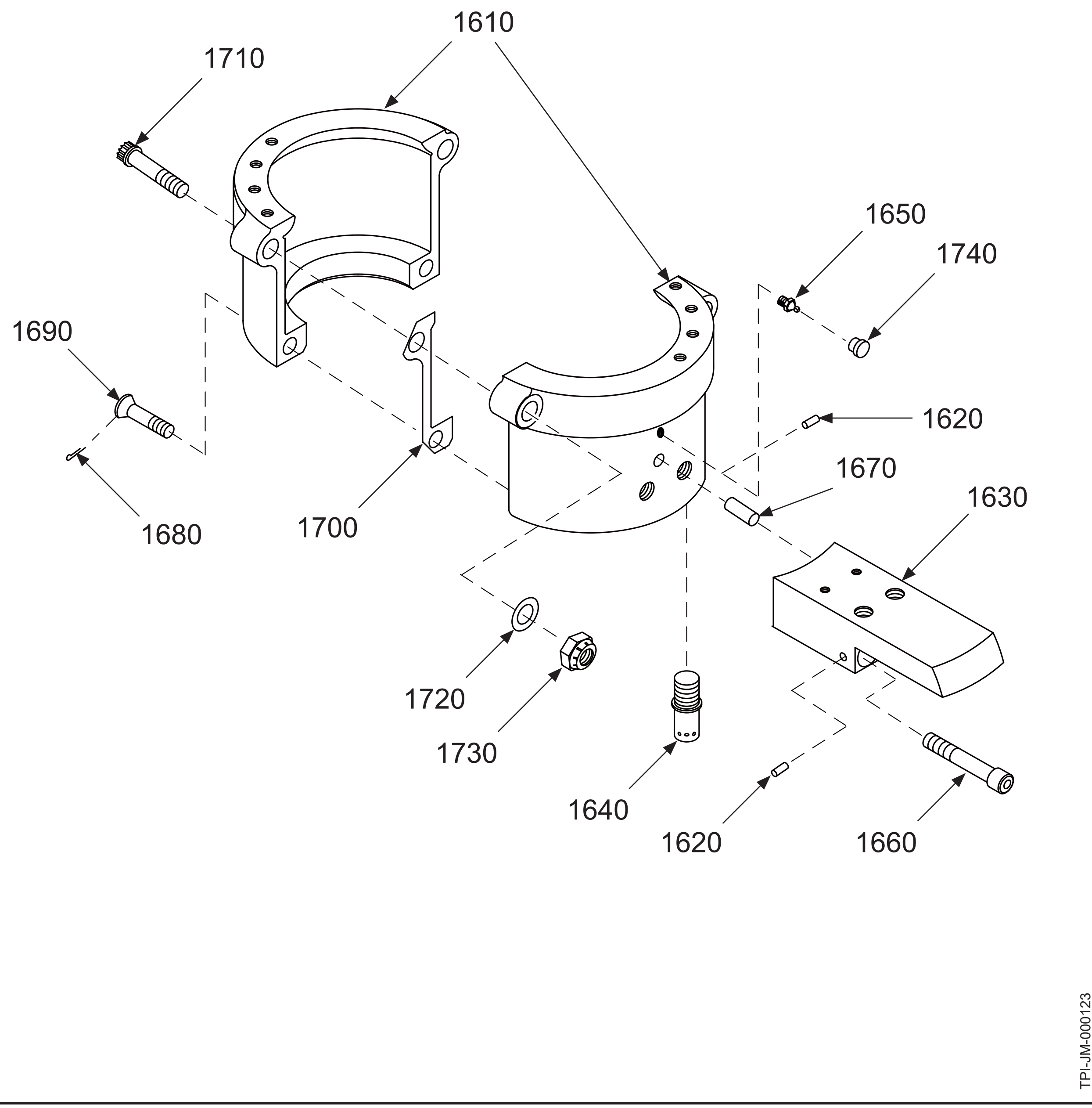
838-36 Clamp Assembly
Figure 10A-1

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-1		**838-36 CLAMP ASSEMBLY**				
-1605	D-7838-36	PCP: CLAMP UNIT		1		PCP
1610	C-3-1AL	• PCP: BLADE CLAMP		1		PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	B-2007	• COUNTERWEIGHT		1		
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		1	Y	
1660	A-2036-16	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-16	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-47-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

838-36 Clamp Assembly



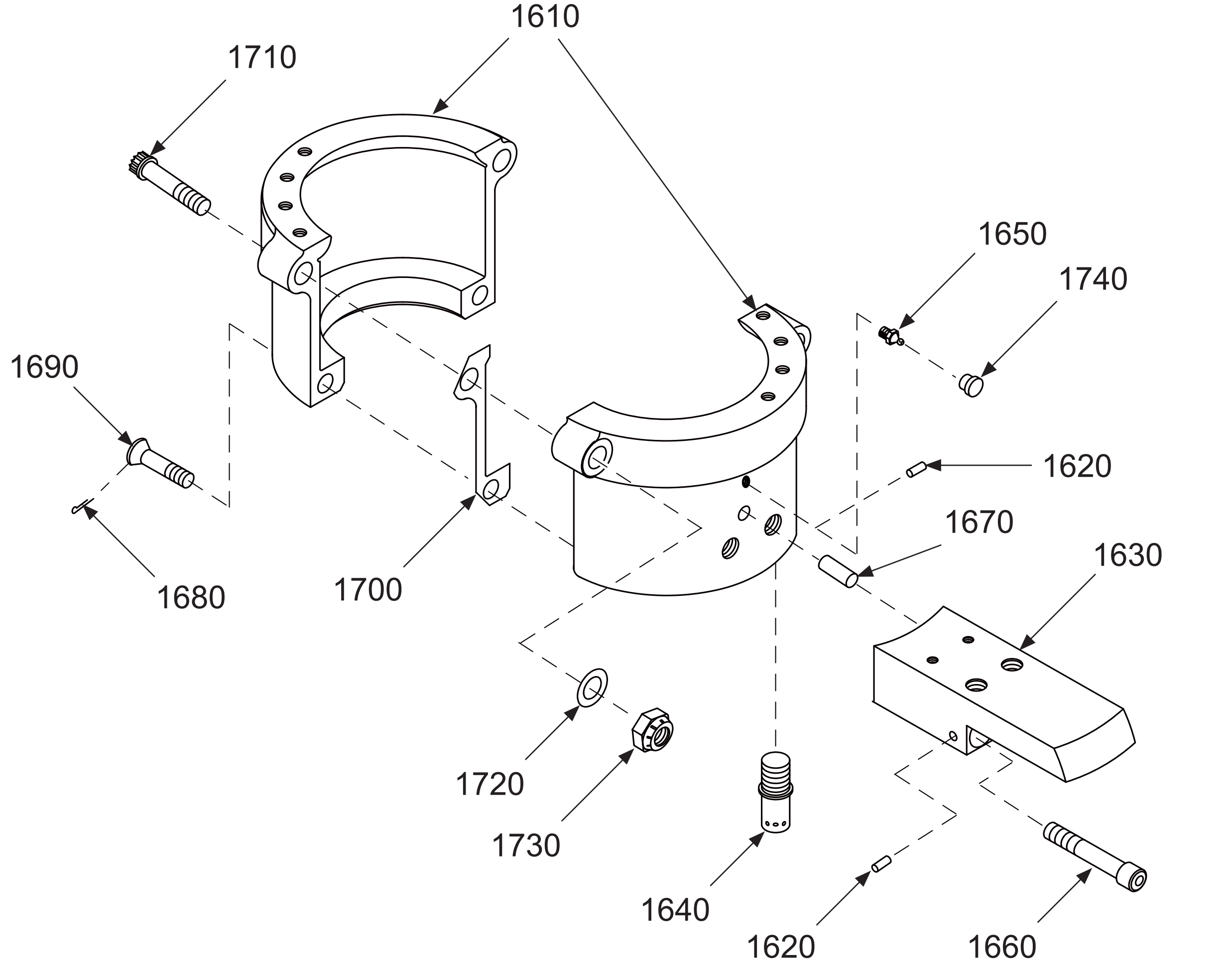
838-1036 Clamp Assembly
Figure 10A-2

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-2		**838-1036 CLAMP ASSEMBLY**				
-1605	D-7838-1036	PCP: CLAMP UNIT		1		PCP
1610	D-6831-1AL	• PCP: CLAMP, BLADE, "MV" SHANK		1	Y	PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	B-2007	• COUNTERWEIGHT		1		
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		1	Y	
1660	A-2036-16	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-16	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-6871-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

