Manual No. 300
Revision 4
November 2018

HARTZELL

Operation, Maintenance Manual, and Logbook for Propeller Systems

HM-5V1-B1000-A

HM-6V1-A1000-A

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

REVISION 4 HIGHLIGHTS

Revision 4, dated November 2018, incorporates the following:

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

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

- INTRODUCTION
  - Removed the section, "Required Publications"
  - Revised the section, "Maintenance Practices"
  - Revised the section, "Overhaul (Major Periodic Inspection)"
  - Added the section, "Reference Publications"
  - Revised the section, "Definitions"
  - Revised the section, "Abbreviations"
  - Added the section, "Hartzell Propeller Inc. Product Support"
  - Added the section, "Hartzell Propeller Inc. Recommended Facilities"

REVISION 4 HIGHLIGHTS

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

Revision No.	Issue Date	Comments
Original	Feb/09	New Issue
Revision 1	Sep/13	Reissue
Revision 2	Apr/16	Minor Revision
Revision 3	Apr/17	Minor Revision
Revision 4	Nov/18	Minor Revision

RECORD OF REVISIONS

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

Revision Number	Issue Date	Date Inserted	Inserted By
2	Apr/16	Apr/16	HPI
3	Apr/17	Apr/17	HPI
4	Nov/18	Nov/18	HPI

Revision Number	Issue Date	Date Inserted	Inserted By

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	Inserted By

Revision Number	Issue Date	Date Inserted	Inserted By

RECORD OF TEMPORARY REVISIONS

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

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

RECORD OF TEMPORARY REVISIONS

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

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

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 A 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
HM-SL-003	Rev. 3, Apr/17

Service Document Number	Incorporation Rev./Date

SERVICE DOCUMENT LIST

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

LIST OF EFFECTIVE PAGES

Chapter	Page	Rev. Level	Date
Cover/Inside Cover	Cover and Inside Cover	Rev. 4	Nov/18
Revision Highlights	1 and 2	Rev. 4	Nov/18
Record of Revisions	3 and 4	Rev. 2	Apr/16
Record of Temporary Revisions	5 and 6	Rev. 2	Apr/16
Service Document List	7 and 8	Rev. 3	Apr/17
List of Effective Pages	9 and 10	Rev. 4	Nov/18
Table of Contents	11 and 12	Rev. 2	Apr/16
Introduction	1-1 thru 1-14	Rev. 4	Nov/18
Description and Operation	2-1 thru 2-8	Rev. 1	Sep/13
Installation and Removal	3-1 and 3-2	Rev. 1	Sep/13
Installation and Removal	3-3	Rev. 2	Apr/16
Installation and Removal	3-4	Rev. 3	Apr/17
Installation and Removal	3-5 thru 3-7	Rev. 1	Sep/13
Installation and Removal	3-8	Rev. 3	Apr/17
Installation and Removal	3-9 thru 3-28	Rev. 1	Sep/13
Installation and Removal	3-29 and 3-30	Rev. 2	Apr/16
Installation and Removal	3-31 thru 3-34	Rev. 1	Sep/13
Testing and Troubleshooting	4-1 and 4-2	Rev. 3	Apr/17
Testing and Troubleshooting	4-3	Rev. 1	Sep/13
Testing and Troubleshooting	4-4 and 4-5	Rev. 3	Apr/17
Testing and Troubleshooting	4-6 thru 4-8	Rev. 1	Sep/13
Inspection and Check	5-1	Rev. 3	Apr/17
Inspection and Check	5-2 thru 5-6	Rev. 2	Apr/16
Inspection and Check	5-7 thru 5-10	Rev. 1	Sep/13
Inspection and Check	5-11	Rev. 3	Apr/17
Inspection and Check	5-12 thru 5-18	Rev. 2	Apr/16
Maintenance Practices	6-1	Rev. 3	Apr/17
Maintenance Practices	6-2 thru 6-8	Rev. 1	Sep/13
Maintenance Practices	6-9	Rev. 2	Apr/16
Maintenance Practices	6-10 thru 6-21	Rev. 1	Sep/13
Maintenance Practices	6-22 thru 6-26	Rev. 3	Apr/17
Records	7-1 thru 7-26	Rev. 1	Sep/13

(This page is intentionally blank.)

TABLE OF CONTENTS

(This page intentionally left blank.)

INTRODUCTION - CONTENTS

(This page is intentionally blank.)

1. Statement of Purpose

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

A. This manual supports Hartzell Propeller Inc. aluminum hub Hovercraft propellers with composite blades. The 5 blade propeller model number HM-5V1-B1000-A was previously identified as propeller model number 103245. Refer to Table 2-1, Propeller Model Designation.

B. The purpose of this manual is to enable qualified personnel to install, operate, and maintain Hartzell Propeller Inc. aluminum hub Hovercraft propellers.

C. This manual covers several design types.

NOTE: All propeller models covered by this manual use composite propeller blades.

D. General

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

(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) After business hours, you may leave a message on our 24 hour product support line at (937) 778-4376. A technical representative will contact you during normal business hours. Urgent COG (Craft on Ground) support is also available 24 hours per day, seven days per week via this message service.

(c) Additional information is available on our website at www.hartzellprop.com.

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

(2) This manual is to be used by personnel who are trained and experienced with Hartzell Propeller Inc. products.

(3) This manual provides operation, installation, and line maintenance information for the Hartzell Propeller Inc. propeller Hovercraft system with composite blades.

(4) Installation, removal, operation, and troubleshooting data is included in this publication; however, the Hovercraft manufacturer’s manuals should be used in addition to this information.

2. General

A. Personnel Requirements

(1) Inspection, Repair, and Overhaul

(a) Compliance to the applicable regulatory requirements established by the Maritime and Coastguard Agency (MCA) or foreign equivalent is mandatory for anyone performing or accepting responsibility for any inspection and/or repair and/or overhaul of any Hartzell Propeller Inc. Hovercraft product.

(b) Personnel performing maintenance on propellers are expected to have sufficient training and certifications (when required by the applicable authority) to accomplish the work required in a safe manner.

B. Maintenance Practices

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

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

(3) Safe Handling of Paints and Chemicals

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

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

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

(4) Observe applicable torque values during maintenance.

(5) Before installing the propeller on the engine, the propeller must be statically balanced. New propellers are statically balanced at Hartzell Propeller Inc. Overhauled propellers must be statically balanced by the overhaul facility before return to service.

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

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

2 Additional procedures may be found in the Hovercraft Propeller Maintenance Manual 301.

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

(7) As applicable, follow military standard NASMS33540 for safety wire and cotter pin general practices. Use 0.020 inch (0.50 mm) or 0.032 inch (0.82 mm) diameter stainless steel safety wire unless otherwise indicated.

CAUTION: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF THIS MANUAL. INFORMATION CONTAINED IN THIS MANUAL MAY BE SIGNIFICANTLY CHANGED FROM EARLIER REVISIONS. FAILURE TO COMPLY WITH THIS MANUAL OR THE USE OF OBSOLETE INFORMATION MAY CREATE AN UNSAFE CONDITION THAT MAY RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE. FOR THE MOST RECENT REVISION LEVEL OF THIS MANUAL, REFER TO THE HARTZELL PROPELLER INC. WEBSITE AT WWW.HARTZELLPROP.COM.

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

(9) The Hovercraft manufacturer’s manuals should be used in addition to the information in this manual due to possible special requirements for specific Hovercraft applications.

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

3. Component Life and Service

A. Overhaul (Major Periodic Inspection)

(1) Overhaul (Major Periodic Inspection) is the periodic disassembly, cleaning, inspection, repairing as necessary, reassembly, and testing of a component.

NOTE: Throughout the text of this publication the terms Major Periodic Inspection and Overhaul are considered interchangeable.

(2) The overhaul interval is based on hours of service (operating time) or on calendar time.

(a) At such specified periods, the propeller hub assembly and the blade assemblies should be completely disassembled and inspected for cracks, wear, corrosion, and other unusual or abnormal conditions. As specified, certain parts should be refinished, and certain other parts should be replaced.

(3) Contact the Hartzell Propeller Inc. Product Support Department for specific information concerning overhaul (major periodic inspection).

B. Rework

(1) Rework is correction of major damage caused by physical mishap or failure.

(2) Rework is done on an irregular basis as necessary and required. The propeller may have to be re-balanced after rework procedures.

(3) Certain rework procedures, such as shot peening, must be performed at the Hartzell Propeller Inc. factory or in a facility that has been approved by Hartzell Propeller Inc.

(4) The amount, degree, and extent of major damage determine whether or not a component can be reworked without overhaul.

C. Repair

(1) Repair is correction of minor damage caused during normal operation. It is done on an irregular basis, as required.

(2) The amount, degree, and extent of damage determine whether or not a component can be repaired without overhaul.

D. Component Life

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

(2) Both references are necessary in defining the life of the component. Occasionally a part may be “life limited,” which means that it must be replaced after a specified period of use.

(3) Overhaul returns the component or assembly to zero hours TSO (Time Since Overhaul), but not to zero hours TT (Total Time).

(4) Rework or repair without overhaul does not affect TSO or TT.

E. Propeller Critical Parts

(1) Procedures in this manual may involve Propeller Critical Parts. These procedures have been substantiated based on Engineering analysis that expects this product will be operated and maintained using the procedures and inspections provided in the ICS for this product. Refer to the Illustrated Parts List chapter for the applicable propeller model for the identification of Propeller Critical Parts.

(2) Numerous propeller system parts can produce an aircraft Major or Hazardous effect, even though those parts may not be considered as Propeller Critical Parts. The operating and maintenance procedures and inspections provided in the ICS for this product are, therefore, expected to be accomplished for all propeller system parts.

4. Reference Publications

A. Hartzell Propeller Inc. Publications

Active Hartzell Propeller Inc. Service Bulletins, Service Letters, Service Instructions, and Service Advisories.

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

Hartzell Propeller Inc. Manual 165A (61-00-65) - Illustrated Tool and Equipment Manual - Available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 202A (61-01-02) - Standard Practices Manual, Volumes 1 through 11 - Volume 7, Consumable Materials and Packaging and Storage is available on the Hartzell Propeller Inc. website at www.hartzellprop.com

Hartzell Propeller Inc. Manual 301 - Hovercraft Propeller Maintenance and Overhaul Manual

B. References to Hartzell Propeller Inc. Publications

(1) Special tooling is required for procedures throughout this manual. For further tooling information, refer to Table 3-1, Special Tools and Equipment in the Installation and Removal chapter of this manual and Hartzell Propeller Inc. Illustrated Tool and Equipment Manual 165A (61-00-65).

(a) Tooling references appear with the prefix “TE” directly following the tool name to which they apply. For example, a template which is reference number 133 will appear as: template TE133.

(2) Consumable materials are referenced in certain sections throughout this manual. Specific approved materials are listed in Table 3-2, "Consumable Materials List" in the Installation and Removal chapter of this manual and in the Consumable Materials chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-00-02).

(a) The reference number for a consumable material will appear with the prefix “CM” directly following the material to which it applies. For example, an approved adhesive which is reference number 23 will appear as: approved adhesive CM23. Only those items specified may be used.

5. Definitions

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

Term	Definition
Annealed	Softening of material due to overexposure to heat
Blade Angle	Measurement of blade airfoil location described as the angle between the blade airfoil and the surface described by propeller rotation
Brinelling	A depression caused by failure of the material in compression
Chord	A straight line distance between the leading and trailing edge of an airfoil
Cold Rolling	Compressive rolling process for the retention area of single shoulder blades that provides improved strength and resistance to fatigue
Composite Material	Kevlar® (yellow) or graphite (black) fibers bound together with or encapsulated within an epoxy resin
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	Gradual material removal or deterioration due to chemical action
Crack	Irregularly shaped separation within a material, sometimes visible as a narrow opening at the surface
Debond	Separation of two materials that were originally bonded together in a separate operation
Delamination	Internal separation of the layers of composite material
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component

Term	Definition
Erosion	Gradual wearing away or deterioration due to action of the elements
Exposure	Leaving material open to action of the elements
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag
Gouge	Surface area where material has been removed
Hazardous Propeller Effect	The hazardous propeller effects are defined in Title 14 CFR section 35.15(g)(1)
Horizontal Balance	Balance between the blade tip and the center of the hub
Impact Damage	Damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object
Major Propeller Effect	The major propeller effects are defined in Title 14 CFR section 35.15(g)(2)
Nick	Removal of paint and possibly a small amount of material
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 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. These products are not certificated by any authority. There is no identification stamp comparable to TC and PC on the hubs and blades. Experimental parts are normally stamped with an “X” at or near the end of the part number.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control lever and the actual engine (propeller) RPM are equal
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain seaworthiness

Term	Definition
Overspeed	Condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the propeller control lever
Overspeed Damage	Damage that occurs when the propeller hub assembly rotates at a speed greater than the maximum limit for which it is designed
Pitch	Same as “Blade Angle”
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear
Porosity	An aggregation of microvoids. See "Voids"
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the Hovercraft or back up
Scratch	Same as “Nick”
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
Superseded	Parts that are considered seaworthy for continued operation but may no longer be available
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine craft 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
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

Term	Definition
Underspeed	The condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the propeller control lever
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 a Hovercraft propeller caused by air flowing through it while the engine is not producing power

6. Abbreviations

Abbreviation	Term
AN	Air Force-Navy (or Army-Navy)
CMM	Craft Maintenance Manual
COG	Craft on Ground
Ft-Lb	Foot-Pound
ICS	Instructions for Continued Seaworthiness
ID	Inside Diameter
In-Lb	Inch-Pound
IPS	Inches Per Second
kPa	Kilopascals
Lbs	Pounds
MCA	Maritime and Coastguard Agency
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection (Overhaul)
MS	Military Standard
MSDS	Material Safety Data Sheet
N•m	Newton-Meters
OD	Outside Diameter
POH	Pilot’s Operating Handbook
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
TBO	Time Between Overhaul
TC	Type Certificate
TSN	Time Since New
TSO	Time Since Overhaul
UID	Unique Identification

7. Hartzell Propeller Inc. Product Support

   A. Hartzell Propeller Inc. is ready to assist you with questions about your propeller system. 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. Hartzell Product Support can also be reached by fax at (937) 778-4215, and by email at techsupport@hartzellprop.com.