838-1036 Clamp Assembly



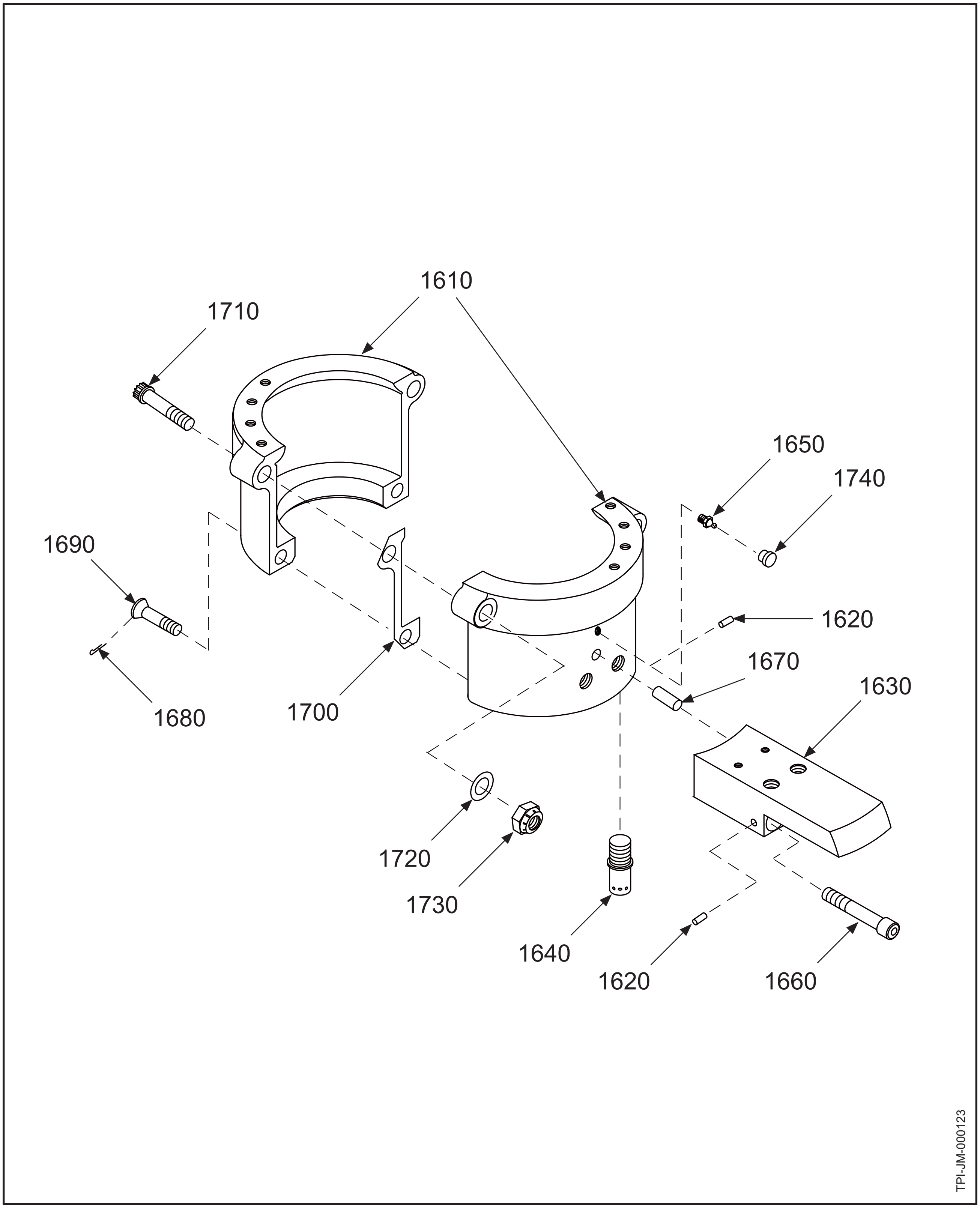
838-70(L) Clamp Assembly
Figure 10A-3

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-3		**838-70(L) CLAMP ASSEMBLY**				
-1605	D-7838-70(L)	PCP: CLAMP UNIT		1		PCP
1610	C-3-1A C-3-1AL	• PCP: BLADE CLAMP • PCP: BLADE CLAMP	A B	1 1		PCP PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	B-2007-1	• COUNTERWEIGHT		1		
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		1	Y	
1650A	B-6686	• FITTING, LUBRICATION, ALTERNATE FOR ITEM 1650 USED UNDER COUNTERWEIGHT AND SLUG		1	Y	
1660	A-2036-16	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-16	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-47-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043	NUT, 3/8-24, HEX, SELF-LOCKING SUPERSEDED BY ITEM 1730A		2	Y	
1730A	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING SUPERSEDES ITEM 1730		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
A	838-70		
B	838-70L		

- ITEM NOT ILLUSTRATED

838-70(L) Clamp Assembly



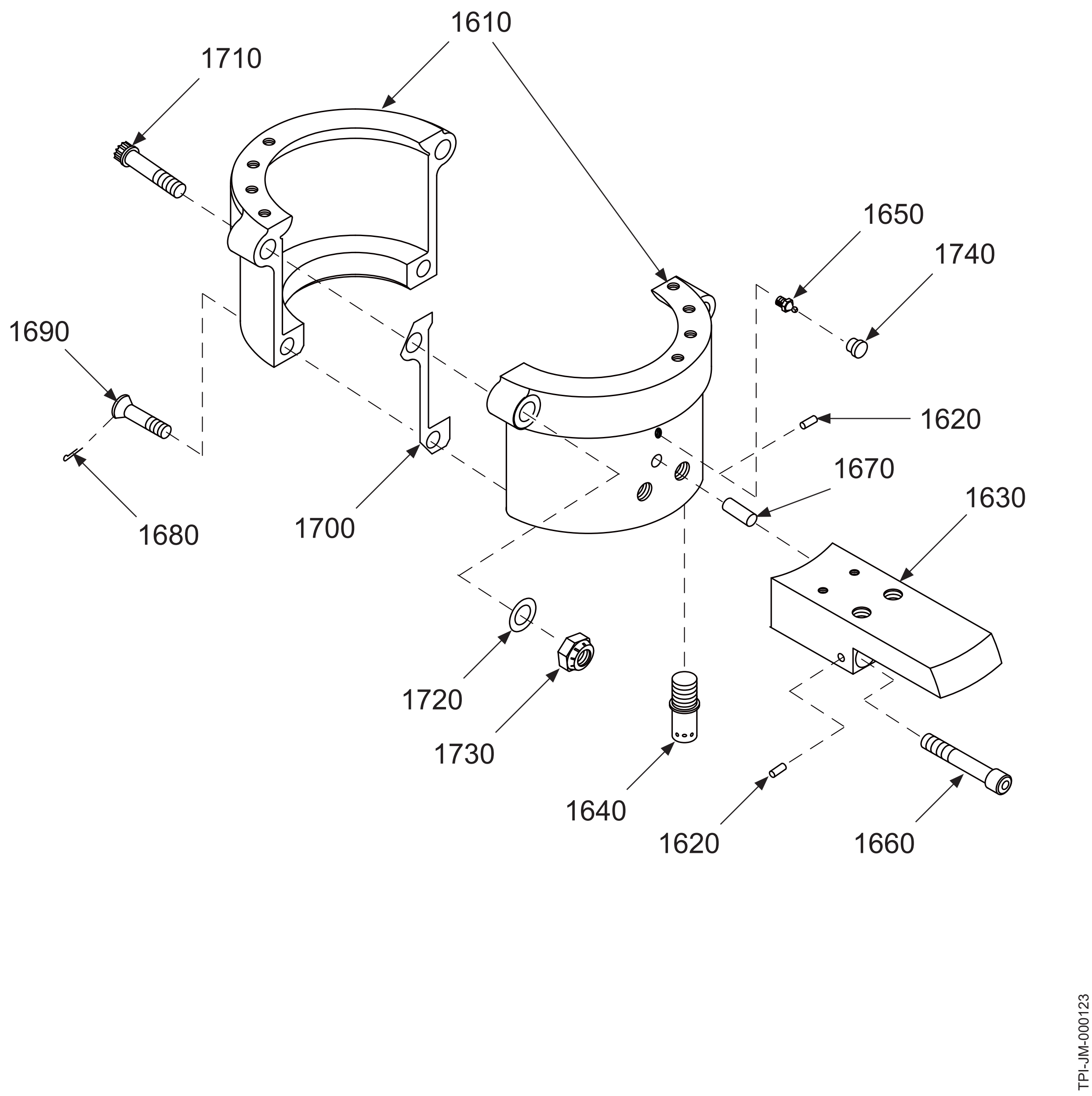
838-1070(L) Clamp Assembly
Figure 10A-4

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-4		**838-1070(L) CLAMP ASSEMBLY**				
-1605	D-7838-1070(L)	PCP: CLAMP UNIT		1		PCP
1610	D-6831-1A	• PCP: CLAMP, BLADE, "MV" SHANK	A	1	Y	PCP
	D-6831-1AL	• PCP: CLAMP, BLADE, "MV" SHANK	B	1	Y	PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	B-2007-1	• COUNTERWEIGHT		1		
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		1	Y	
1650A	B-6686	• FITTING, LUBRICATION, ALTERNATE FOR ITEM 1650 USED UNDER COUNTERWEIGHT AND SLUG		1	Y	
1660	A-2036-16	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-16	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700A	A-6871-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043	NUT, 3/8-24, HEX, SELF-LOCKING SUPERSEDED BY ITEM 1730A		2	Y	
1730A	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING, SUPERSEDES ITEM 1730		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
A	838-1070		
B	838-1070L		

- ITEM NOT ILLUSTRATED

838-1070(L) Clamp Assembly



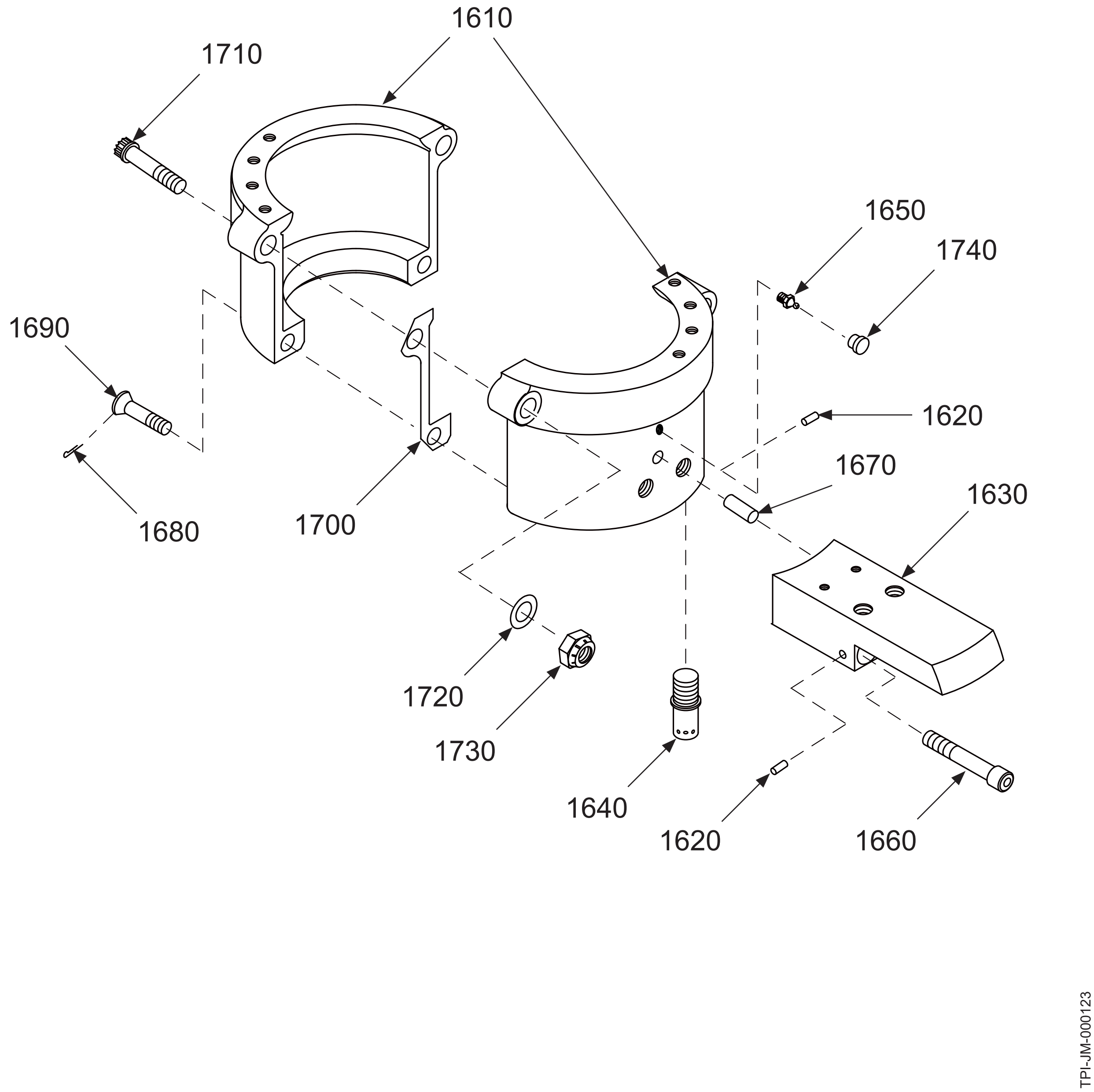
838-77(L) Clamp Assembly
Figure 10A-5

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-5		**838-77(L) CLAMP ASSEMBLY**				
-1605	D-7838-77(L)	PCP: CLAMP UNIT		1		PCP
1610	C-3-1C	• PCP: BLADE CLAMP	A	1		PCP
	C-3-1CL	• PCP: BLADE CLAMP	B	1		PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	833-29R	• PCP: COUNTERWEIGHT UNIT		1		PCP
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		2	Y	
1650A	B-6686	• FITTING, LUBRICATION, ALTERNATE FOR ITEM 1650		1	Y	
1660	A-2036-24	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-24	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-47-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
A	838-77		
B	838-77L		

- ITEM NOT ILLUSTRATED

838-77(L) Clamp Assembly



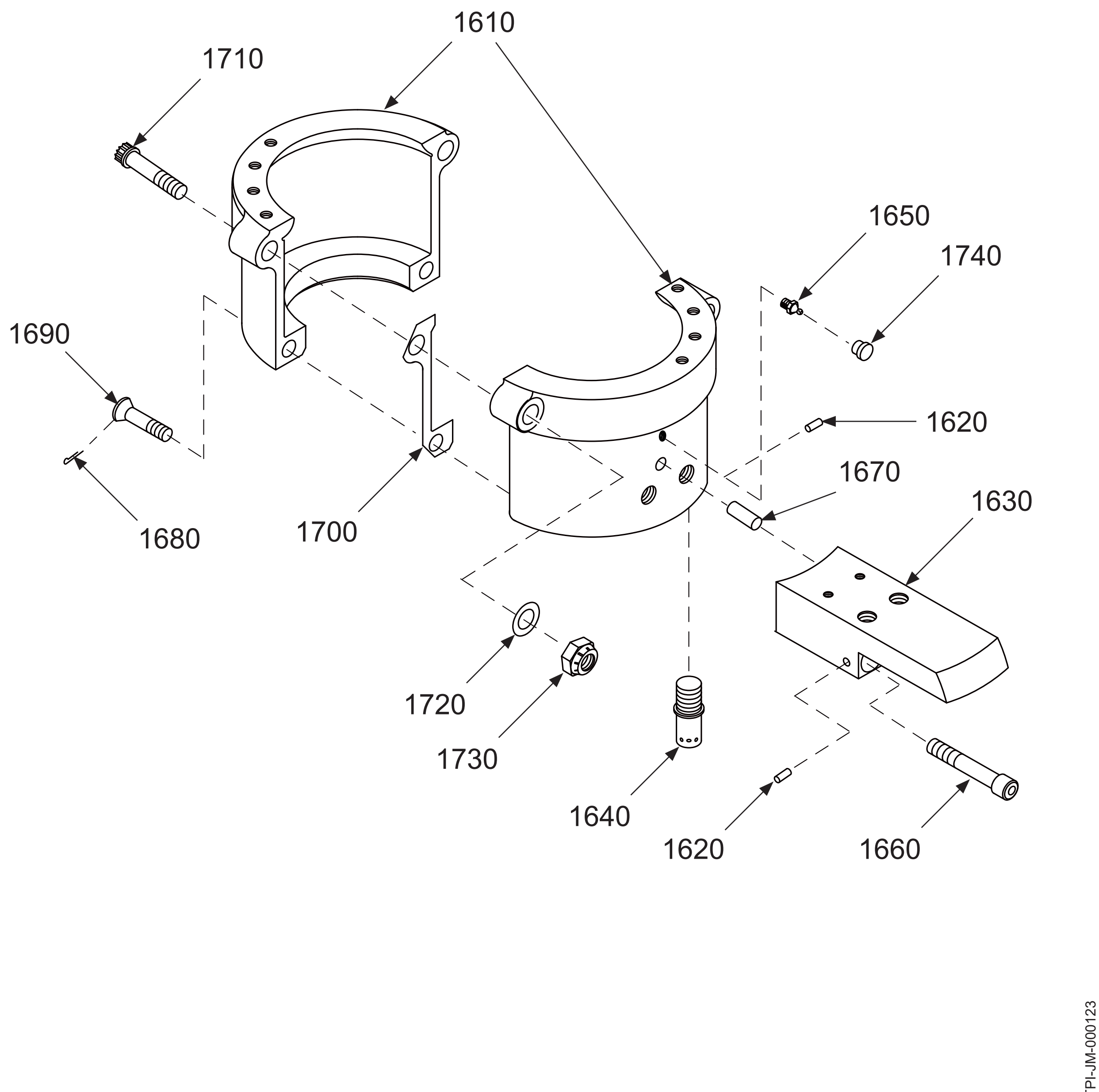
838-1077(L) Clamp Assembly
Figure 10A-6

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-6		**838-1077(L) CLAMP ASSEMBLY**				
-1605	D-7838-1077(L)	PCP: CLAMP UNIT		1		PCP
1610	D-6831-1C D-6831-1CL	• PCP: BLADE CLAMP • PCP: BLADE CLAMP	A B	1 1		PCP PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630A	833-29RL	• PCP: COUNTERWEIGHT UNIT		1		PCP
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		2	Y	
1650A	B-6686	• FITTING, LUBRICATION, ALTERNATE FOR ITEM 1650		1	Y	
1660	A-2036-24	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-24	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-6871-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
A	838-1077		
B	838-1077L		

- ITEM NOT ILLUSTRATED

838-1077(L) Clamp Assembly



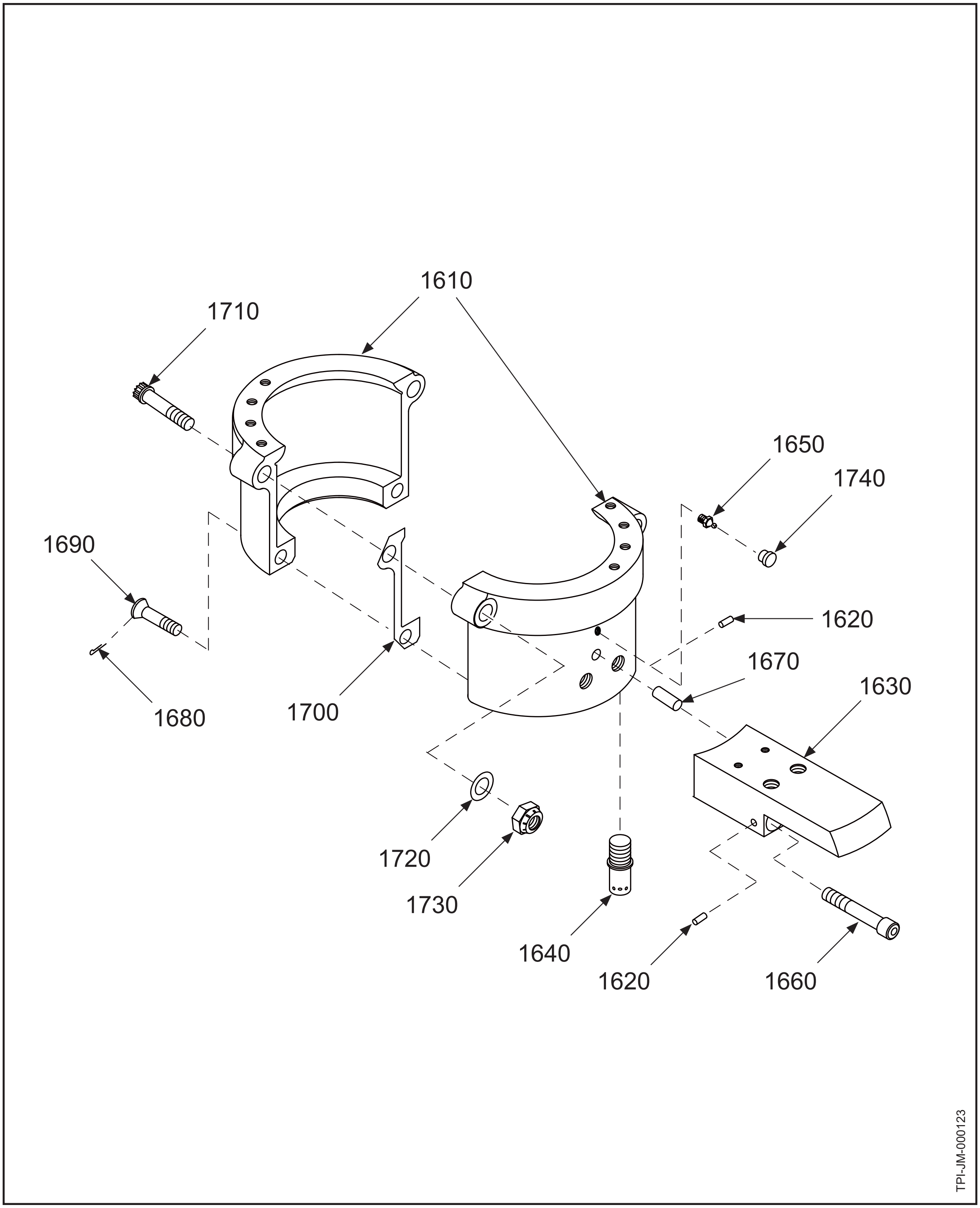
838-108 Clamp Assembly
Figure 10A-7

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-7		**838-108 CLAMP ASSEMBLY**				
-1605	D-7838-108	PCP: CLAMP UNIT		1		PCP
1610	C-3-1C	• PCP: CLAMP, BLADE		1		PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	833-29RL	• COUNTERWEIGHT UNIT		1		
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		2	Y	
1660	A-2036-24	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-24	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-47-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