   B. After business hours, you may leave a message on our 24 hour product support line at (937) 778-4376 or at (800) 942-7767, toll free from the United States and Canada. A technical representative will contact you during normal business hours. Urgent AOG support is available 24 hours per day, seven days per week via this message service.

   C. Additional information is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

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

8. Warranty Service

   A. If you believe you have a warranty claim, it is necessary to contact the Warranty Administrator at Hartzell Propeller Inc. Hartzell Propeller's Warranty Administrator will provide a blank *Warranty Application* form. It is necessary to complete this form and return it to the Warranty Administrator for evaluation **before proceeding with repair or inspection work**. Upon receipt of this form, the Warranty Administrator will provide instructions on how to proceed. The Hartzell Propeller Inc. Warranty may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4379, or toll free at (800) 942-7767. Hartzell Propeller Inc. Warranty Administration can also be reached by fax at (937) 778-4215 or by email at warranty@hartzellprop.com.

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

9. Hartzell Propeller Inc. Recommended Facilities

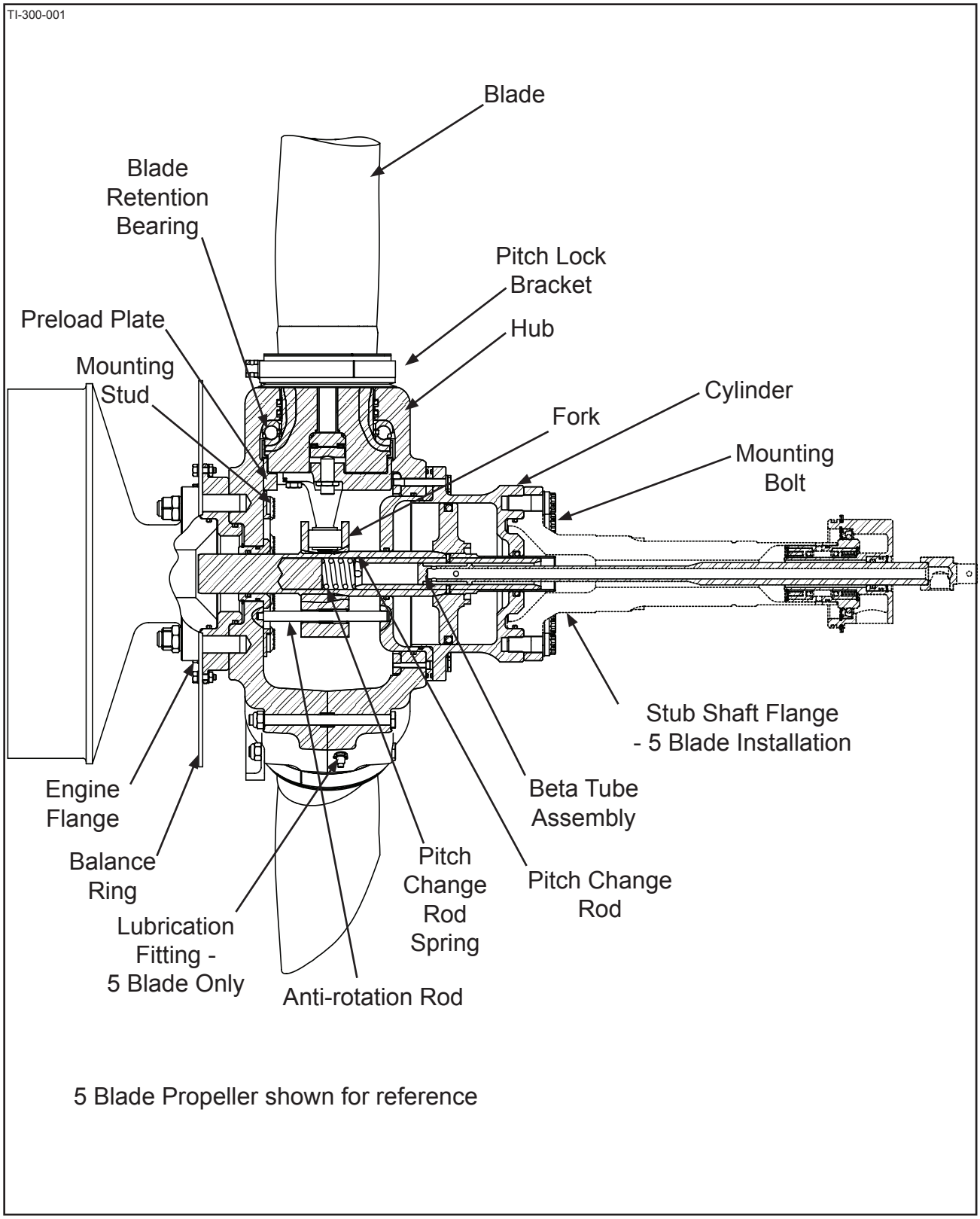
   A. Hartzell Propeller Inc. recommends using Hartzell Propeller Inc. approved distributors and repair facilities for the purchase, repair, and overhaul of Hartzell propeller assemblies or components.

   B. 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.

DESCRIPTION AND OPERATION - CONTENTS

LIST OF FIGURES

LIST OF TABLES



Propeller System Components
Figure 2-1

1. Functional Description and Operation of Propeller System

   A. The Hartzell Propeller Inc. Hovercraft propellers consists of the a variable pitch propeller assembly, a beta tube assembly, and a beta manifold. The propeller assembly is a dual acting system. The propeller assembly may be a single acting or a dual acting system. Refer to Table 2-1 and Table 2-2 for propeller model definitions.

   B. The beta tube assembly is connected to a high pressure oil source and fitted to the propeller through the beta manifold assembly. When commanded to change blade pitch, the beta tube assembly is moved to the corresponding position and directs high pressure oil to the propeller assembly.

   C. The beta manifold assembly is connected to the hydraulic oil drain port and drains the oil from the propeller when the propeller is changing blade pitch.

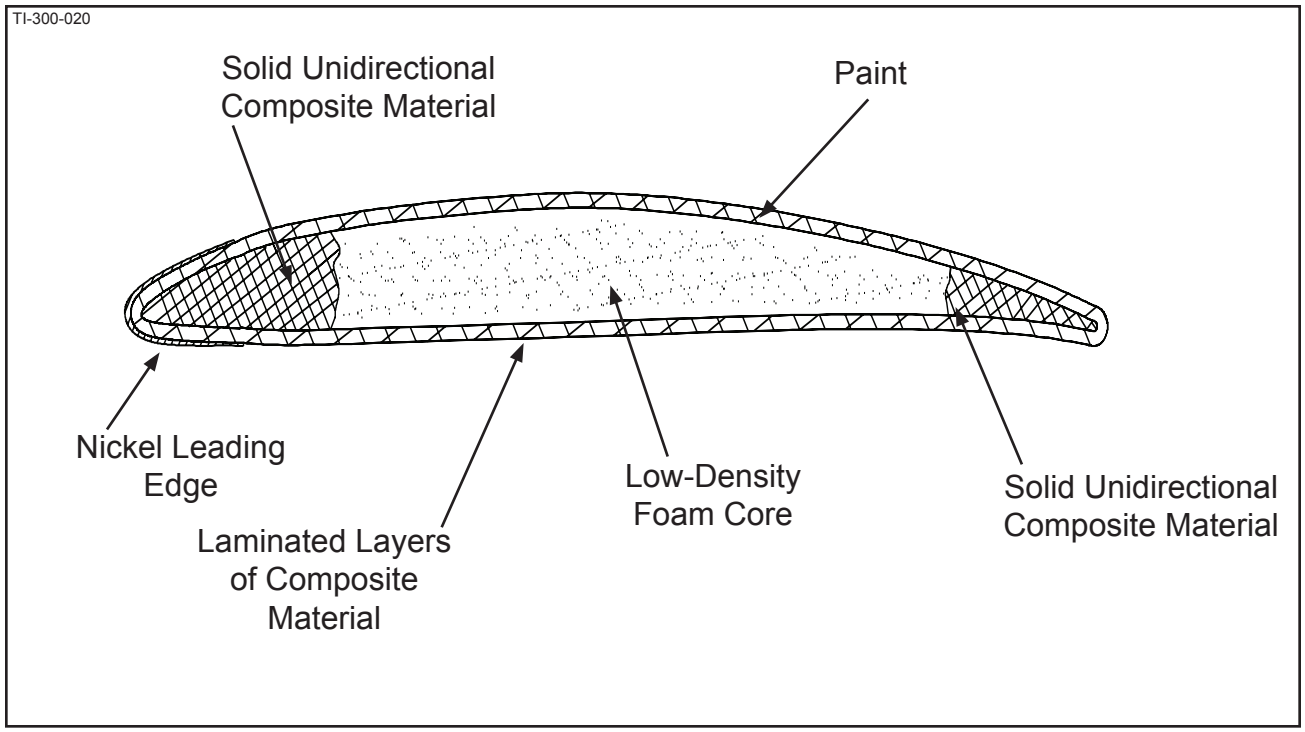
   D. The propeller assembly is constructed of a two piece aluminum hub and composite blades.

   E. A cover plate and cylinder create a cylinder cavity to house the piston.

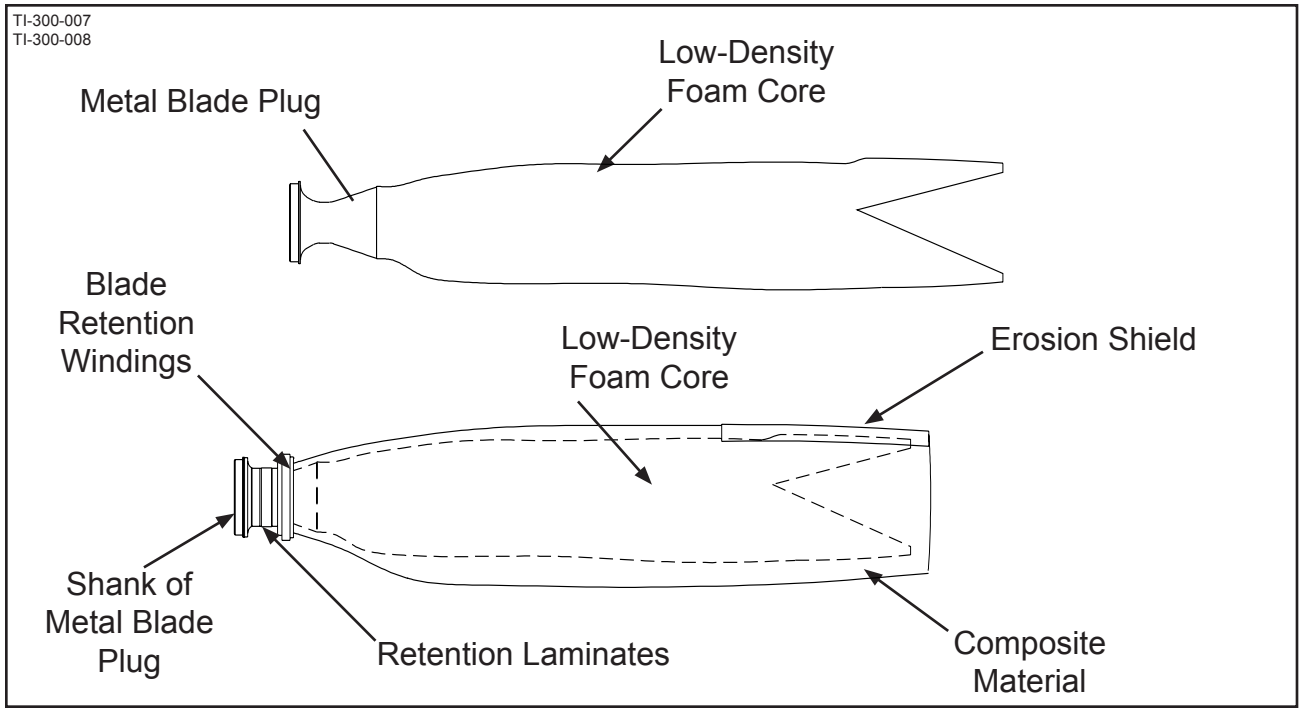
   F. The piston is connected to the fork through a pitch change rod.

   G. The direction of oil pressure to one side of the piston corresponds to a movement in the fork, which in turn, changes the blade angle of the composite propeller blades.

   H. The propeller assembly incorporates a pin to permit the blades to be manually set at a pre-determined angle. This permits the propeller to provide thrust in the event of a propeller oil system failure.



Section of Typical Composite Blade
Figure 2-2



Basic Components of the Composite Blade
Figure 2-3

2. Description of Composite Blade

   A. The Hartzell Propeller Inc. composite blade is composed of a metal blade shank retention section. A low-density foam core is molded into the metal blade shank and supports built-up layers of composite laminate (Figure 2-2).

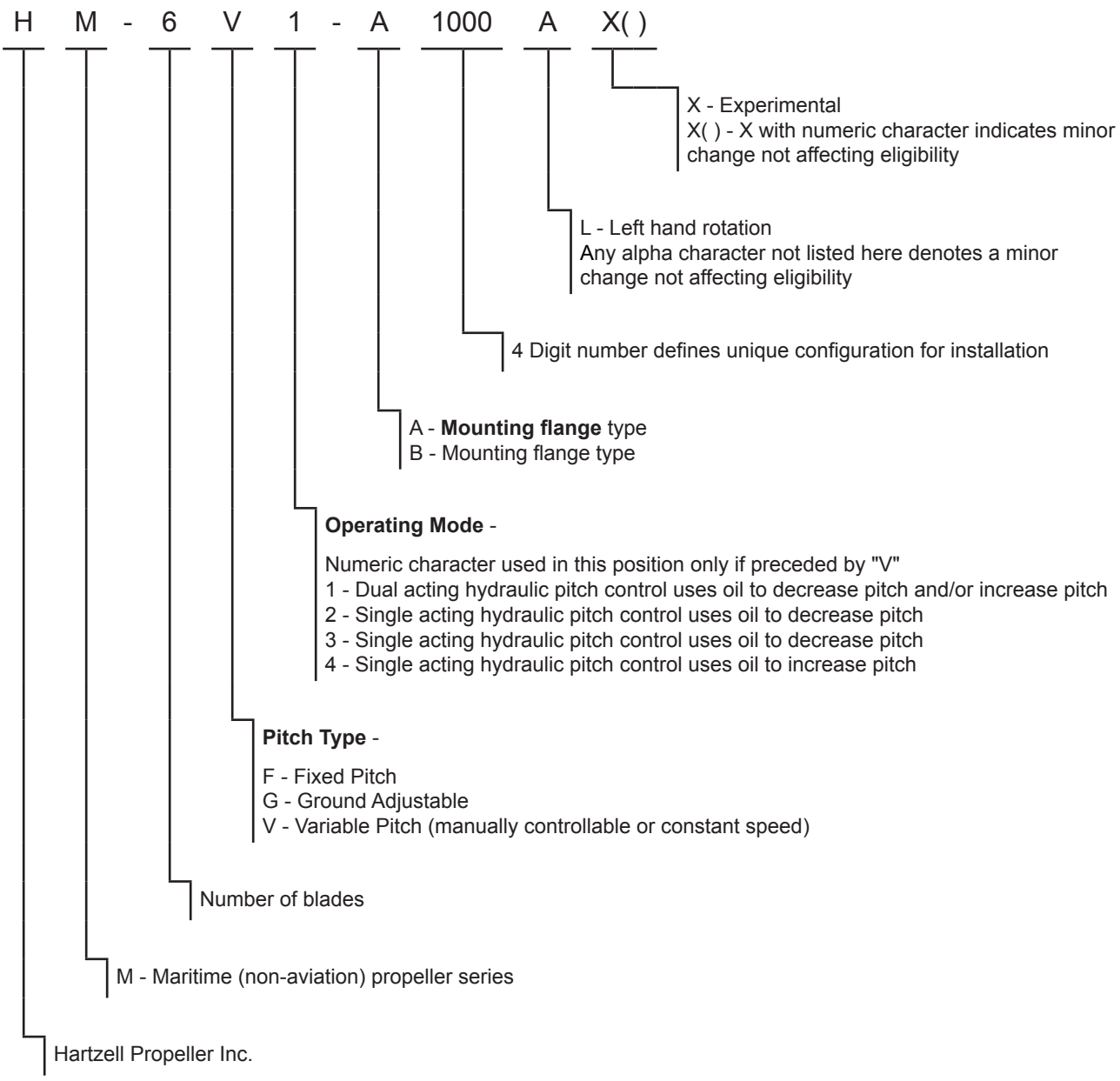
   B. An erosion shield of electroformed nickel is bonded to the blade to protect the blade leading edge from erosion and impact damage.

   C. Filament windings of composite material provide blade retention of the blade material to the internal metal blade plug (Figure 2-3). The composite laminates that are a structural component of the blade, also provide a retention load path directly under the bearing for blade retention.

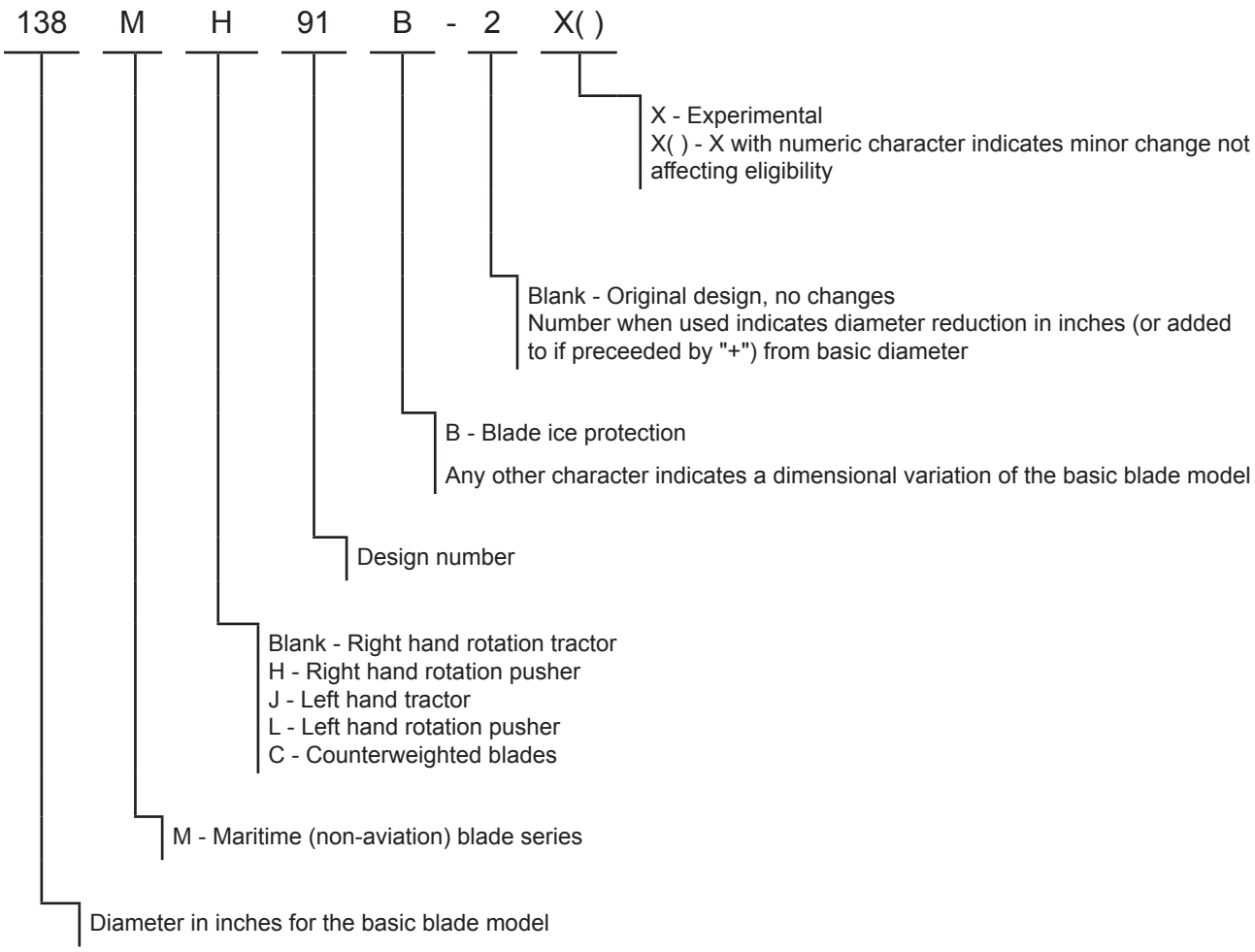
   D. Some designs use a filament winding on the inboard end of the erosion shield to aid the retention of the erosion shield. This winding is sometimes referred to as an erosion shield winding and should not be confused with the blade retention winding used to secure the blade material to the internal metal plug.

   E. The composite blade is balanced in the horizontal plane during production by adding lead wool to a centrally located balance tube in the metal blade shank that may protrude into the blade's foam core.

   F. The blades are painted with a finish covering of paint to protect the entire blade from erosion and damage.



Propeller Model Designations
Table 2-1



Blade Model Designations
Table 2-2

(This page is intentionally blank.)

INSTALLATION AND REMOVAL - CONTENTS

LIST OF FIGURES

LIST OF TABLES

(This page intentionally left blank.)

1. Tools, Consumables, and Expendables

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

(1) Tools

(a) Certain instructions throughout this manual refer to tools that will be required for propeller removal and installation. Specific tools are listed in Table 3-1, Special Tools and Equipment.

(b) Tooling references appear with the prefix “TE” directly following the tool name to which they apply. For example, "Blade Stands TE126".

(2) Consumable Materials

(a) Certain instructions throughout this manual refer to consumable materials. Specific approved materials are listed Table 3-2, Consumable Materials.

(b) The reference numbers for consumable materials appear with the prefix “CM” directly following the material to which they apply. For example, "Solvent CM23".

(3) Expendables

(a) 0.020 inch (0.50 mm) or 0.032 inch (0.82 mm) diameter stainless steel safety wire

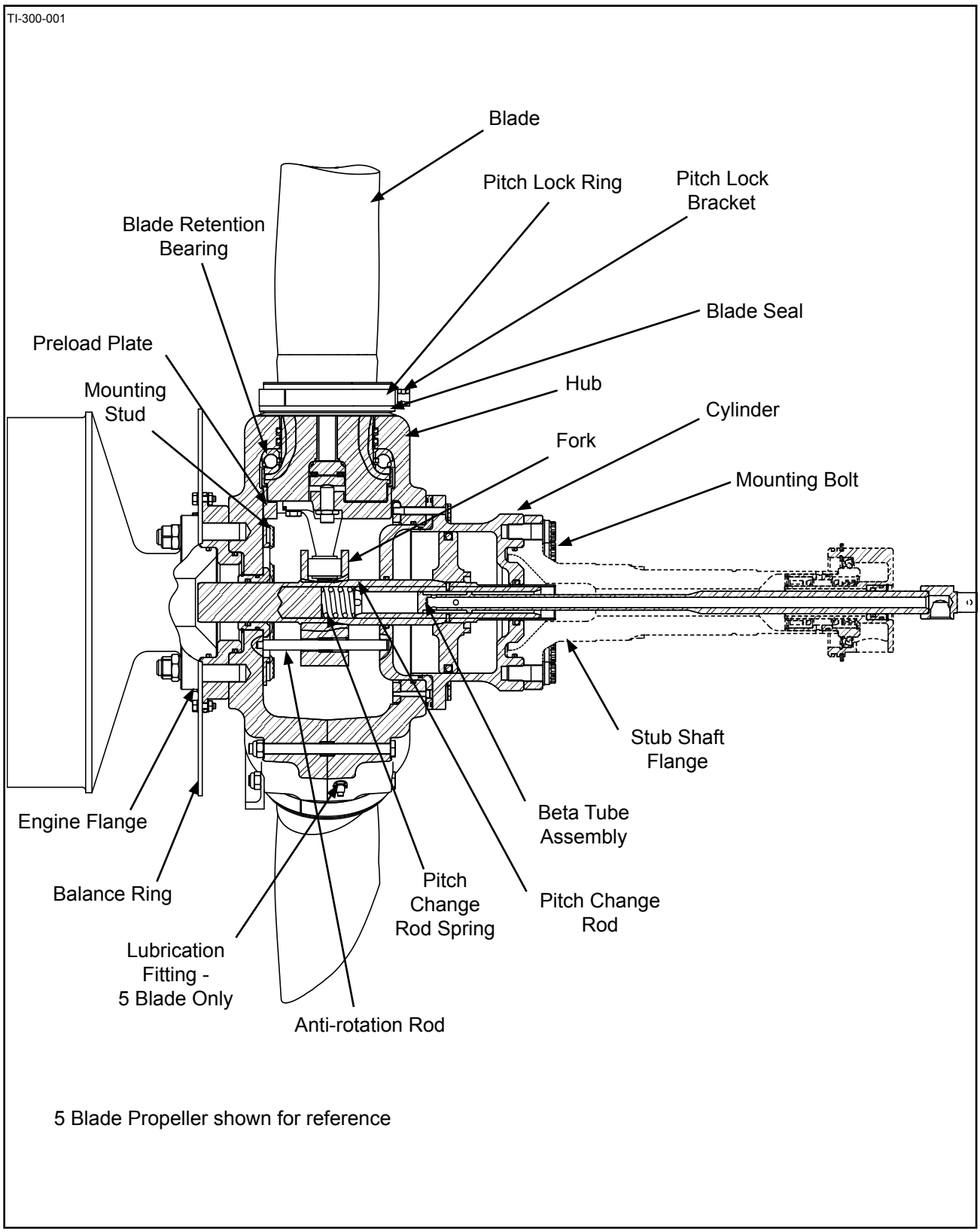
(b) O-ring - propeller to engine seal - Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification.

Reference No.	Hartzell Propeller Inc. Part Number	Description
TE5	AST-2877	Torque Wrench Adapter
TE97	BST-2960-1	Digital Protractor
TE126	BST-3024	Blade Stands
TE155	AST-2877-1	Torque Wrench Adapter
TE159	BST-10007	Threadless Headless Pin
TE262	EN1901	Propeller Sling
TE495	104287	Torque Wrench
TE506	104507	Leak Check Manifold - 6 Blade
TE507	104504	Adapter
TE509	105167	Check Cylinder - 6 Blade
TE519	BST-2912-20	Flange Adapter - 6 Blade
TE520	BST-2912-21	Flange Adapter - 5 Blade
N/A	103155	Pitch Lock Pin

Special Tools and Equipment
Table 3-1

Reference No.	Hartzell Propeller Inc. Part Number	Description
CM8	A-6741-8	Sealant 3M Scoth Seal, EC800
CM9	A-6741-9	Sealant 3M Scoth Seal, EC801
CM12	A-6741-12-( )	Lubricant - Aeroshell 5, 6, 7, 22; Royco 22CF
CM21	A-6741-21	Loctite 222
CM23	N/A	Kwik Dry Stoddard Solvent
CM46	A-6741-46	Henkel/Loctite, #1, P/N 30512
CM108	A-6741-108	Lubricant, Starrett, M1
CM109	N/A	Spray Clean
CM118	A-3338-7	MIL-PRF-83483 Anti-Sieze Compound
CM161	A-6741-161	Sealant, PRC-Desota International PR1422A-1/1 or PR1440A-1/2
CM210	A-6741-210	Innospec, Oil Dye Red B4 Liquid
CM257	A-6741-257	Sealant, Silicone, 430 gm, ThreeBond, 1216E430G
CM302	A-6741-302(-1)	Shell Rotella T65W-40

Consumable Materials List
Table 3-2



Propeller System Components
Figure 3-1

2. Propeller Assembly Pre-Installation

A. Inspection of Shipping Package

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

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

B. Uncrating

(1) Place the propeller container on a firm support.