838-108 Clamp Assembly



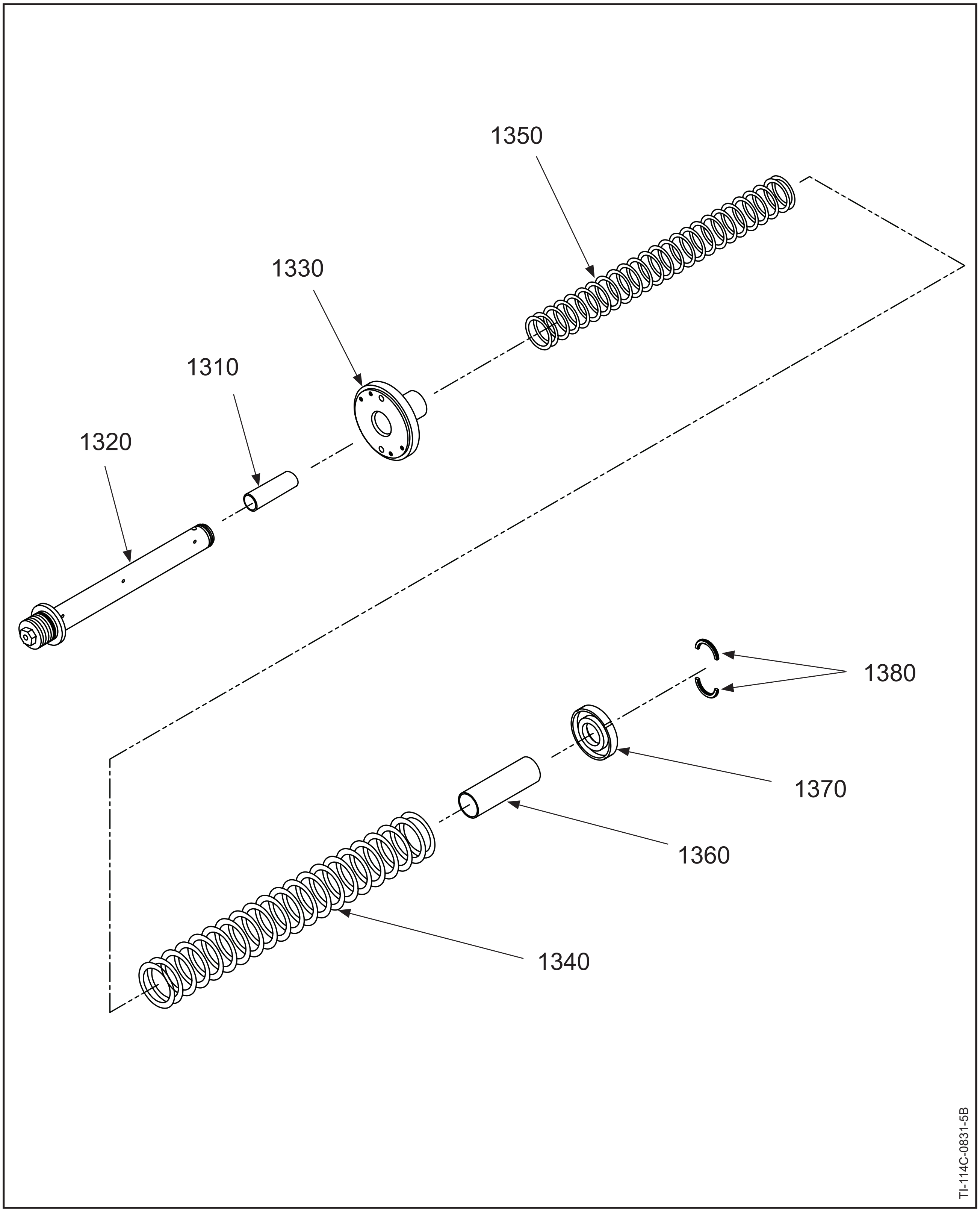
838-1108 Clamp Assembly
Figure 10A-8

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-8		**838-1108 CLAMP ASSEMBLY**				
-1605	D-7838-1108	PCP: CLAMP UNIT		1		PCP
1610	D-6831-1C	• PCP: CLAMP, BLADE, "MV" SHANK		1		PCP
1620	A-285	• SPRING PIN, 3/32", CRES		3	Y	
1630	833-29RL	• COUNTERWEIGHT UNIT		1		
1640	A-304	• LINKSCREW, 1/2-20		1	Y	
1650	B-6588-1	• FITTING, LUBRICATION		2	Y	
1660	A-2036-24	• SCREW, 7/16-20, CAP, MODIFIED REPLACED BY ITEM 1660A		2	Y	
1660A	107995-24	• BOLT, 7/16-20, 12 POINT, REPLACES ITEM 1660		2	Y	
1670	A-65	• DOWEL PIN, 1/4, REPLACED BY ITEM 1670A		1	Y	
1670A	101375	• PLUG, PULL, REPLACES ITEM 1670, POST HC-SB-61-285		AR	Y	
1680	B-3838-3-2	COTTER PIN		2	Y	
1690	A-282	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDED BY ITEM 1690A		2	Y	
1690A	A-321	SCREW, 3/8-24 DOUBLE 60° HEAD SUPERSEDES ITEM 1690, POST HC-SB-61-137A		2	Y	
1700	A-6871-1	GASKET, CLAMP		2	Y	
1710	A-2017	BOLT, 3/8-24, 12 POINT		2	Y	
1720	A-2031	WASHER, 3/8"		2	Y	
1730	A-2043-1	NUT, 3/8-24, HEX, SELF-LOCKING		2	Y	
1740	B-6544	CAP, FITTING, LUBRICATION		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

838-1108 Clamp Assembly



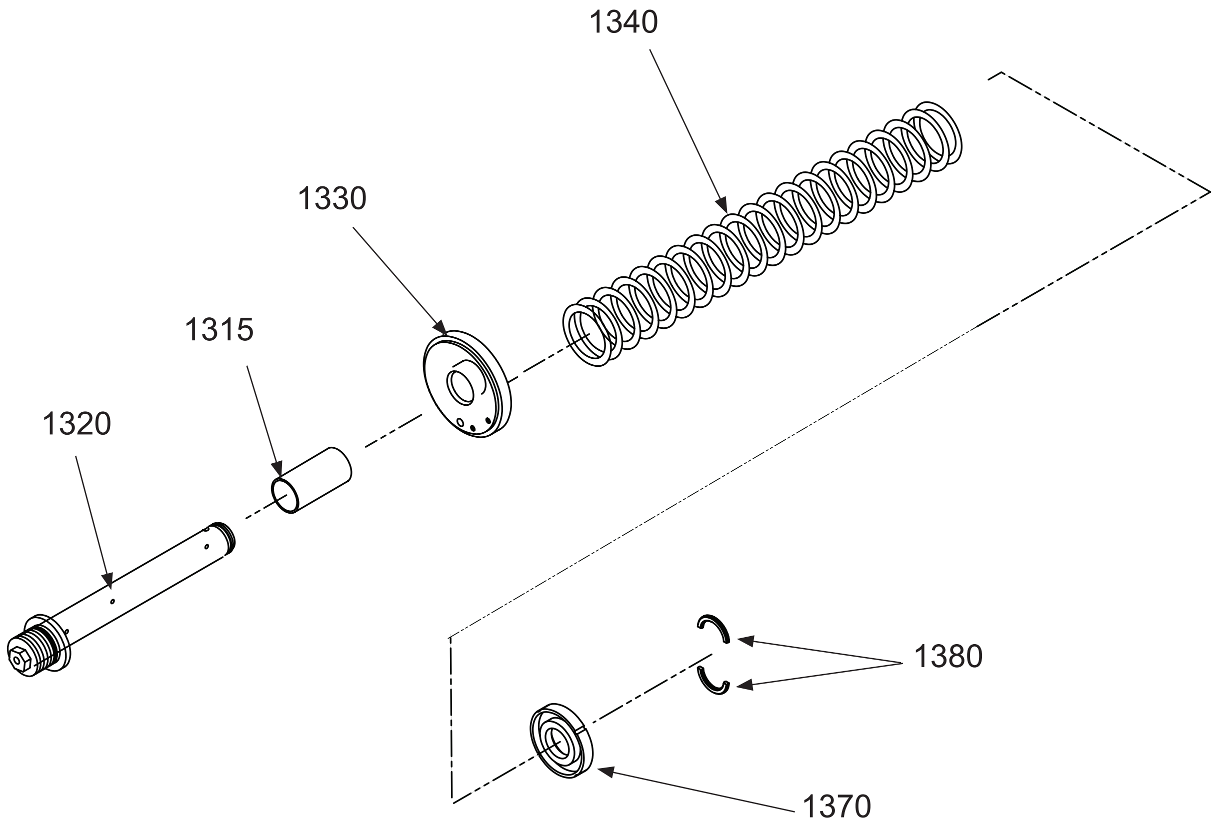
831-5B Feathering Spring Assembly
Figure 10A-9

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-9		**831-5B FEATHERING SPRING ASSEMBLY**				
1310	A-860-10	SLEEVE, STOP		1		
1320	B-855-A	ROD, PITCH CHANGE		1		
1330	A-856	SPRING RETAINER, FLANGED (FRONT)		1		
1340	B-853	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1350	B-953	SPRING, COMPRESSION, FEATHERING		1		
1360	A-860-8	SLEEVE, STOP		1		
1370	A-857	SPRING RETAINER, REAR		1		
1380	A-858	KEEPER, SPLIT, REAR		1	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

831-5B Feathering Spring Assembly



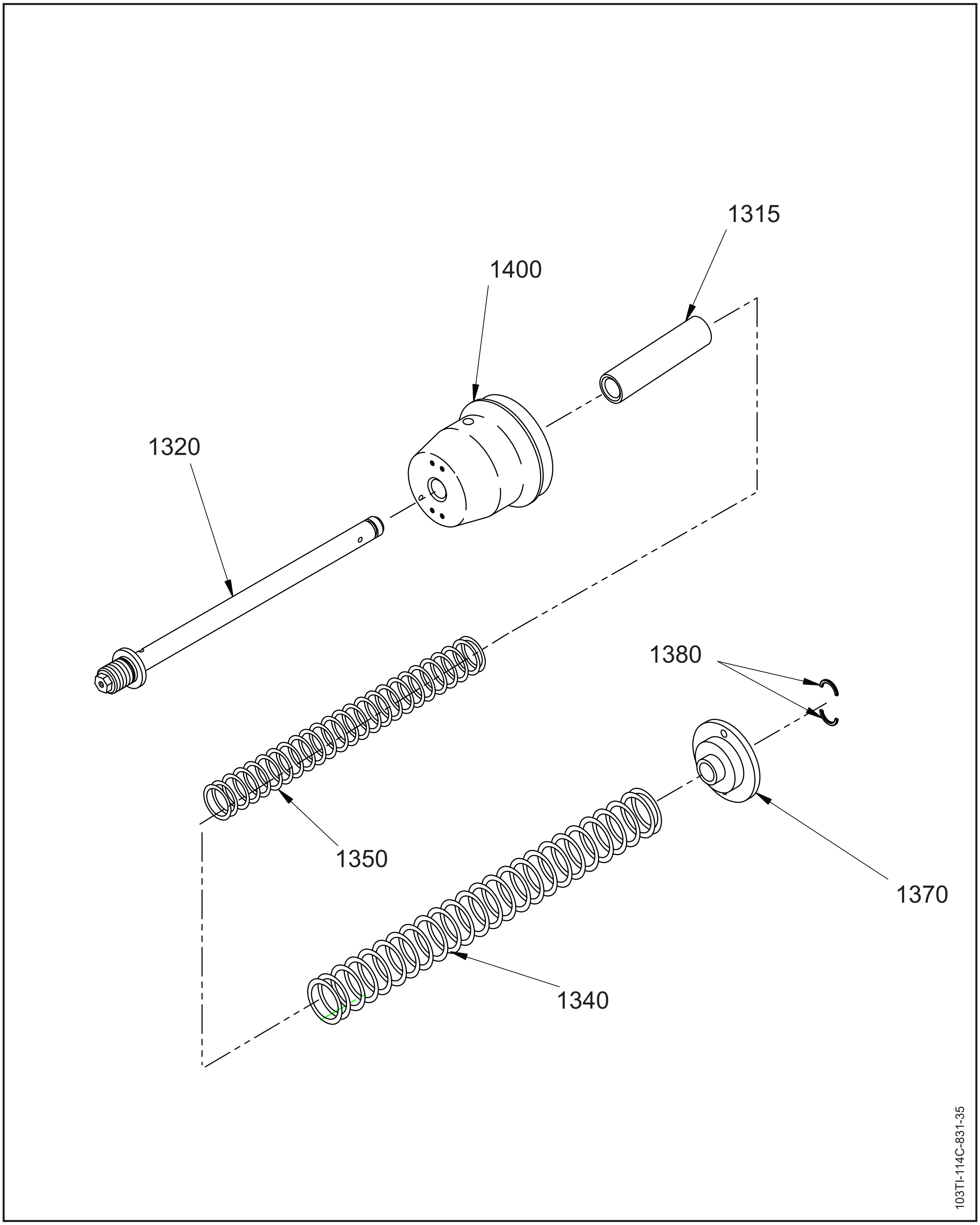
831-15 Feathering Spring Assembly
Figure 10A-10