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

(3) Remove the blades from the cardboard box.

(4) Remove the hub from the wooden container.

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

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

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

C. Inspection after Shipment

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

CAUTION 1: TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS, UNLESS SPECIFIED IN TABLE 3-3, TORQUE VALUES.

CAUTION 2: FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER, REFER TO FIGURE 3-9, DETERMINING TORQUE VALUE WHEN USING A TORQUING ADAPTER.

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

Part Number		Description	Torque		
5 Blade	6 Blade		Ft-Lb	In-Lb	N•m
103093	103093	Preload set screw	13-15		19
103192	103192	1/2-20 Thin hex nut, Preload jam nut	10		14
103137	103137	Bolt, 1/4-28, hex head Cylinder mounting to hub	12-14		11
103133	103133	Cylinder mounting ring to hub	Snug		
A-2043-1	A-2043-1	Nut, hub parting line	30 Initial torque		41
A-2043-1	A-2043-1	Nut, hub parting line	38-42 final torque		51-57
A-279		Lubrication fitting	Snug		
	102683	Plug, lubrication fitting	Snug		
B-3808-3	B-3808-3	Bolt, balance ring		30-36	3.3-4.6
A-3527		Nut, propeller mounting drive shaft to propeller	120-130, Wet		163-176, Wet
	104993	Bolt, drive shaft to propeller	175-180, Wet		237-244, Wet
B-3347		Bolt, propeller mounting stub to propeller	120-130, Wet		163-176, Wet
	C-6474	Bolt, propeller mounting stub to propeller	34-38, Wet		46-51, Wet
103004	103004	Pitch change rod to fork, L.H. Thread	76-84, Wet		103-114, Wet
103067	103067	Piston to pitch change rod, L.H. Thread	40-42, Wet		54-57, Wet
B-3384-( )	B-3384-( )	Screw, balance weight	10-12		14-16
B-3384-1H	B-3384-1H	Bolt, 1/4-28, (Beta Manifold Ass'y Housing)	4-6		5.5-8.1

Torque Values
Table 3-3

PART NUMBER		PART DESCRIPTION	WHERE USED
5 Blade	6 Blade		
C-3317-255	C-3317-255	O-ring	Hub/cover plate
C-3317-239-2	C-3317-378	O-ring	Mounting flange to drive shaft
C-3317-168	C-3317-170	O-ring	Cover plate - outer
C-3317-160	C-3317-160	O-ring	Cover plate - inner
C-3317-425-2	C-3317-425-2	O-ring	Piston
C-3317-223-2	C-3317-223-2	O-ring	Pitch change rod to cover plate
C-3317-341-8	C-3317-341-8	O-ring	Blade shank
C-3317-322	C-3317-322	O-ring	Cylinder mtg. flange
C-3317-239-2		O-ring	Mounting flange to drive shaft and Stub shaft to cylinder
C-3317-134-2	C-3317-134-2	O-ring	Stub shaft/beta manifold
A-1037-4	A-1037-4	3/8-24 Hex Head Bolt	Hub clamping bolt
A-2043-1	A-2043-1	3/8-24 Self-locking Hex Nut	Hub clamping nut
B-3834-0632	B-3834-0632	Washer	Hub clamping washer
103093	103093	1/2-20 Oval Point Set Screw	Preload plate
103192	103192	1/2-20 Thin Hex Nut	Preload plate
103137	103137	1/4-28 Hex Head Bolt	Cylinder to Hub
103136	103136	1/4 Washer Seal	Cylinder to hub and Cylinder to beta manifold
B-3347		9/16-18 12 pt. Mounting Bolt	Stub shaft to propeller
A-3257		9/16-18 Self-locking Hex Nut	Drive shaft to propeller flange
	104993	Bolt, 5/8-18, 12 point	Drive shaft to propeller flange
	C-6474	Bolt, 3/8-24, 12 point	Stub shaft to cylinder
A-2048-2		9/16 Countersunk Mounting Washer	Stub shaft to cylinder
	104994	Countersunk Mounting Washer	Drive shaft to propeller
103096		Spiral Retainer Ring	To secure the seal housing
B-3384-1H		Bolt, 1/4-28	Beta manifold ass'y housing

O-ring and Propeller Mounting Hardware Identification
Table 3-4

D. Reassembly Procedures when Blades Have Been Removed for Shipment

(1) All blades are removed from the propeller after assembly at the factory to facilitate shipment.

(2) In such cases the propeller has been fully assembled, tested, inspected, and statically balanced at the factory before blade removal and shipment.

(3) Before starting reassembly, review any of the following information and instructions that are applicable:

(a) Table 3-3, Torque Values

(b) Table 3-4, O-ring and Propeller Mounting Hardware Identification

(c) Approved consumables in Table 3-2, Consumables Materials

(d) Cleaning procedures in the Maintenance Practices chapter of this manual

(e) Inspection and check procedures in the Inspection and Check chapter of this manual

(f) Checking blade track in the Inspection and Check chapter of this manual

(4) The propeller hub has been shipped assembled. Disassemble the hub in accordance with the following procedure:

(a) Put the hub on the rotatable fixture of the assembly table.

(b) Remove cylinder mounting bolts and seal washers that attach the cylinder mounting flange.

(c) Install three threaded headless alignment pins, TE159, in three cylinder attaching holes equally spaced.

(d) Remove the cylinder.

(e) Unscrew and remove the piston.

(f) Unscrew the pitch change rod.

(g) Remove the cover plate.

CAUTION: THE CAP HEAD SCREWS ARE INTENTIONALLY LEFT LOOSE IN THE CYLINDER MOUNTING RING TO FACILITATE ALIGNMENT DURING ASSEMBLY. DO NOT TIGHTEN OR REMOVE THEM AT THIS TIME.

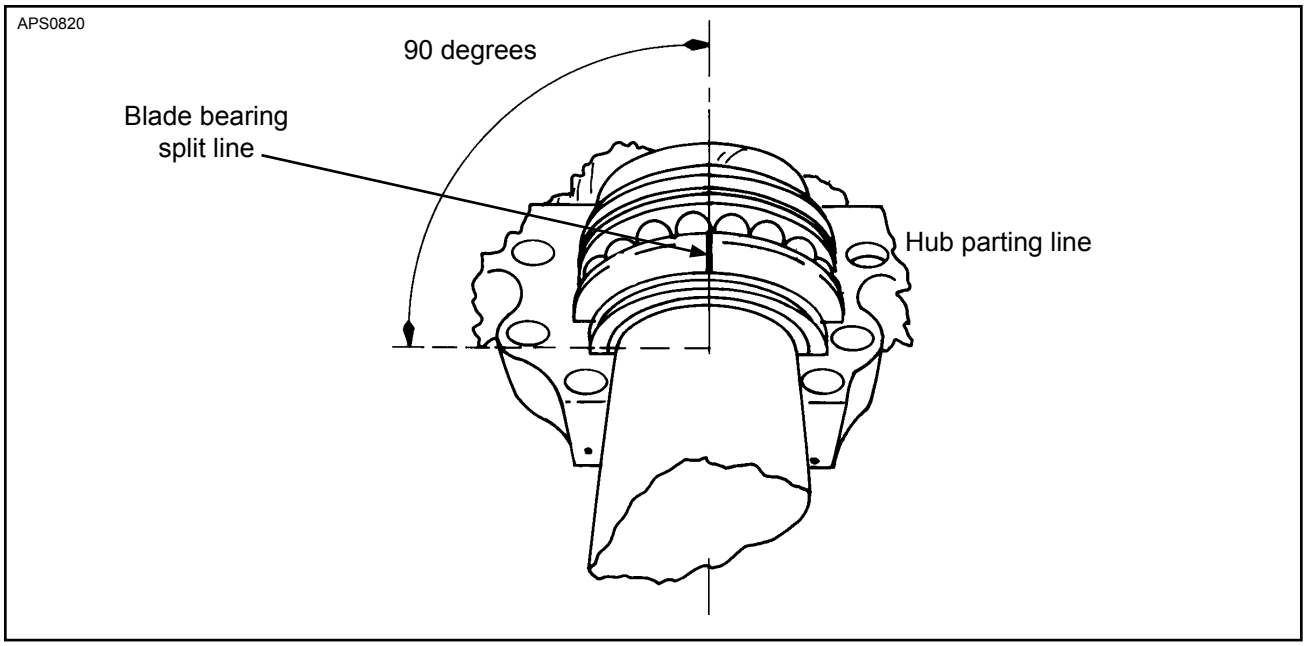
(h) **Do not remove** the smaller cap head screws that secure the cylinder mounting ring to the hub.

(i) Remove the anti-rotation rods.

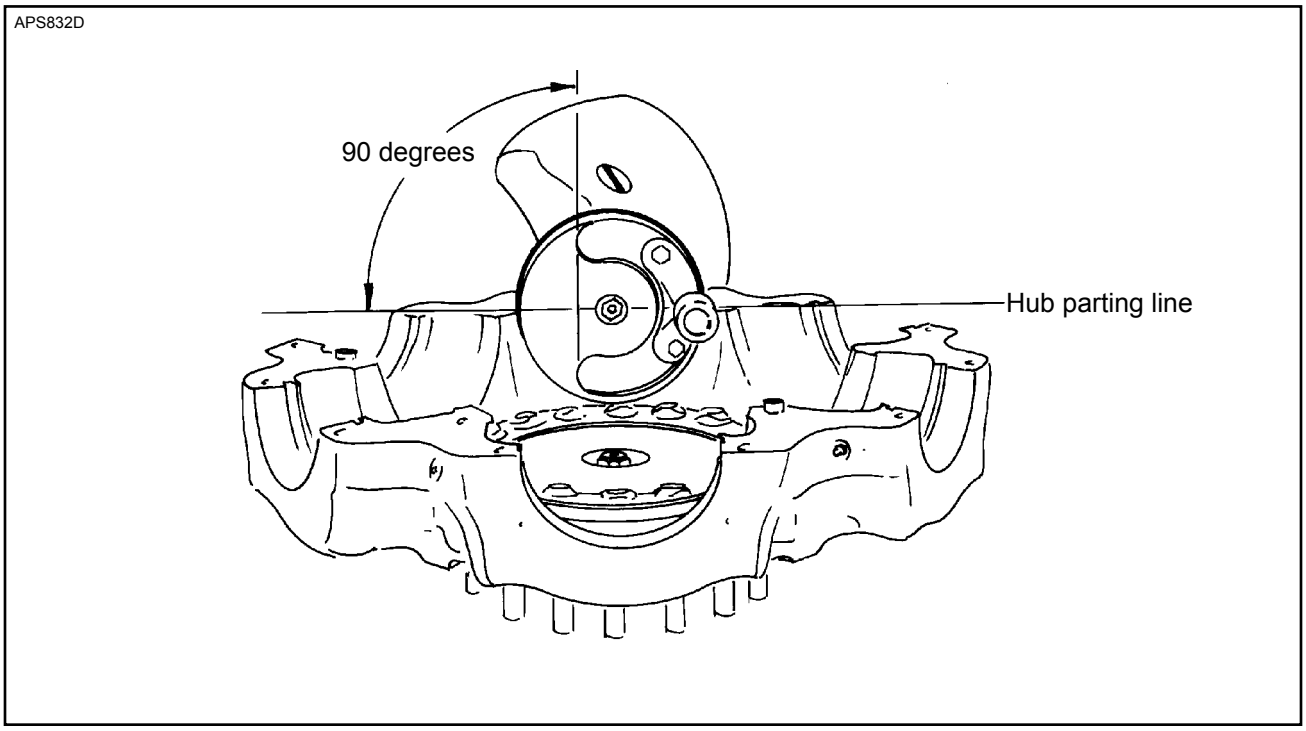
(j) Remove the hub bolts, self locking nuts, and washers from the hub.

(k) Separate the hub halves.

(l) Remove the fork.



Alignment of Blade Bearing Split
Figure 3-2



Position of Preload Plate Cutout
Figure 3-3

CAUTION: DO NOT REMOVE GREASE FROM THE BLADE SOCKETS.

(5) Using solvent CM23 or equivalent, remove all traces of grease from the parting line face. Do not remove grease from the blade sockets.

(6) Using grease CM12, apply a light layer to the hub blade arm O-ring grooves before installation of the blades.

(7) Locate blade number one.

NOTE: Blade and corresponding blade socket are pre-marked at the factory for identification during reassembly.

(8) Carefully remove the packaging over the blade bearing. Any excess grease remaining on the packaging should be wiped on the blade bearing.

(9) Make sure that the preload set screws and jam nuts are installed in the preload plates before propeller assembly.

CAUTION: DO NOT REMOVE THE PRELOAD SET SCREWS.

(10) Using grease CM12, apply a light layer to each blade O-ring.

CAUTION: MAKE SURE THE BLADE SEAL IS INSTALLED ON THE BLADE AND IS NOT TWISTED WHEN INSTALLING IT.

(11) Using grease CM12, apply a light layer to each blade seal.

(12) Install the blade seal on the blade outboard of the pitch lock ring with the narrow side of the blade seal to the hub. Do not permit the blade seal to twist.

(13) Position the two blade O-rings on the blade shank. Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification.

(14) Set up the blade support stand TE126, or equivalent, to support the blade.

(a) Place the support stand approximately ten inches (25.4 cm) inboard of where the blade tip will be.

(15) Carefully position the blade into the corresponding numbered socket of the hub.

(a) Make sure the blade O-rings are properly positioned in the hub O-ring grooves.

(16) Rotate the hub side bearing race until the race split line is located toward the blade trailing edge, 90 degrees from the hub parting line. Refer to Figure 3-2.

(17) As needed, rotate the preload plate so that the cutout is centered on the hub parting line. Refer to Figure 3-3.

(a) Rotate the blade to the midpoint of its travel until the blade is lying flat on the stand.

CAUTION: MAKE SURE THAT THE CHAMFERS ON THE PRELOAD PLATES ARE ALIGNED.

(18) Repeat steps 2.D.(11) through 2.D.(17) for blade number two if assembling a 5 blade propeller and for blade two and three if assembling a 6 blade propeller.

(19) Install the fork onto the cam followers of the blades.

(20) Apply anti-seize CM118 to the pitch change rod and temporarily thread it by hand into the fork in a counterclockwise direction (left-hand threads) until it bottoms out into the fork.

(21) Make sure the alignment mark on the fork is in line with the alignment mark on the hub.

(22) Move the blades to reverse pitch blade angle to raise the fork, so that the cam follower slots and the fork are above the parting line of the hub.

(23) Repeat steps 2.D.(11) through 2.D.(17) for remaining blades.

CAUTION: MAKE SURE THAT THE CHAMFERS ON THE PRELOAD PLATES ARE ALIGNED.

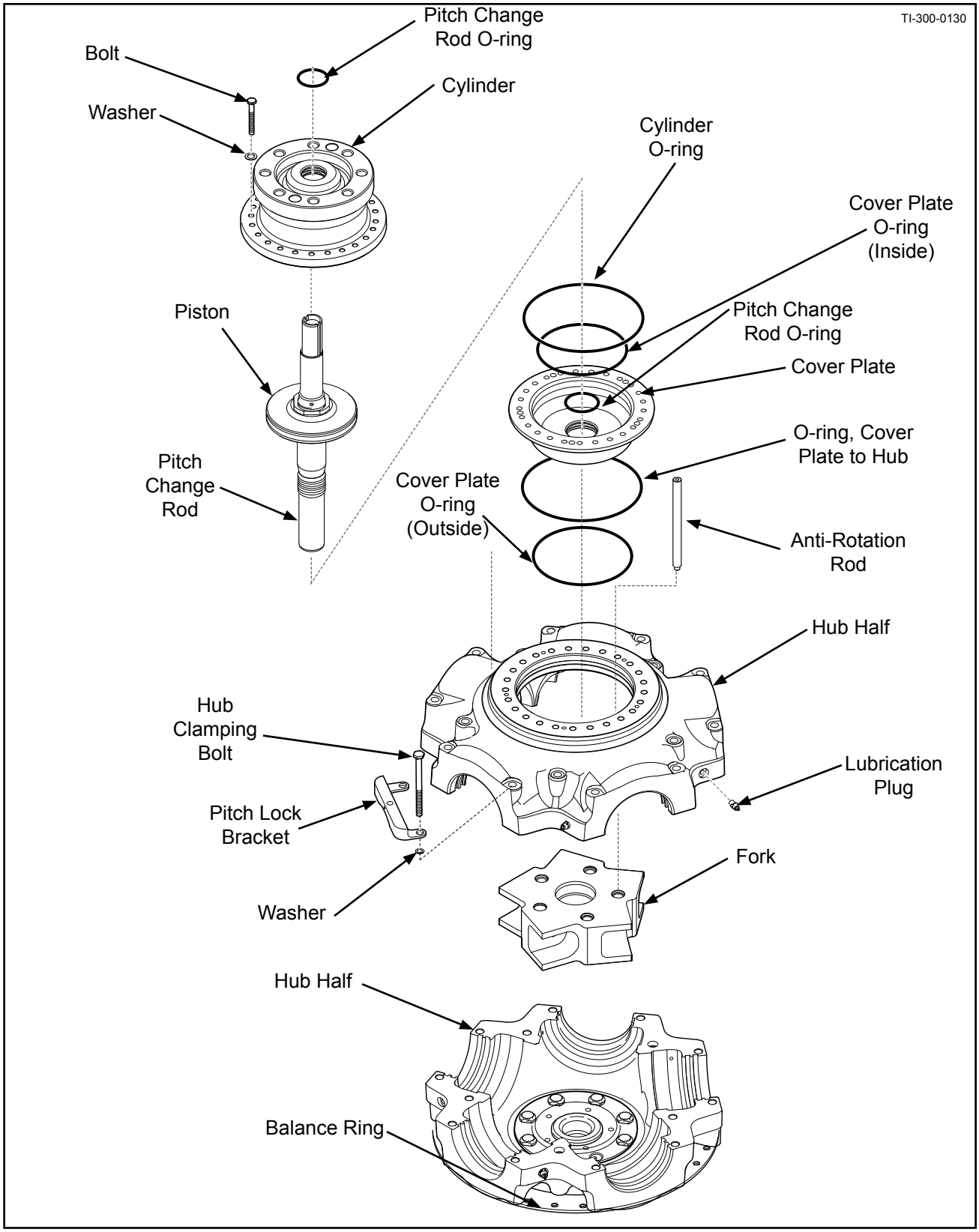
(a) Carefully position the remaining blades into the engine side hub half.

(b) Insert each blade cam follower into its appropriate position in the fork and rotate the blade into place.

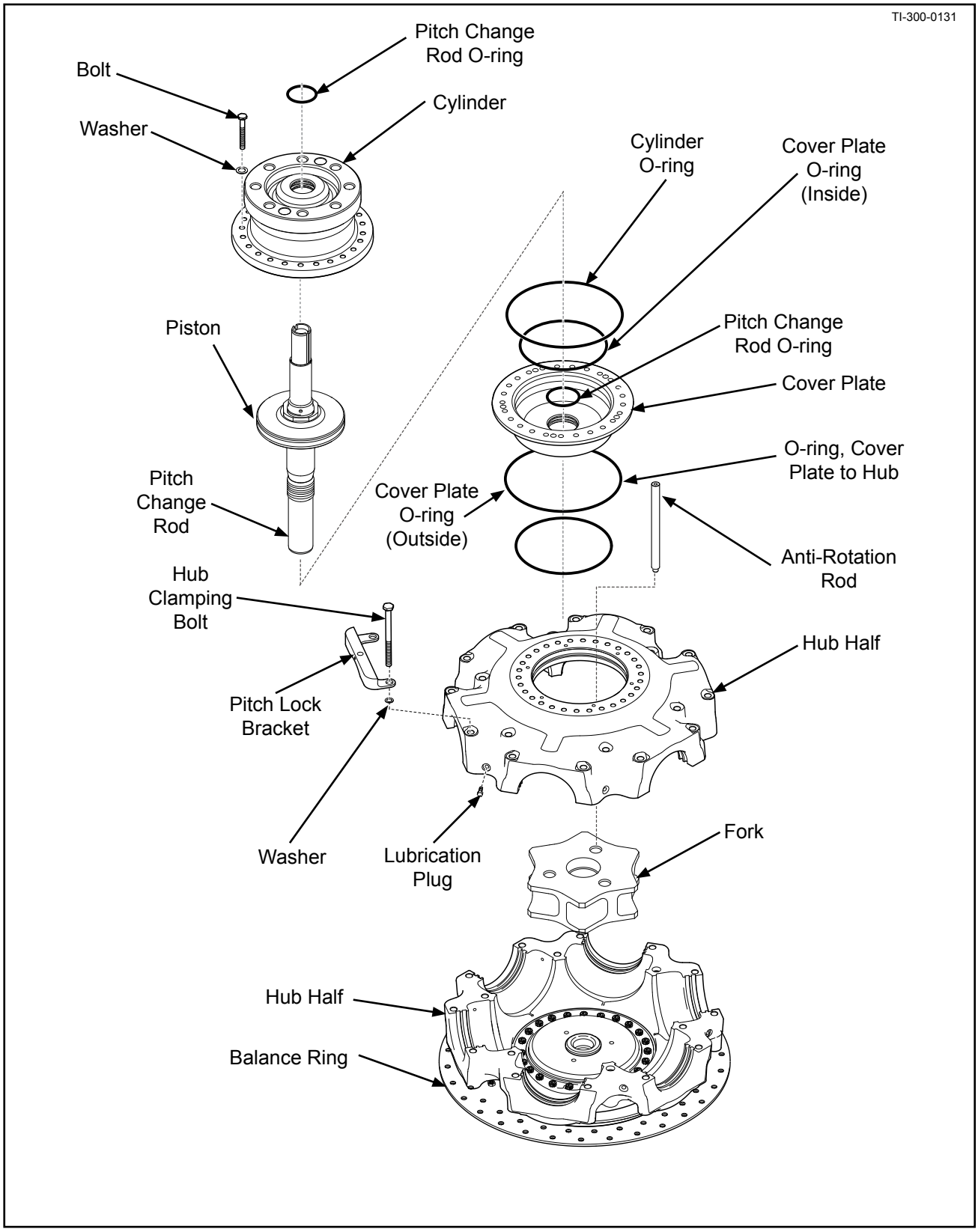
(24) After all blades are installed, rotate each blade to the midpoint of its travel until the blade is lying flat on the stand, camber side up.

(25) Make sure that the blade O-rings, refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification, are seated properly in the hub grooves and that each blade bearing split line is located toward the blade trailing edge, 90 degrees from the hub parting surface. Refer to Figure 3-2.

NOTE: If needed, use a smooth edged wooden tounge depressor to carefully help position and seat the blade O-rings.



5 Blade Hub Assembly
Figure 3-4A



6 Blade Hub Assembly
Figure 3-4B

E. Hub Assembly

CAUTION: WHEN APPLYING SILICONE SEALANT CM257 TO THE HUB PARTING LINES, MAKE SURE THAT EXCESS SILICONE SEALANT CM257 DOES NOT SEEP INTO THE HUB/BLADE O-RING GROOVE WHEN THE HUB CLAMPING BOLTS ARE TORQUED.

(1) Put a bead of silicone sealant CM257 on the hub mating surfaces. Refer to Figure 3-5.

(a) Smooth the bead of silicone sealant CM257 to coat the entire hub parting line surface of the cylinder side hub half with a thin coat of silicone sealant CM257.

(b) Use only enough silicone sealant on the mating surfaces so that a small amount will be squeezed out along the entire parting surface when the hub nuts are properly torqued.

(c) Remove any excess silicone sealant CM257 from the hub/blade O-ring grooves.

(d) Install the cylinder side hub half within 6 minutes of the application of silicone sealant CM257.

TI-301-0141

Applying Sealant Between the Hub Halves
Figure 3-5

(2) Using the hub guide bushings, line up the hub halves and seat the cylinder half of the hub in place.

(a) Make sure that the blade O-rings are in the hub blade O-ring grooves before trying to seat the hub in place.

(3) Install the inner hub clamping bolts, washers, and self locking nuts. Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification for hub clamping bolts, washers, and self locking nuts part numbers.

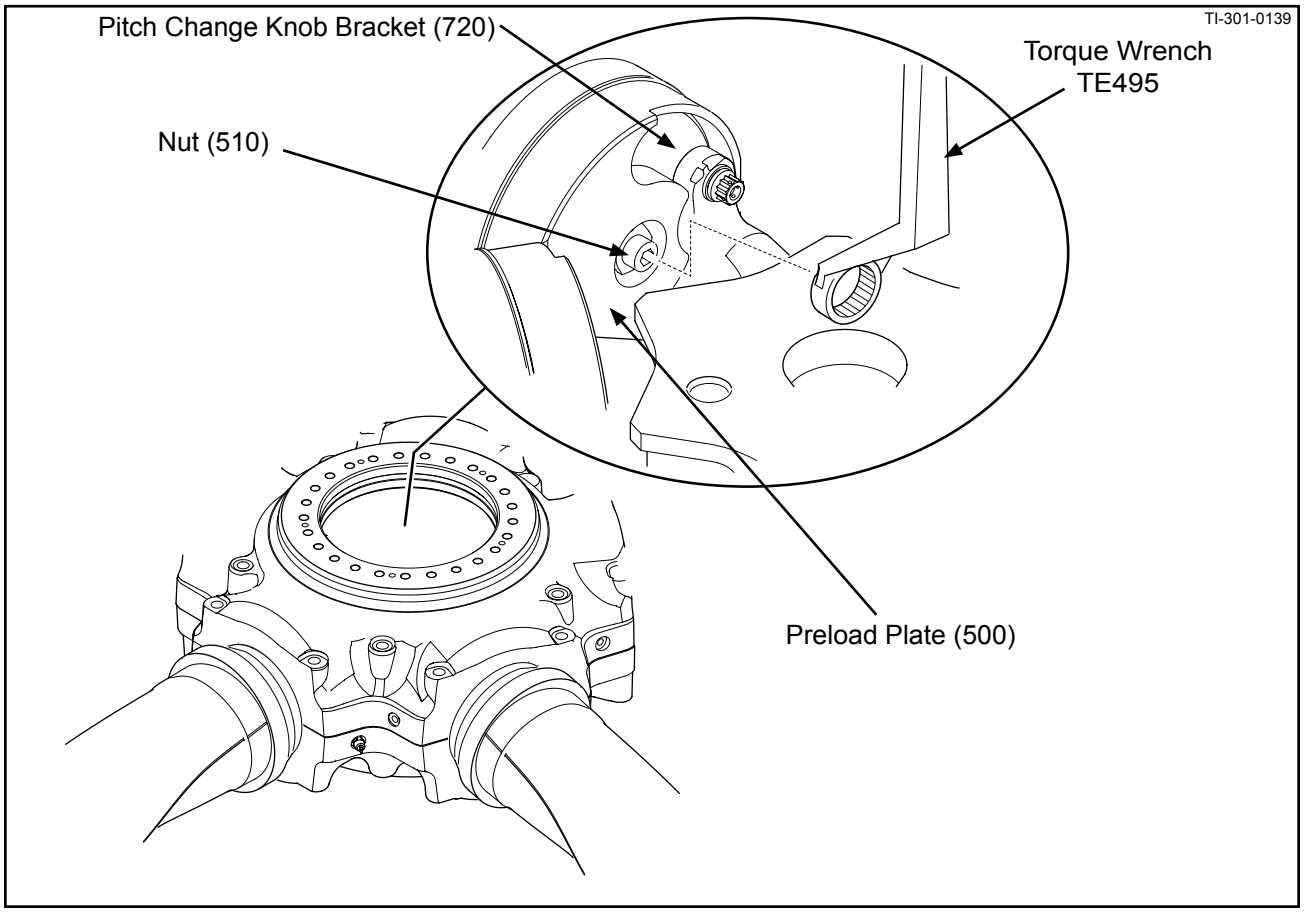
CAUTION: DO NOT TORQUE THE HUB CLAMPING BOLTS AT THIS TIME.