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-10		**831-15 SPRING ASSEMBLY**				
1315	A-2010	SPACER, SPRING				
1320	B-2001	ROD, PITCH CHANGE (MUST BE MATCHED TO D-2006 VALVE ASSEMBLY)		1		
1320A	B-1465-1	ROD, PITCH CHANGE, ALTERNATE FOR ITEM 1320 (MUST BE MATCHED TO D-2006 VALVE ASSEMBLY)		1		
1330	A-871	SPRING RETAINER, FLANGED		1		
1340	B-1363-1	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1370	A-866-2	SPRING RETAINER, REAR		1		
1380	A-867	PCP: KEEPER, SPLIT (REAR)		1	Y	PCP

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

831-15 Feathering Spring Assembly



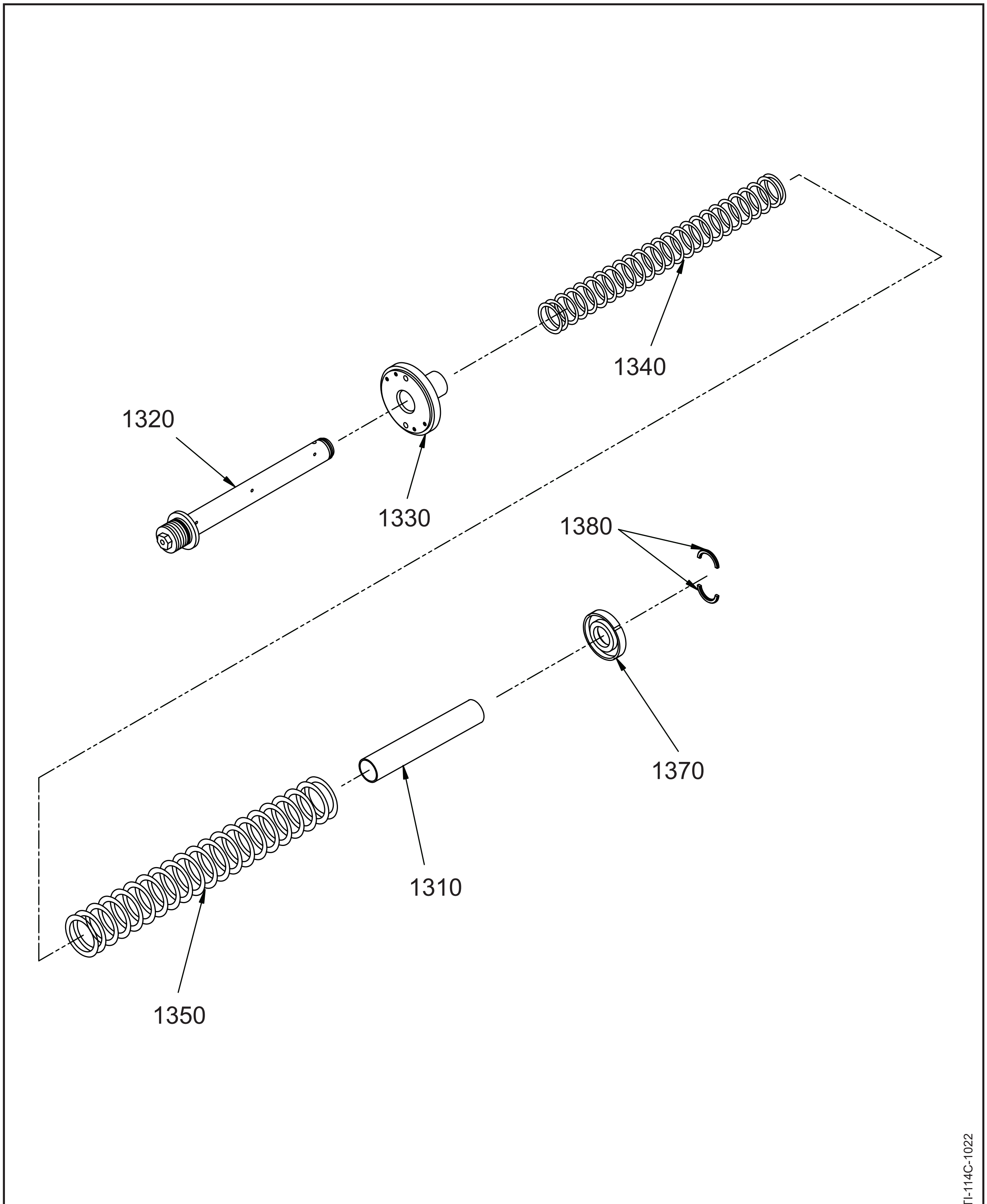
831-35 Spring Assembly
Figure 10A-11

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-11		**831-35 SPRING ASSEMBLY**				
1320	B-1465	PCP: ROD, PITCH CHANGE		1		
1315	B-1461	TUBE, SPACER, SPRING		1		
1340	B-1453	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1350	B-1454	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1370	A-1460	SPRING RETAINER, REAR		1		
1380	A-867	PCP: KEEPER, SPLIT (REAR)		1	Y	PCP
1400	A-3613	SPRING RETAINER CUP, SUPERSEDED BY ITEM 1400A		1		
1400A	106412	SPRING RETAINER CUP SUPERSEDES ITEM 1400, POST HC-SB-61-370		1		
-1540	B-3720	BOLT, 10-32, HEX HEAD		4	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

831-35 Spring Assembly



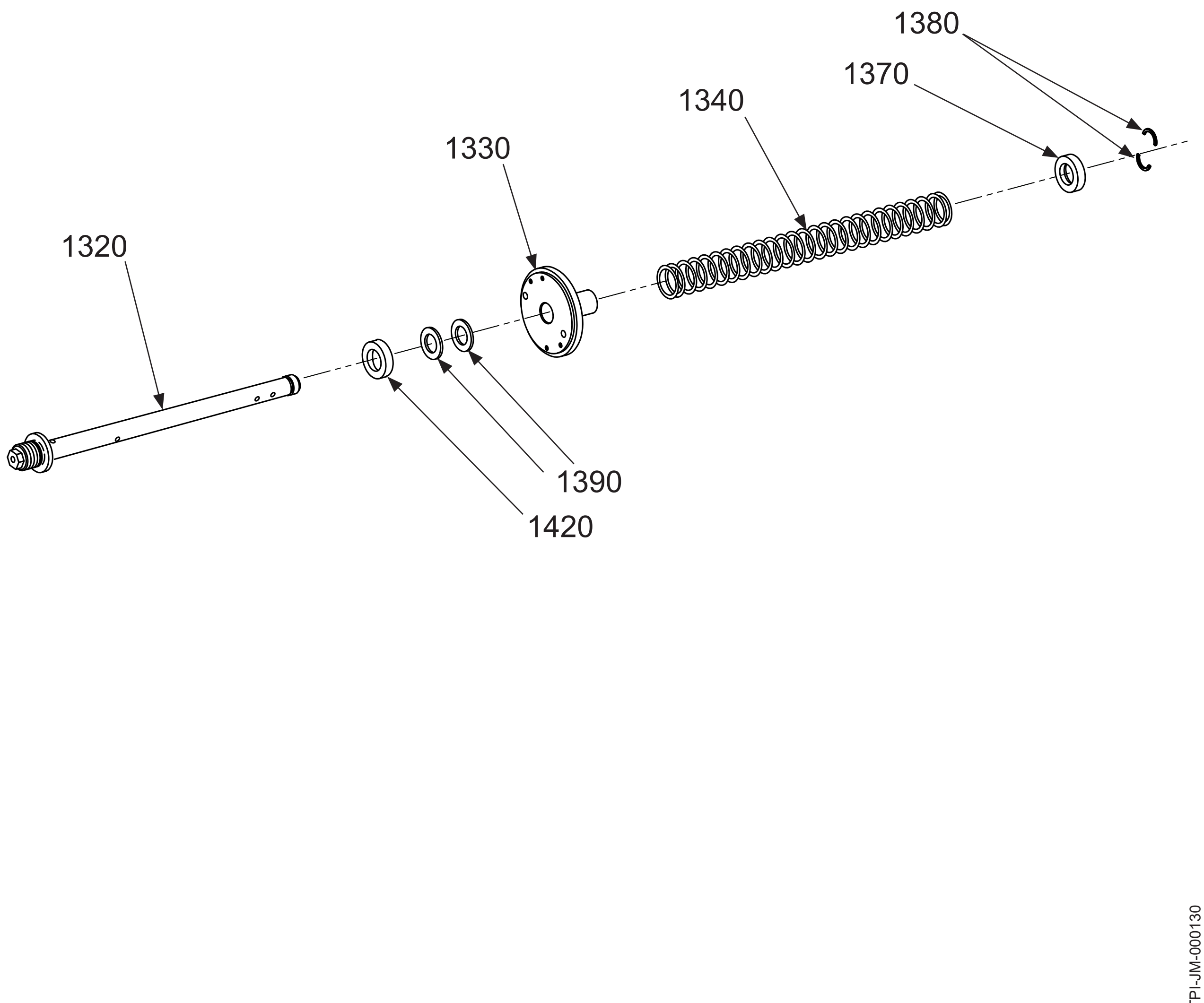
831-53 Spring Assembly
Figure 10A-12

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-12		**831-53 SPRING ASSEMBLY**				
1310	A-860-4	SLEEVE, STOP		1		
1320	B-855-A	ROD, PITCH CHANGE		1		
1330	A-856	SPRING RETAINER, FLANGED		1		
1350	B-853	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1370	A-857	SPRING RETAINER, REAR		1		
1380	A-858	KEEPER, SPLIT (REAR)		1	Y	
1340	B-953	SPRING, COMPRESSION, FEATHERING		1	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