(4) Using a staggered sequence, tighten the hub clamping nuts until snug.

(5) Move the propeller blades to the feather position so that the fork is on the bottom of the hub. This will provide room to permit the torquing of the preload set screws.

(6) Remove the pitch change rod.

(7) Remove the blade stands TE126, or equivalent.



Tightening Preload Plate Set Screw and Jam Nut
Figure 3-6

(8) Set the blade preload.

WARNING: DO NOT ATTEMPT TO REUSE A PREVIOUSLY USED SET SCREW.

CAUTION: MAKE SURE THAT THE PRELOAD PLATES ARE FULLY SEATED. USING YOUR HAND, MOVE THE BLADES UP AND DOWN IN THE HUB SOCKET.

(a) Using a torque wrench TE495, remove the installed preload set screws and jam nuts.

(b) Thoroughly coat the threads of the preload set screws with thread locking compound CM21.

(c) Install the preload set screws into the preload plate threads.

(d) Using a torque wrench TE495, torque each preload set screw in accordance with Table 3-3, Torque Values. Refer to Figure 3-6.

(e) Install the preload jam nuts onto the set screws.

(f) Using torque wrench TE495, torque the preload jam nuts in accordance with Table 3-3, Torque Values. Refer to Figure 3-6.

(g) The blades must turn freely in the hub after setting preload with no evidence of in-and-out movement.

(9) Using a staggered sequence, tighten the inner hub clamping nuts to the initial torque indicated in Table 3-3, Torque Values.

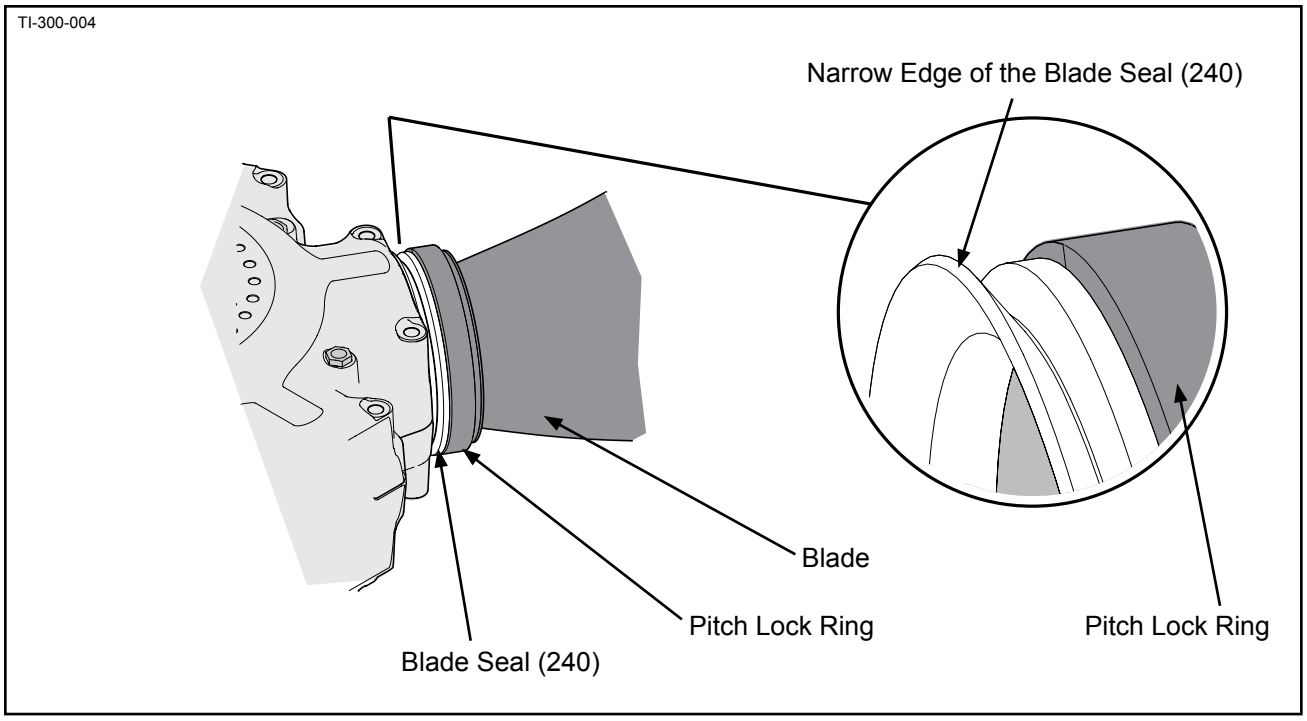
(10) Visually check to make sure some of the silicone sealant CM257 has squeezed out from between the hub halves at the mating surfaces between each blade.

CAUTION: MAKE SURE THE HEADED VALVE PINS ARE SECURELY IN PLACE IN THE PITCH CHANGE ROD BEFORE INSTALLING THE PITCH CHANGE ROD.

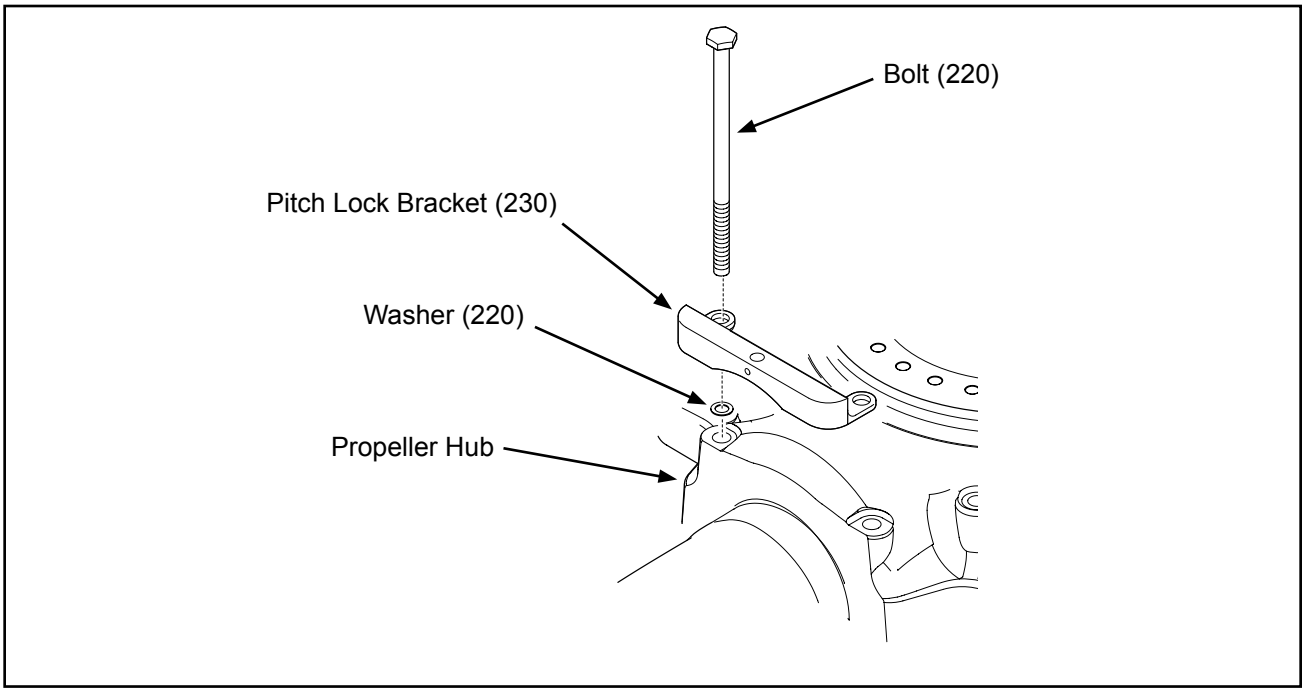
(11) Carefully thread the pitch change rod by hand into the fork by spinning the pitch change rod unit counterclockwise (left-hand threads) as far as possible.

(a) If necessary, using the propeller blades, adjust the position of the fork to seat the pitch change rod properly.

NOTE: The pitch change rod and fork have left-hand threads.



Installation of the Blade Seal
Figure 3-7



Installation of Hub Clamping Bolts and Pitch Lock Bracket
Figure 3-8

(12) Rotate the blades from reverse to full forward to make sure full travel can be achieved.

(a) Using a digital protractor TE97, zero it out on the cylinder mounting flange.

(b) Line up the protractor with the reference tape on the blade.

(c) Check the total blade travel from full forward to full reverse.

1 Acceptable blade tolerance at full forward pitch is 35 degrees +/- 5 degrees.

2 Acceptable blade tolerance at full reverse pitch is -35 degrees +/- 5 degrees.

(d) If full travel is not achieved, remove the cylinder side hub half and find the source of the problem.

(13) Tighten the hub clamping nuts to the final torque indicated in Table 3-3, Torque Values.

(14) Using solvent, remove excess silicone sealant from the seal line between the hub mating surfaces.

(15) Install a pitch lock bracket on each hub socket. Refer to Figure 3-7 and Figure 3-8.

(16) Install a washer under each end of the pitch lock bracket. Refer to Figure 3-7.

(17) Insert the remaining hub clamping hub bolts and washers.

(18) Install the hub clamping self-locking nuts and washers on the hub bolts.

(19) Tighten the hub clamping self-locking nuts to the initial torque indicated in Table 3-3, Torque Values, using a staggered sequence to make sure that a uniform pull-down on the hub halves.

(20) Using a staggered sequence, torque the hub clamping self locking nuts to the final torque indicated in Table 3-3, Torque Values.

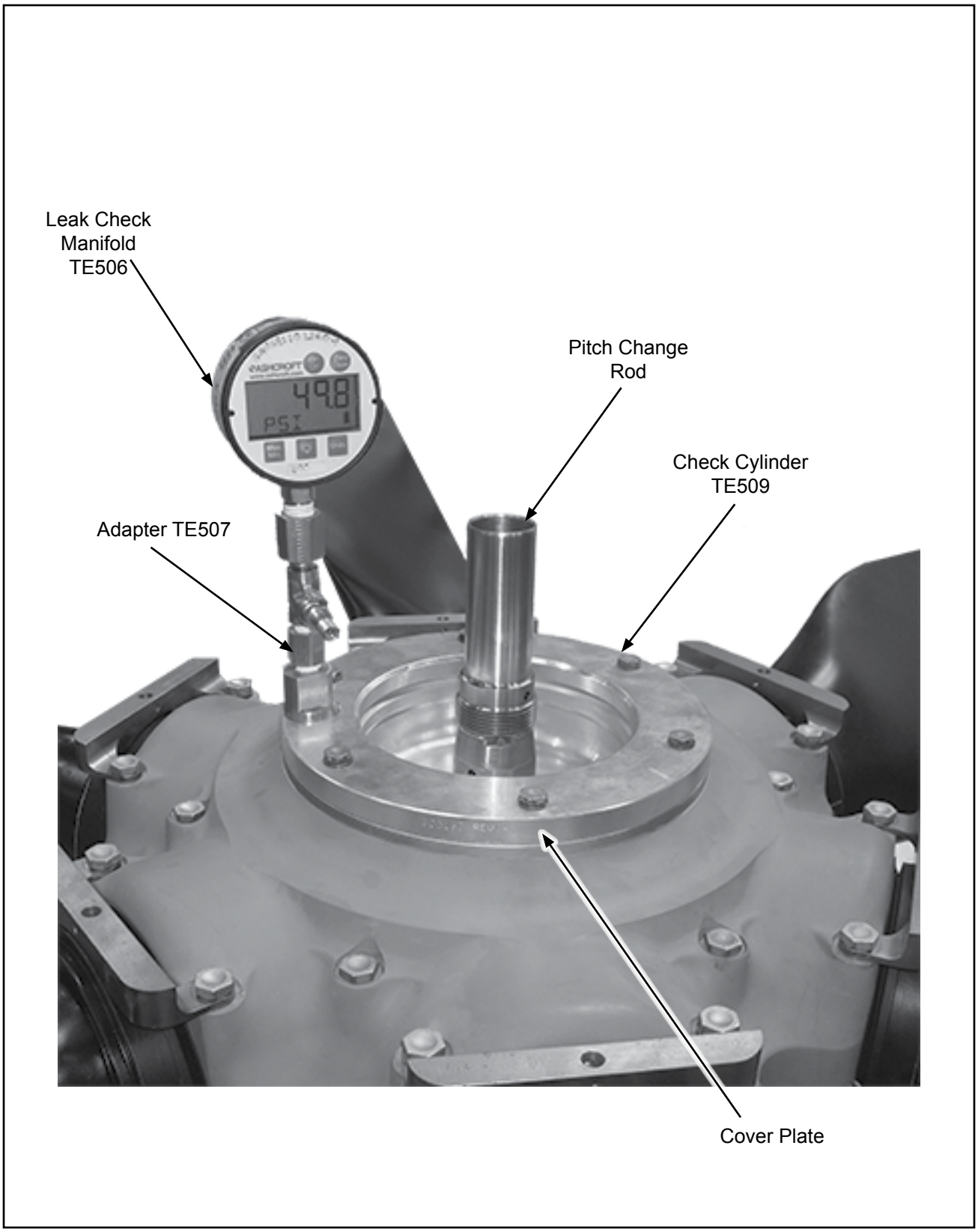
(21) Move the blade seal between the pitch lock ring and the hub. Make sure that the wide side of the blade seal is next to the pitch lock ring. Refer to Figure 3-8.

NOTE: Do not permit the blade seal to twist.

(22) Rotate the blades to full forward, so that the fork rests on the hub.

(23) Make sure that the blades turn freely in the hub after setting preload and after final torque of the hub clamping nuts with no evidence of in-and-out movement.

(24) Rotate the blades to the reverse position, toward the top of the hub.



Pressure Check Hub
Figure 3-9

(25) Put the small end of the anti-rotation rod in place on the fork.

(a) Make sure that the rods engage in the engine side hub half.

(b) Apply a small amount of lubricant CM12 on the top of each anti-rotation rod.

(c) Install a spacer on each anti-rotation rod.

(26) Install threaded, headless alignment pins TE159 through the hub unit and into the cylinder mounting ring.

(27) Tighten the threaded, headless alignment pins TE159 until snug.

(28) Using grease CM12, apply a light layer to the O-ring on the side of the cover plate that will seat between the hub and the cover plate.

(29) Using grease CM12, apply a light layer to the O-ring in the hub that is between the hub and the cover plate.

(30) Rotate the blade pitch to approximately 3/4 reverse pitch. Make sure that the anti-rotation rods do not move.

(31) Align the cover plate marking to the marking on the hub. (The marks will be made by the manufacturer.)

CAUTION: IF THE GAP BETWEEN THE COVER PLATE AND THE HUB IS GREATER THAN 0.100 INCH, (2.54 MM) DO NOT ATTEMPT TO TORQUE THE ASSEMBLY SCREWS. DAMAGE TO THE COMPONENTS MAY RESULT.

(32) Install the cover plate over the threaded, headless alignment pins TE159 until it is within 0.100 inch (2.54 mm) of the hub surface.

(33) Install the O-ring on the face side of the cover plate.

(34) Install the check cylinder tool TE509 on the cover plate. Refer to Figure 3-9.

(35) Using two (2) bolts and two (2) seal washers, attach the check cylinder tool TE509 to the cover plate.

(36) Remove the threaded, headless alignment pins TE159.

(37) Using the remaining bolts and seal washers, attach the check cylinder tool TE509 to the cover plate.

(38) Tighten the bolts, using a staggered pattern, until the cover plate is flush with the hub. Refer to Figure 3-9

(39) Perform a pressure check - 6 Blade Only

(a) Install the leak check manifold TE506 with adapter TE507 to the check cylinder tool TE509.

(b) Apply 50 PSI (3.44 Bar) air pressure through the leak check manifold TE506.

(c) Permit the pressure to stabilize for 5 minutes.

(d) A minimum of 45 PSI (3.10 Bar) must be maintained.

NOTE: Pressure will drop, but must maintain a minimum of 45 psi.

(e) If a minimum of 45 PSI (3.10 Bar) is not maintained, reapply 50 PSI (3.44 Bar) and using leak detector CM122 troubleshoot the leak.

(f) If a minimum of 45 PSI (3.10 Bar) is maintained, remove the leak check manifold TE506 and adapter TE507.

(g) Remove the check cylinder tool TE509, the two (2) bolts, and two (2) washers.

(h) Install the two (2) threaded, headless alignment pins TE159.

(i) Remove the remaining bolts and washers.

(40) Torque the pitch change rod in accordance with Table 3-3, Torque Values.

(41) Stretch the O-ring and install the O-ring in the ID of the cover plate between the cylinder and the cover plate.

NOTE: To prevent the O-ring from getting cut during installation of the cylinder, stretch the O-ring before installing in the groove.

(42) Make sure that the O-ring is completely seated in the O-ring groove.

(a) If the O-ring is not 100% seated in the groove, remove the O-ring and repeat the stretch.

(b) If the O-ring cannot be 100% seated in the groove, replace the O-ring.

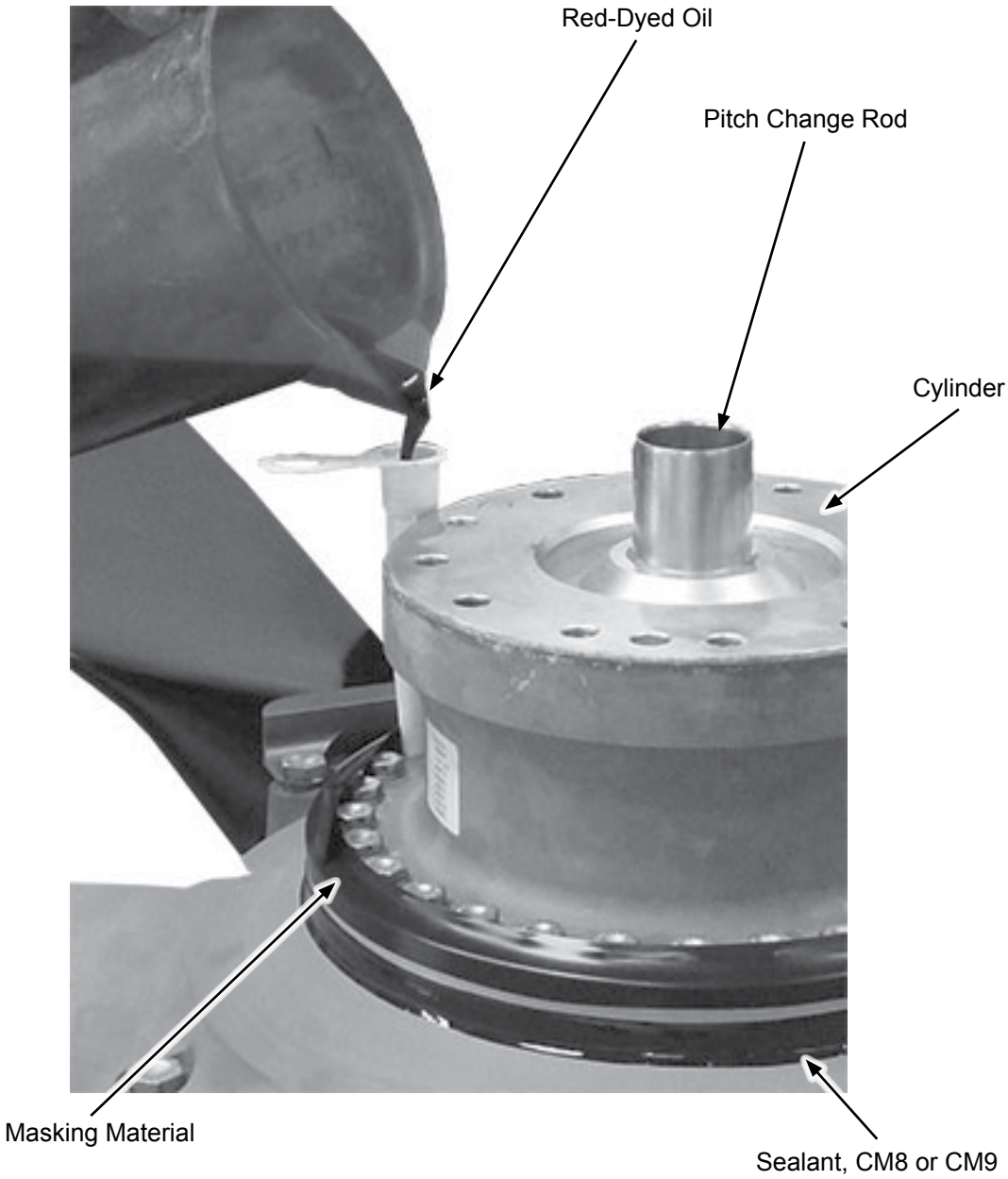
(43) Apply anti-seize CM118 to the external threads of the pitch change rod.

CAUTION: MAKE SURE THE WRENCHING FLATS ON THE PISTON ARE TOWARDS THE TOP WHEN INSTALLING IT OVER THE PITCH CHANGE ROD.

(44) Install the piston over the pitch change rod, wrenching-flats towards the top.

NOTE: The piston has left-handed threads.

(45) Torque the piston in accordance with Table 3-3, Torque Values.



Oil-filling 6 Blade Propeller
Figure 3-10

CAUTION: MAKE SURE THE O-RING IS 100% SEATED IN THE O-RING GROOVE BEFORE INSTALLATION OF THE CYINDER.

(46) Carefully align the bolt holes in the cylinder over the alignment pins.

(47) Attach the cylinder to the hub with washers and bolts, evenly spaced. Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification.

(48) Tighten the bolts until snug.

(49) Remove the threaded, headless alignment pins TE159.

(50) Install the remaining washers and bolts, except two.

(51) Torque the cylinder mounting bolts in accordance with Table 3-3, Torque Values.

(52) Check the blade travel

(a) Using a digital protractor TE97, zero it out on the cylinder mounting flange.

(b) Line up the protractor with the reference tape on the blade.

(c) Check the total blade travel from full forward to full reverse.

1 Acceptable blade tolerance at full forward pitch is 35 degrees +/- 5 degrees.

2 Acceptable blade tolerance at full reverse pitch is -35 degrees +/- 5 degrees.

(53) Sealing the parting lines between the hub, cover plate, and cylinder - 6 Blade Only

(a) Using masking material, mask the area outside of the seams between the cover plate, the cylinder mounting flange, and the hub.

(b) Apply sealant CM8 or CM9, to the edges of the cover plate and the cylinder mounting flange.

(c) Remove the masking material.

(54) Oil fill the hub - 6 Blade Only

(a) Using masking material, mask the edges of the cylinder mounting flange to prevent red-dyed oil from leaking onto the hub surfaces.

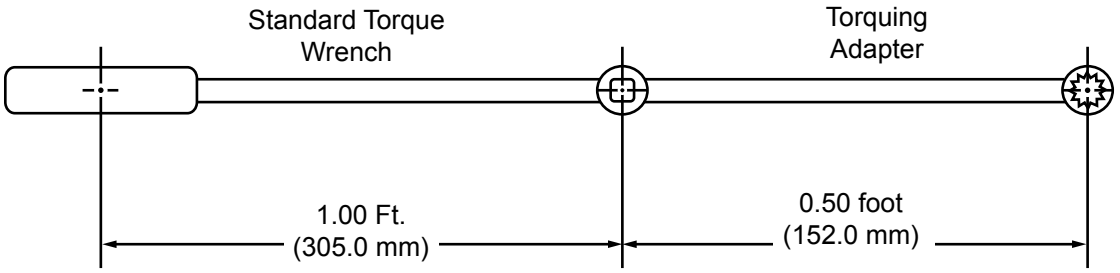
(b) Mix 3.75 quarts of oil CM302 and red dye CM210 to a ratio of 256 to 1.

(c) Using one of the cylinder attaching bolt holes without a bolt and washer installed, insert the red-dyed oil into the hub cavity.

(d) Remove the masking material.

(e) Using solvent, remove any excess red-dyed oil from the threads of the bolt hole.

APS0212A



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

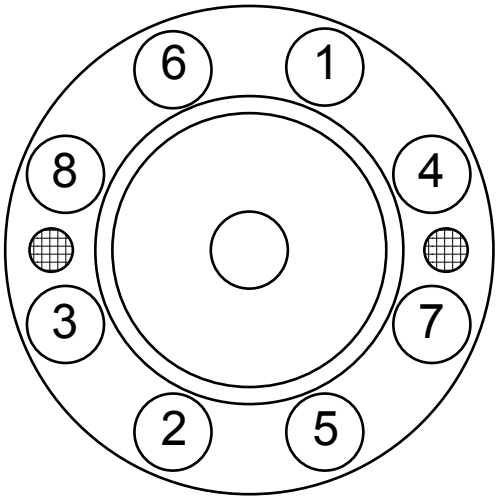
EXAMPLE:

$$\frac{\text{100 ft-lb (136 N•m) x 1 ft. (305 mm)}}{\text{1.00 ft. (305.0 mm) + 0.50 ft. (152.0 mm)}} = \text{66.7 ft-lb (90 N•m)} < \text{reading on torque wrench with 6-inch (152.0 mm) adapter for actual torque of 100 ft-lb (136 N•m)}$$

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.

Determining Torque Value When Using Torquing Adapter
Figure 3-11

TI-300-016



SEQUENCE A

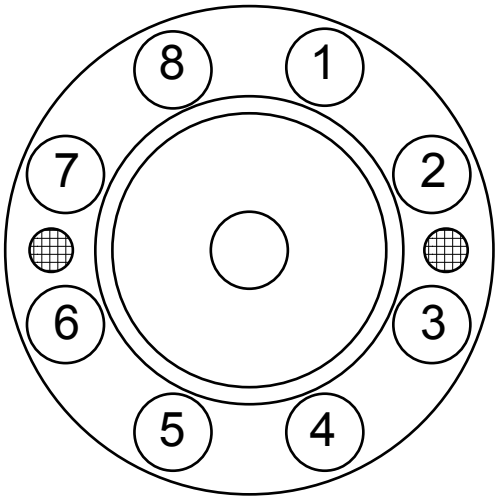
SEQUENCE A

Use Sequence A for steps one and two.
Step 1 - Torque all bolts to 40 ft-lbs (54 N•m).
Step 2 - Torque all bolts to 80 ft-lbs (108 N•m).