831-53 Spring Assembly



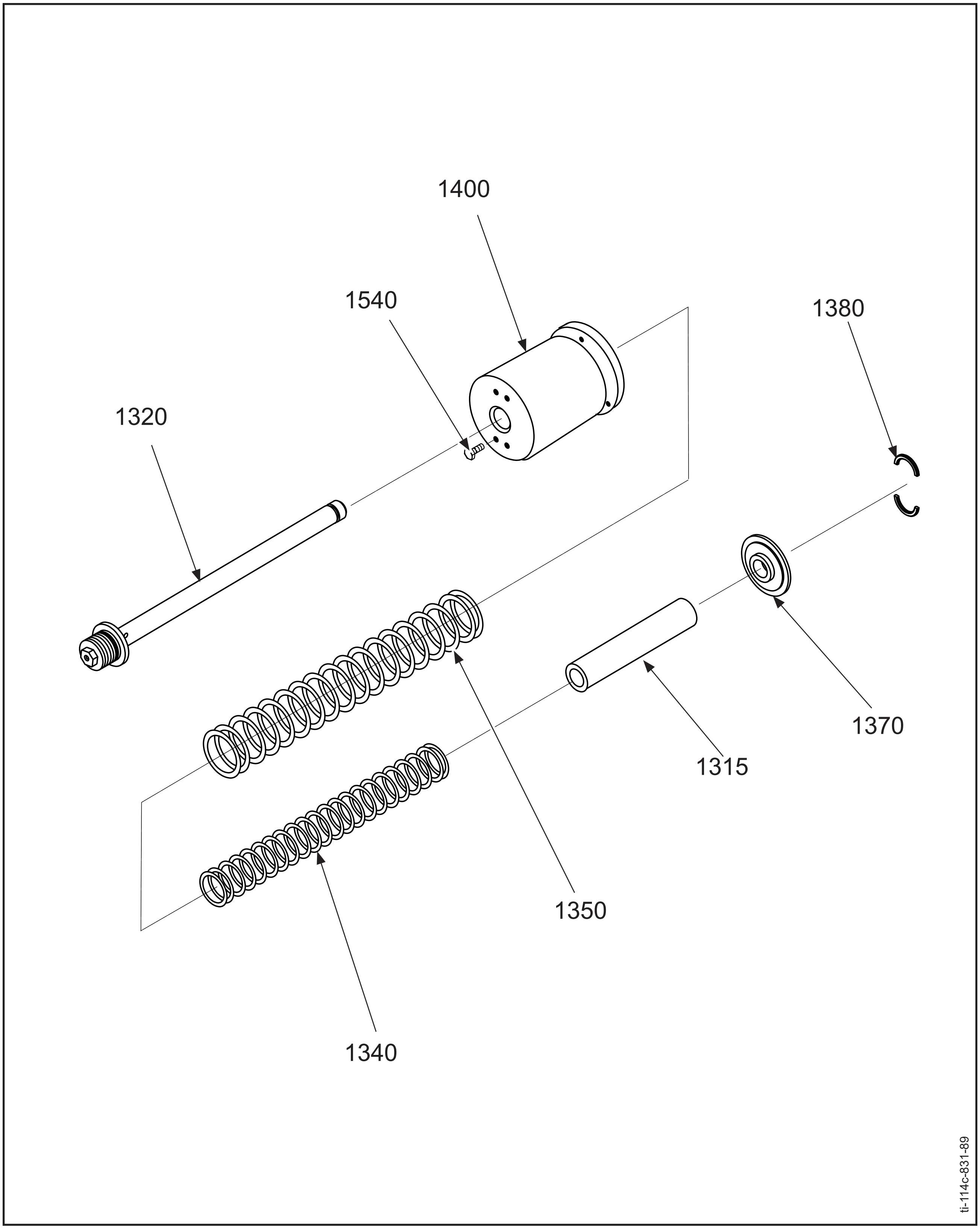
831-85 Spring Assembly
Figure 10A-13

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-13		**831-85 SPRING ASSEMBLY**				
1320	B-868AS	PCP: ROD, PITCH CHANGE SUPERSEDED BY ITEM 1320A		1		PCP
1320A	D-5862	PCP: ROD, PITCH CHANGE SUPERSEDES ITEM 1320		1		PCP
1330	A-871	SPRING RETAINER, FLANGED		1		
1340	B-1363-1	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1370	A-866	SPRING RETAINER, REAR		1		
1380	A-867	PCP: KEEPER, SPLIT (REAR)		1	Y	PCP
1390	A-3087	PCP: SPACER, SPRING		AR	Y	PCP
1420	A-2010-3	SPACER, SUPERSEDED BY ITEM 1420A		AR		
1420A	B-6023-( )	SPACER, SUPERSEDES ITEM 1420		AR		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

831-85 Spring Assembly



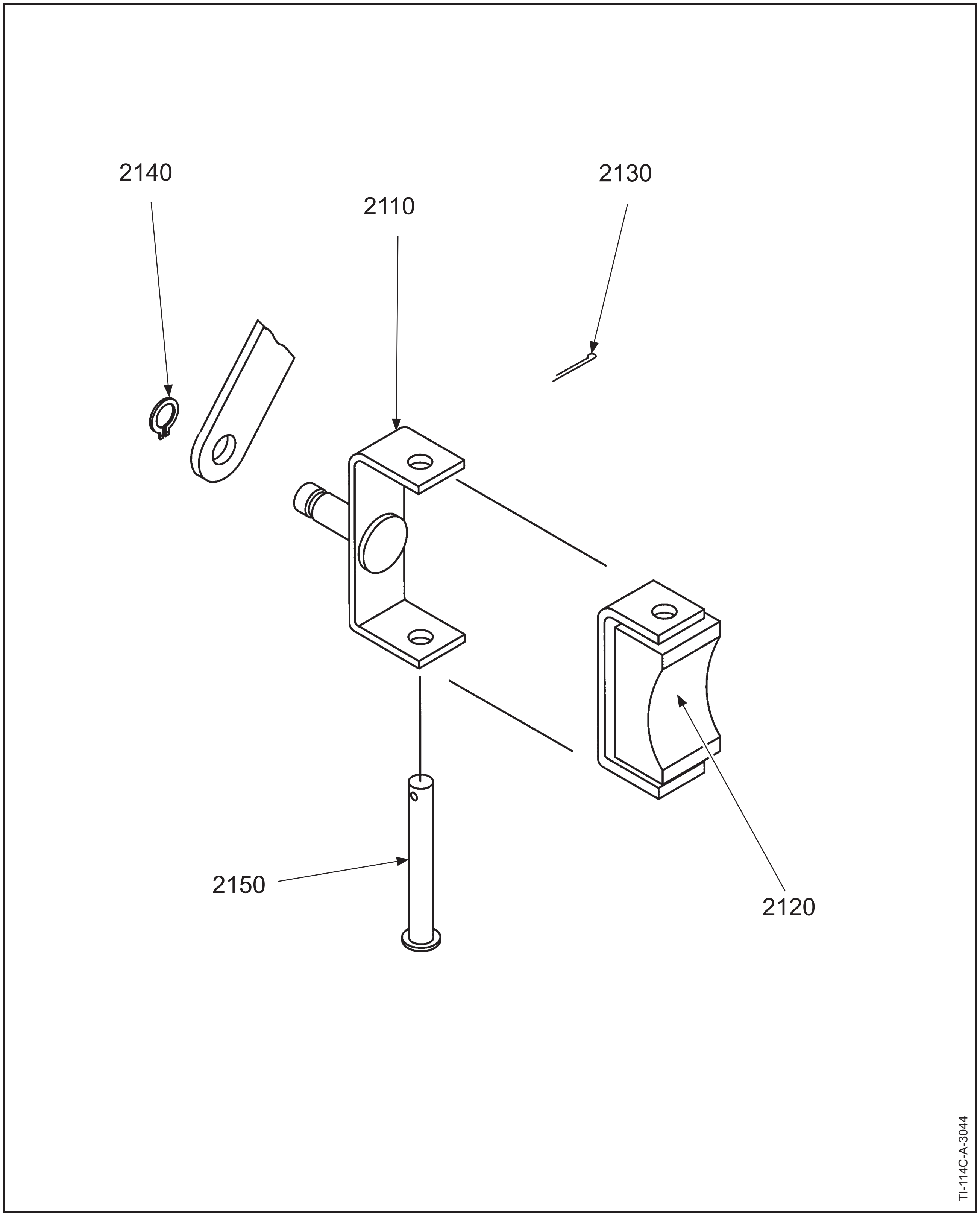
831-89 Spring Assembly
Figure 10A-14

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-14		**831-89 SPRING ASSEMBLY**				
1315	B-1461	TUBE, SPACER, SPRING		1		
1320	D-5862-5	PCP: ROD, PITCH CHANGE		1		PCP
1340	B-1453	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1350	B-1454	PCP: SPRING, COMPRESSION, FEATHERING		1		PCP
1370	A-1460	SPRING RETAINER, REAR		1		
1380	A-867	PCP: KEEPER, SPLIT		1	Y	PCP
1400	A-3613	SPRING RETAINER CUP SUPERSEDED BY ITEM 1400A		1		
1400A	106412	SPRING RETAINER CUP SUPERSEDES ITEM 1400, POST HC-SB-61-370		1		
1540	B-3720	BOLT, 10-32, HEX HEAD		4	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

831-89 Spring Assembly



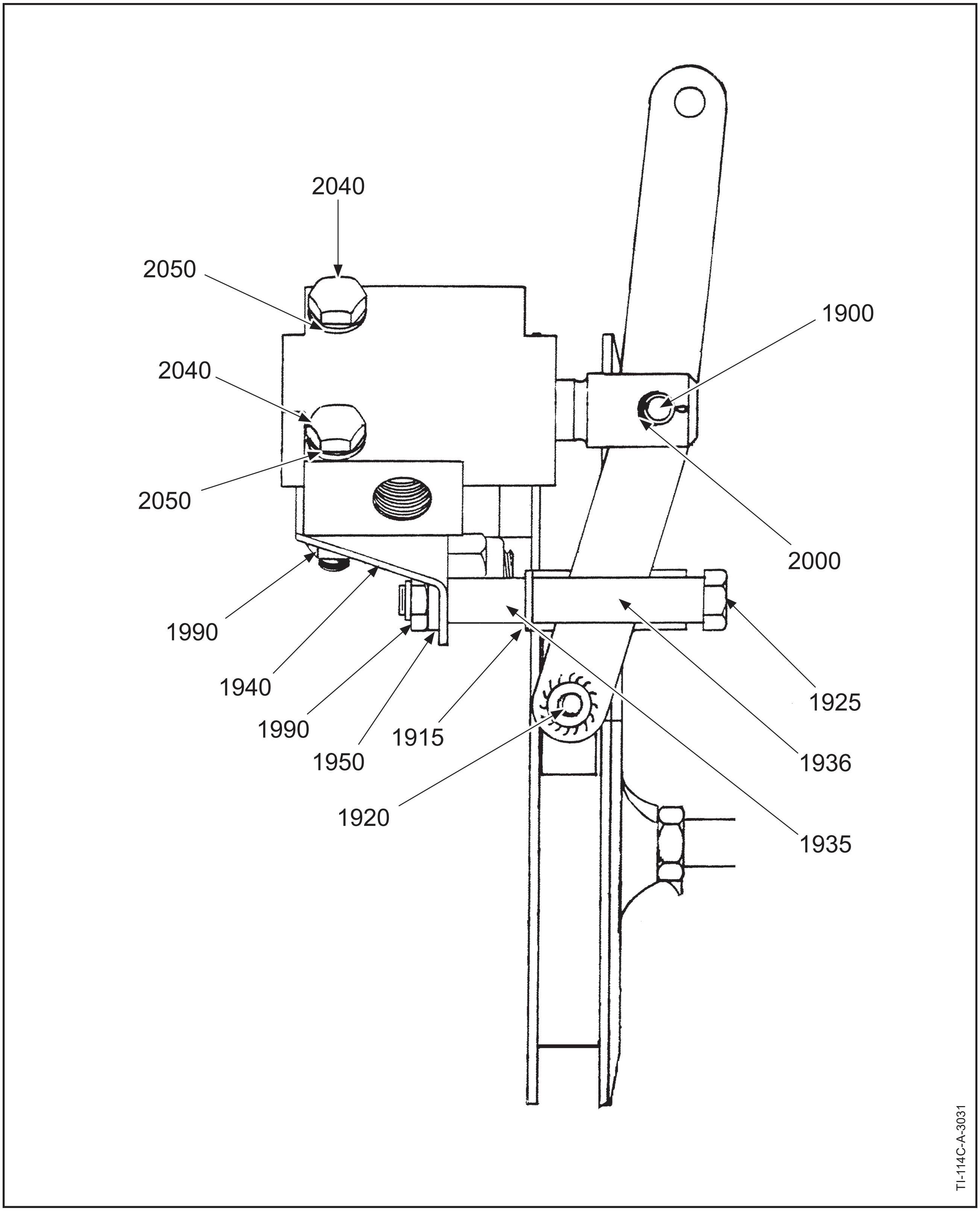
A-3044 Beta Feedback Block Assembly
Figure 10A-15

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-15		**A-3044 BETA FEEDBACK BLOCK ASSEMBLY**				
2110	A-3025	YOKE UNIT		1		
2120	A-3026	CARBON BLOCK - UNIT		1	Y	
2130	B-3838-2-2	COTTER PIN, SUPERSEDED BY ITEM 2130A		1	Y	
2130A	A-4543	COTTER PIN, T-HEAD, SUPERSEDES ITEM 2130		1	Y	
2140	B-3843-25PP	SNAP RING, EXTERNAL		1	Y	
2150	A-3027	CLEVIS PIN, SUPERSEDED BY ITEM 2150A		1	Y	
2150A	B-3844-53	CLEVIS PIN, SUPERSEDES ITEM 2150		1	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

A-3044 Beta Feedback Block Assembly



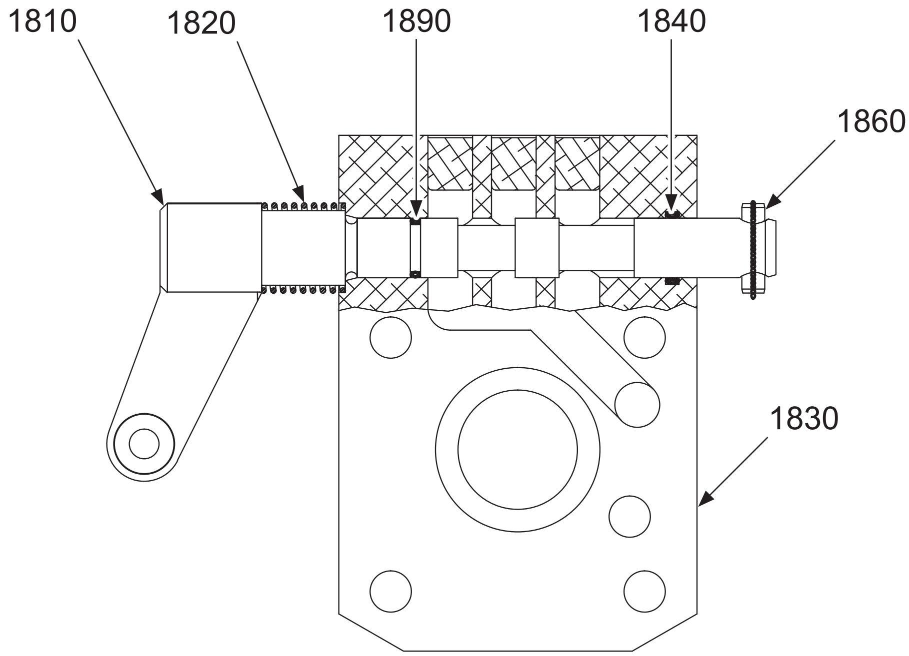
A-3031 Beta Valve Assembly
Figure 10A-16

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-16		**A-3031 BETA VALVE ASSEMBLY**				
-1810	A-3033	SPOOL, VALVE		1		
-1820	A-3146	SPRING		1		
-1830	A-3032	BODY, CONTROL VALVE		1		
-1840	C-3317-112	O-RING		1	Y	
-1860	B-6378-0750	SPRING PIN, 1/8 INCH CRES		1	Y	
-1880	A-3034	STOP, VALVE		1		
1890	C-3317-012	O-RING		1		
		ASSOCIATED MOUNTING PARTS				
1900	B-6644-11	CLEVIS PIN		1		
1915	A-3016	GUIDE, LEVER, BETA VALVE		1		
1920	A-3013	RELIEF VALVE LEVER		1		
1925	B-3384-34H	BOLT, 1/4-28, HEX HEAD		1	Y	
1935	A-3017	SLEEVE, GUIDE, LEVER		1		
1936	A-3017-1	SLEEVE, GUIDE, LEVER		1		
1940	B-3015	BRACKET, REVERSING VALVE		1		
1950	B-3851-0463	WASHER		1	Y	
1990	B-3808-4	NUT, HEX, SELF-LOCKING		2	Y	
2000	B-3838-2-2	COTTER PIN		1	Y	
2040	B-3384-13	BOLT		2	Y	
2050	B-3851-0463	WASHER		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

A-3031 Beta Valve Assembly



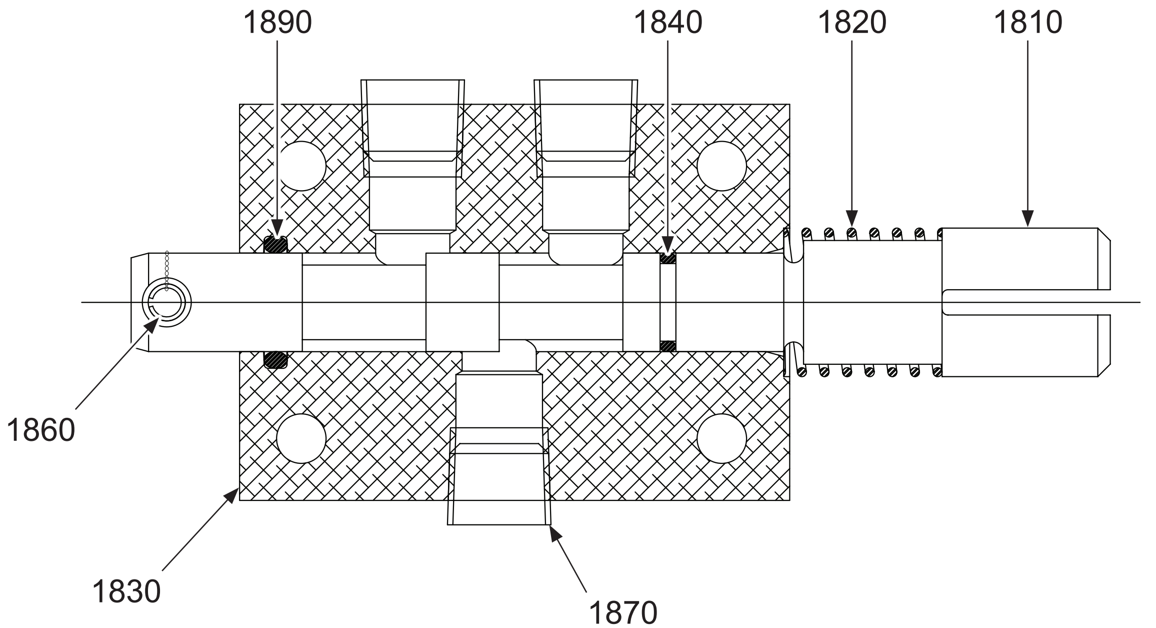
A-4117 Beta Valve Assembly
Figure 10A-17

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-17		**A-4117 BETA VALVE ASSEMBLY**				
1810	A-4120	SPOOL, BETA VALVE - UNIT		1		
1820	A-4119	SPRING, COMPRESSION		1		
1830	C-4115	VALVE BODY, BETA		1		
1840	C-3317-112	O-RING		1	Y	
1860	B-6582-0750	SPRING PIN, 3/16 INCH, CRES		1		
1890	C-3317-012	O-RING		1	Y	
		ASSOCIATED MOUNTING PARTS (NOT SHOWN)				
-1910	A-3144	EXTENSION, DRIVE, GOVERNOR		1		
-1930	B-1104	GASKET, GOVERNOR		2	Y	
-1980	A-3147-3	STUD, 5/16-18 AND 5/16-24		4	Y	
-2100	A-3044	BLOCK, BETA FEEDBACK - ASSEMBLY (REFER TO "A-3044 BETA FEEDBACK BLOCK ASSEMBLY" IN THIS CHAPTER FOR EXPLODED VIEW/PARTS LIST)		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

A-4117 Beta Valve Assembly



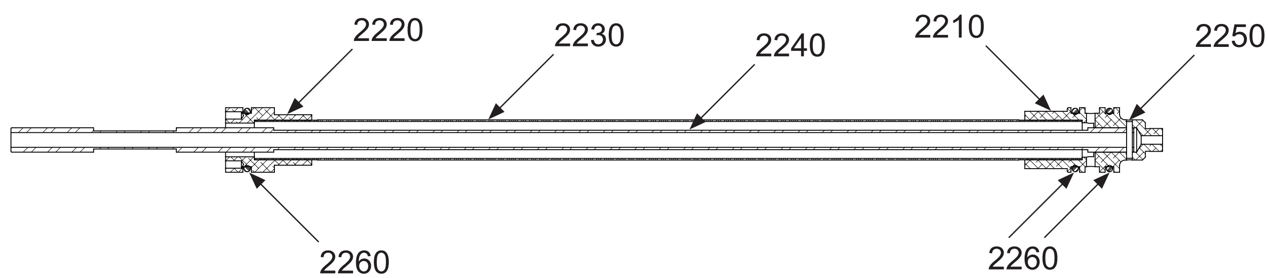
B-2372 Beta Valve Assembly
Figure 10A-18

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-18		**B-2372 BETA VALVE ASSEMBLY**				
1810	A-2364	SPOOL, BETA VALVE		1		
1820	A-4119	SPRING, COMPRESSION		1		
1830	B-2363	BETA VALVE BODY		1		
1840	C-3317-112	O-RING		1	Y	
1860	B-6582-0750	SPRING PIN, 3/16 INCH, CRES		1		
1890	C-3317-012	O-RING		1	Y	
1870	B-3885-3	PLUG, PIPE, ALUMINUM		3		
		ASSOCIATED MOUNTING PARTS (NOT SHOWN)				
-1885	B-4112	ADAPTER, BETA VALVE		1		
-1910	A-3144	EXTENSION, DRIVE, GOVERNOR		1		
-1980	A-3147-3	STUD, 5/16-18 AND 5/16-24		4	Y	
-1930	B-1104	GASKET, GOVERNOR		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

B-2372 Beta Valve Assembly



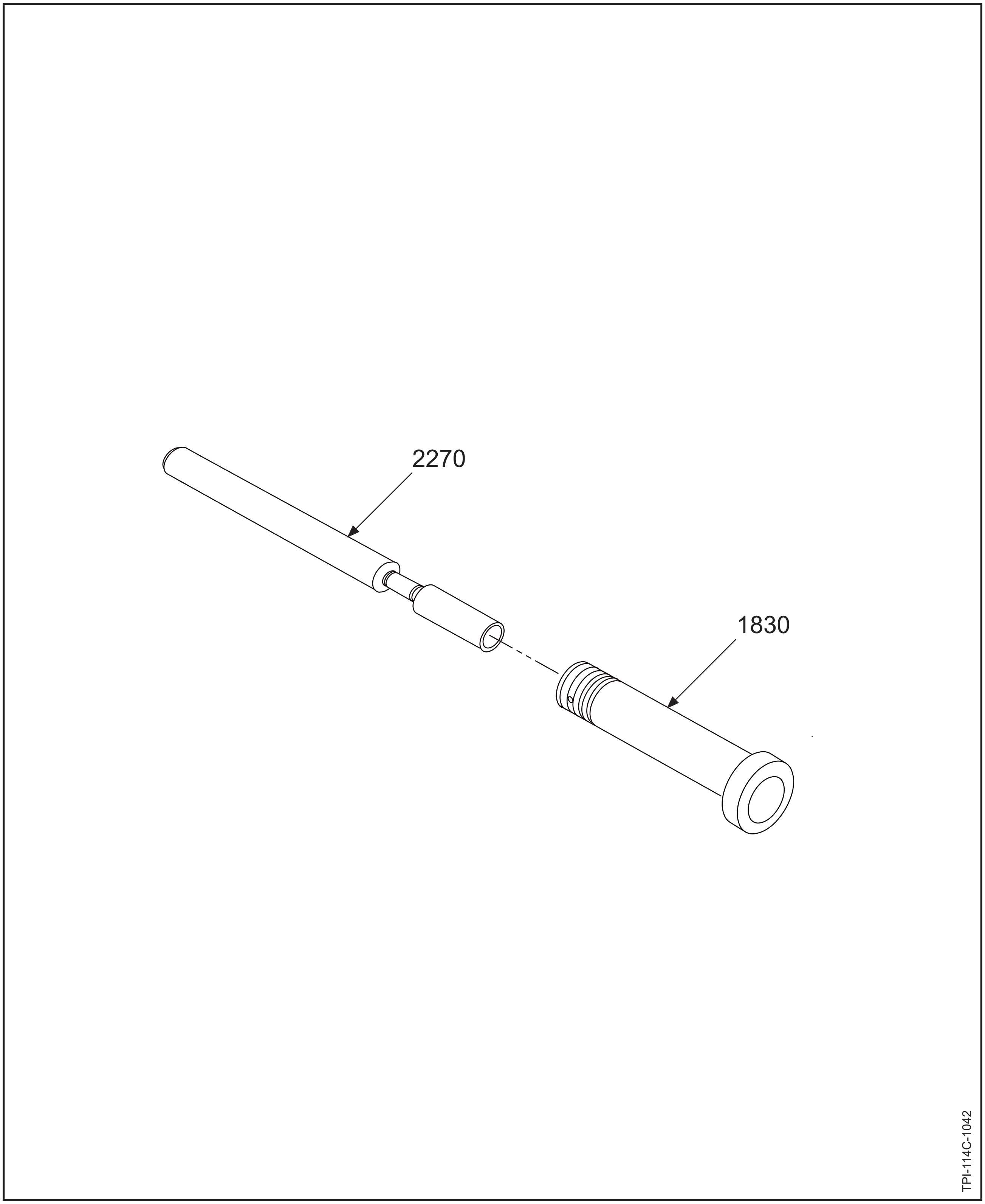
D-2006 Valve Assembly
Figure 10A-19

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-19		**D-2006 VALVE ASSEMBLY**				
2210	A-2004	FITTING, "A", VALVE TUBE		1		
2220	A-2003	FITTING, "B", VALVE TUBE		1		
2230	A-2005	FITTING, "C", VALVE TUBE		1		
2240	B-2002	FITTING, "D", VALVE TUBE		1		
2250	A-2011	DOWEL PIN 1/8"		1		
2260	C-3317-216	O-RING		3	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

D-2006 Valve Assembly



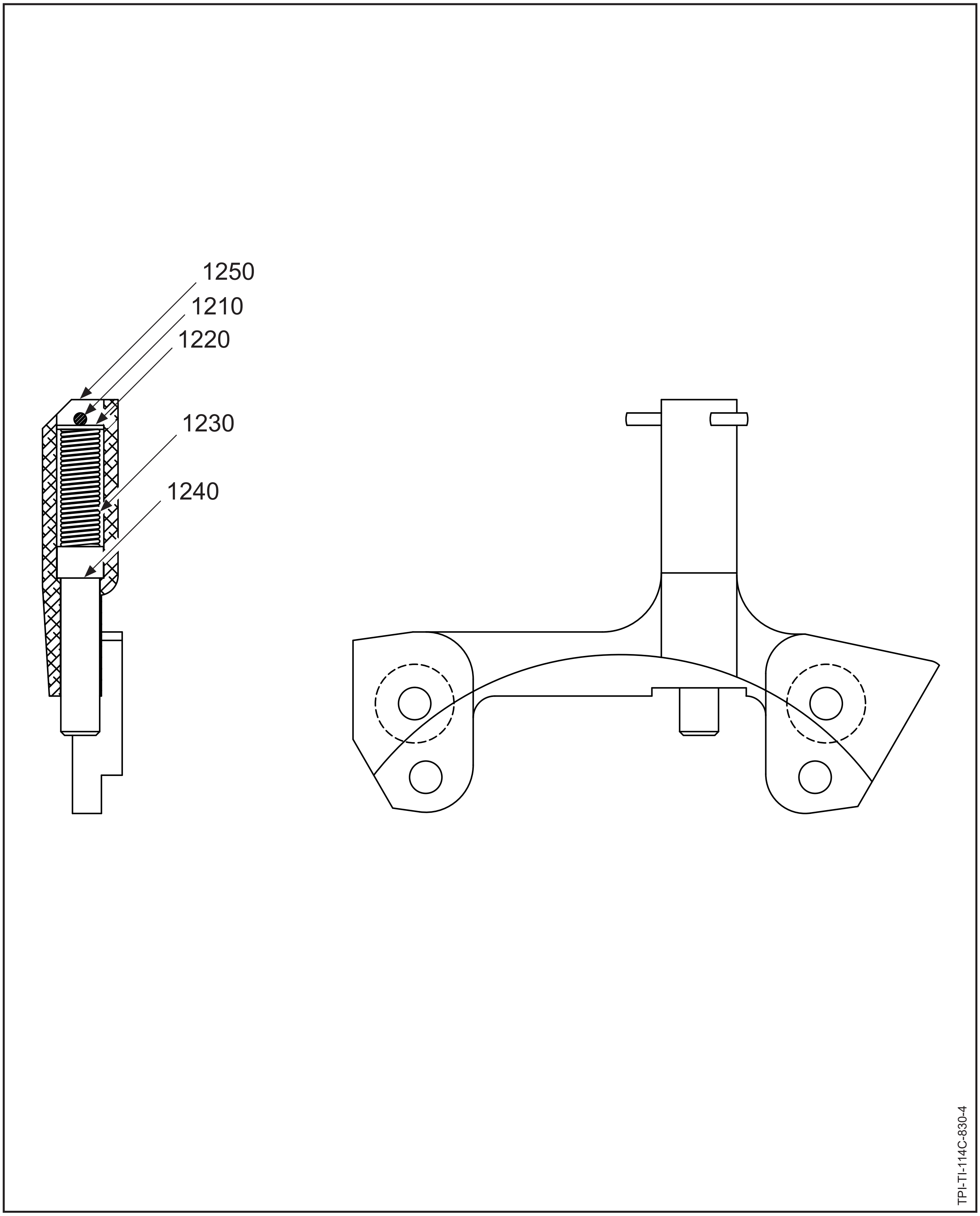
B-1457 Valve Unit
Figure 10A-20

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-20		**B-1457 VALVE UNIT**				
1830	B-1455	VALVE BODY		1		
-1860	B-6378-1000	SPRING PIN, 1/8 INCH, CRES		1	Y	
2270	B-1456	VALVE SLEEVE		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

B-1457 Valve Unit



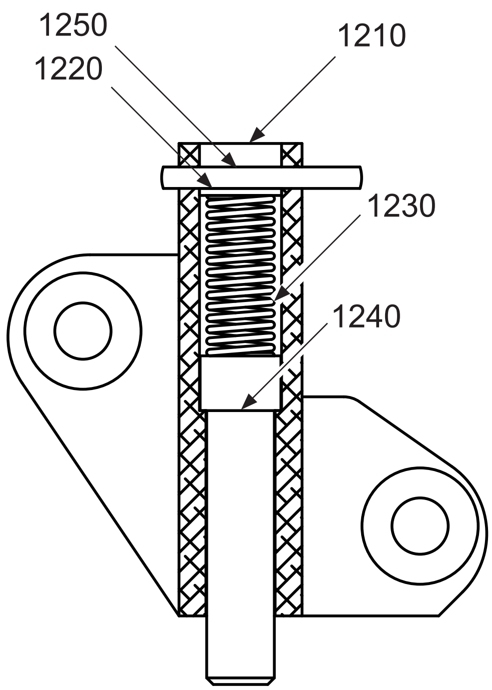
830-4(L) Start Lock Assembly
Figure 10A-21

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-21		**830-4(L) START LOCK ASSEMBLY**				
1210	B-3838-3-3	COTTER PIN		1	Y	
1220	B-3851-N832	WASHER		1	Y	
1230	A-884	SPRING, COMPRESSION		1	Y	
1240	A-883	PIN, START LOCK		1		
1250	B-882-4	BRACKET, START LOCK	A	1		
	B-882-4L	BRACKET, START LOCK	B	1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
A	830-4 START LOCK ASSEMBLY		
B	830-4L START LOCK ASSEMBLY		

- ITEM NOT ILLUSTRATED

830-4(L) Start Lock Assembly



830-27 Start Lock Assembly
Figure 10A-22

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10A-22		**830-27 START LOCK ASSEMBLY**				
1210	B-3838-3-3	COTTER PIN		1	Y	
1220	B-3851-N832	WASHER		1	Y	
1230	A-884-4	SPRING, COMPRESSION		1	Y	
1240	A-883	PIN, START LOCK		1		
1250	B-3814-2	BRACKET, START LOCK, SUPERSEDED BY ITEM 1250A		1		
1250A	101225	BRACKET, START LOCK, SUPERSEDES ITEM 1250		1		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

830-27 Start Lock Assembly

(Blank Page)