SEQUENCE B

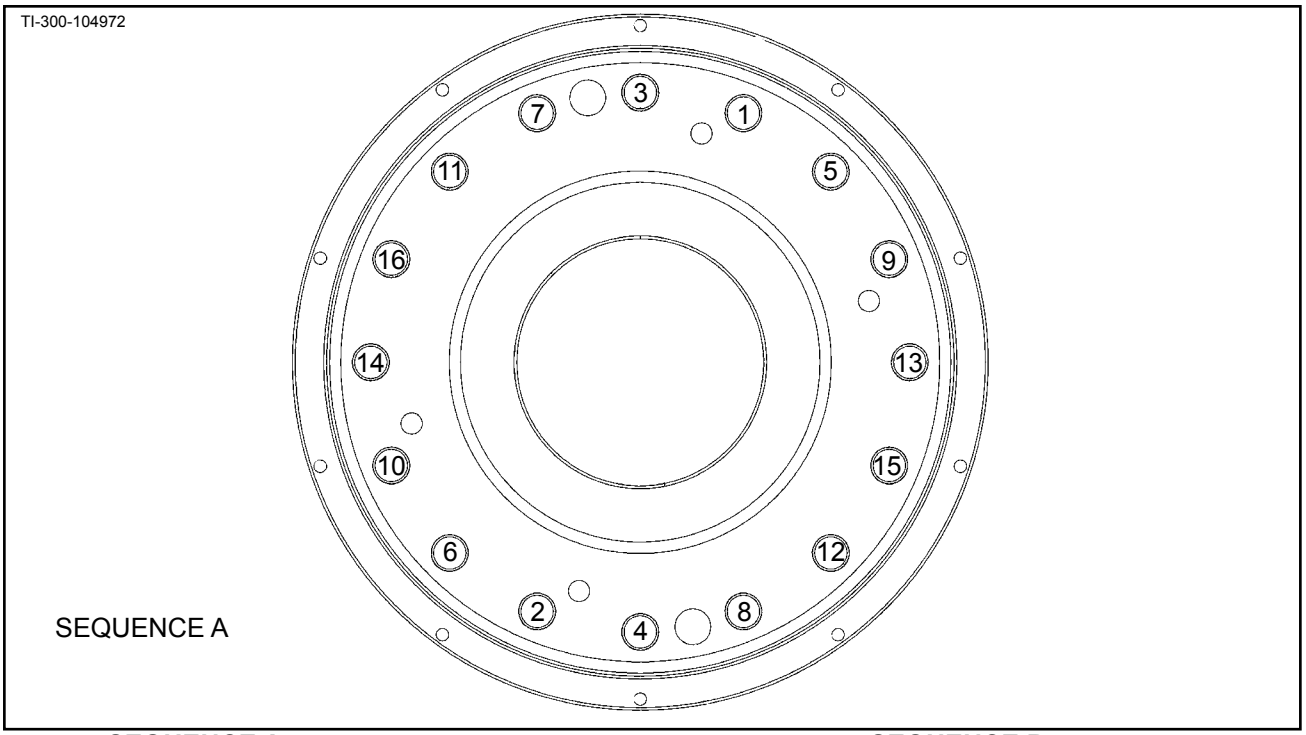
Use Sequence B for step three.
Step 3 -Torque all bolts in accordance with Table 3-1.

TI-300-016



SEQUENCE B

Diagram of Torquing Sequence for Propeller Mounting Bolts
5 Blade - Cylinder and Engine Flanges
6 Blade - Cylinder Flange Only
Figure 3-12 (1 of 2)



SEQUENCE A

Use Sequence A for steps one and two.
Step 1 - Torque all bolts to 40 ft-lbs (54 N•m).
Step 2 - Torque all bolts to 80 ft-lbs (108 N•m).

SEQUENCE B

Use Sequence B for step three.
Step 3 -Torque all bolts in accordance with Table 3-1.

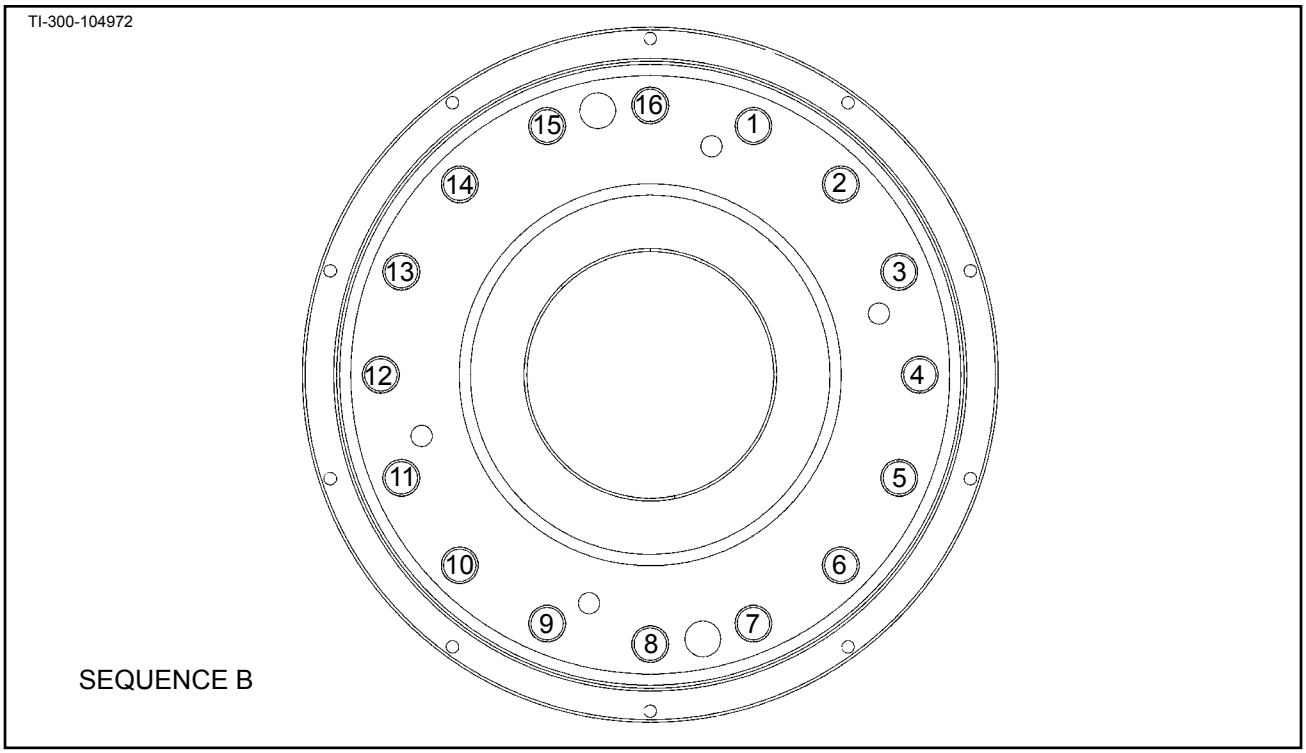


Diagram of Torquing Sequence for Propeller Mounting Bolts
6 Blade - Engine Flange
Figure 3-12 (Page 2 of 2)

(f) Install the two bolts and washers in the remaining cylinder attaching holes.

(g) Torque the bolts in accordance with Table 3-3, Torque Values.

(h) Safety the cylinder/cover plate bolts with 0.020 inch (0.50 mm) or 0.032 inch (0.82 mm) stainless steel safety wire.

3. Propeller Assembly Installation

A. Propeller Installation

CAUTION 1: DO NOT USE METHYL-ETHYL-KETONE (MEK) TO CLEAN PROPELLER SURFACES OR BLADE PARTS. MEK CAN WEAKEN PAINT AND SEALANTS USED ON THE PROPELLER.

CAUTION 2: SURFACES MUST BE COMPLETELY CLEANED TO AVOID FOREIGN OBJECT DAMAGE TO THE HUB AND FLANGE MATING SURFACES.

(1) Using solvent CM23, clean the propeller flanges, stub shaft flange, and drive shaft flange of oil and dirt.

(2) Permit solvent CM23 to dry.

(3) Lubricate and install one each of the manufacturer's supplied O-rings on the drive shaft flange and on the stub shaft flange.

(4) Install the previously removed Hovercraft stub shaft onto the cylinder mounting flange in accordance with the Hovercraft manufacturer's instructions.

(5) Install the washers and the bolts on the stub shaft flange and tighten in a cross-wise pattern. Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification for mounting hardware.

(6) Use a torque wrench and a torque wrench adaptor TE5, TE155, or equivalent to torque all bolts in sequences and steps shown in Figure 3-12. Refer to Table 3-3, Torque Values and Figure 3-11 to determine the proper torque value.

(7) Safety wire the bolts with 0.020 inch (0.50 mm) or 0.032 inch (0.82 mm) stainless steel safety wire.

(8) Install the drive shaft onto the propeller assembly in accordance with the Hovercraft manufacturer's instructions.

(9) Install the washers and the lock nuts on the drive shaft and tighten in a cross-wise pattern. Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification for mounting hardware.

(10) Torque the lock nuts in sequences and steps shown in Figure 3-12, in accordance with Table 3-3, Torque Values.

WARNING: MAKE SURE THAT ANY SLING USED RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

CAUTION: EXTREME CARE MUST BE TAKEN WHEN INSTALLING THE PROPELLER ON THE HOVERCRAFT TO PREVENT DAMAGE TO THE SHAFT AND/OR MOUNTING STUDS AND BLADES.

(11) Install the drive shaft, propeller, and stub shaft assembly onto the Hovercraft in accordance with the Hovercraft manufacturer's instructions.

B. Beta Manifold Assembly Installation

(1) If not already installed, apply a thin coating of oil to the beta manifold assembly O-rings, refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification, and install them in the grooves of the beta manifold support assembly.

(2) Carefully clean the inner side of the stub shaft with solvent.

(3) Permit the solvent to dry.

(4) Apply a thin coat of aviation grade engine oil to the beta manifold assembly.

(5) With the housing seal and spiral ring removed, slide the beta manifold assembly onto the propeller stub shaft.

(6) Align the attachment holes in the stub shaft with the holes in the beta manifold assembly.

(7) Apply sealant CM46 to the washer and screw and attach the beta manifold assembly. Refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification.

(8) Torque the bolts in accordance with Table 3-3, Torque Values.

(9) Safety the bolts with 0.020 inch (0.50 mm) safety wire.

CAUTION: MAKE SURE THE SEAL HOUSING IS INSTALLED CHAMFER SIDE UP.

(10) Apply a thin coat of aviation grade engine oil to the seal housing (not a Hartzell Propeller Inc. part) and carefully slide it into position, chamfer side up.

(11) Secure the sleeve with the spiral retainer ring, refer to Table 3-4, O-ring and Propeller Mounting Hardware Identification.

(12) Attach the drain hose to the manifold in accordance with the Hovercraft manufacturer's instructions.

C. Beta Tube Installation

(1) Prepare the beta tube for installation.

CAUTION: USE CARE TO AVOID SCRATCHING OR DAMAGING THE BETA TUBE WHILE INSTALLING IT.

(a) Remove the cover from the beta tube.

(b) Using solvent CM23, clean the beta tube.

(c) Permit the solvent CM23 to dry.

(d) Apply a thin coating of aviation grade engine oil over the entire length of the beta tube.

CAUTION: THE PROPELLER MUST NOT REACH THE INTERNAL HARD STOPS DURING NORMAL OPERATION OF THE PROPELLER. THE MAXIMUM PITCH MUST BE LIMITED BY THE TRAVEL OF THE BETA TUBE.

(2) Before operating the propeller, turn the blades several times by hand from reverse pitch to forward pitch position to make sure the blades will turn freely.

(3) Move the blades to flat pitch.

(4) Install the beta tube into the beta manifold assembly and move it in and out, rotate it to make sure it moves with no binding.

(5) Connect the beta tube to the linkage in accordance with the Hovercraft manufacturer's instructions.

CAUTION: USE CARE NOT TO BEND OR DAMAGE THE BETA TUBE WHILE PERFORMING HYDRAULIC CONNECTIONS.

(6) Complete all necessary hydraulic connections in accordance with the Hovercraft manufacturer's instructions.

D. Propeller Operation

WARNING 1: BEFORE OPERATING THE PROPELLER, CHECK ALL BOLTS, SCREWS, AND NUTS FOR PROPER TORQUE AND SECURE THE HOVERCRAFT IN ACCORDANCE WITH THE HOVERCRAFT MANUFACTURER'S INSTRUCTIONS.

WARNING 2: MAKE SURE OF THE SAFETY OF PERSONNEL AND CLEAR THE DECK IN FRONT OF THE PROPELLER BEFORE OPERATING THE HOVERCRAFT.

CAUTION: MAKE SURE THE PRESET HYDRAULIC PRESSURE IS AT THE CORRECT LEVEL BEFORE OPERATING THE HOVERCRAFT ENGINE.

4. Propeller Assembly Removal

A. Beta Tube Removal

CAUTION: USE CARE NOT TO BEND OR DAMAGE THE BETA TUBE WHILE DISCONNECTING HYDRAULIC CONNECTIONS.

(1) Disconnect all necessary hydraulic connections in accordance with the Hovercraft manufacturer's instructions.

(2) Disconnect the beta tube from the linkage in accordance with the Hovercraft manufacturer's instructions.

(3) Remove the beta tube.

B. Beta Manifold Removal

(1) Remove and discard the spiral retainer ring that secures the seal housing.

(2) Remove the seal housing.

(3) Remove and discard the screws and washers attaching the beta manifold assembly.

(4) Remove the beta manifold assembly.

C. Propeller Removal

WARNING: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

CAUTION: EXTREME CARE MUST BE TAKEN WHEN REMOVING THE PROPELLER ON THE HOVERCRAFT TO PREVENT DAMAGE TO THE SHAFT AND/OR MOUNTING STUDS AND BLADES.

(1) With the drive shaft and stub shaft attached, remove the propeller assembly from the Hovercraft.

(2) Remove the safety wire from the bolts on the stub shaft.

(3) Remove and discard the bolts and washers from the stub shaft.

(4) Remove and discard the lock nuts and washers from the drive shaft.

(5) Remove the drive shaft in accordance with the Hovercraft manufacturer's instructions.

(6) With a propeller sling and mobile hoist, carefully remove the propeller assembly from the stub shaft.

(7) Place the propeller on a suitable cart for transportation.

5. Disassembly of a Propeller for Shipment

A. Place the propeller on the build bench or stand.

B. Remove and discard the safety wire from the cylinder mounting bolts.

C. Remove the cylinder mounting bolts from the hub.

CAUTION: USE CAUTION WHEN REMOVING THE CYLINDER FROM THE COVER PLATE. EXCESS OIL MAY SPILL OUT.

D. Remove the cylinder from the cover plate.

E. Install four (4) headless pins in the cover plate, evenly spaced.

F. Rotate the blades to reverse pitch to expose the piston.

G. Break the torque on the piston.

H. Remove the piston.

I. Remove the propeller from the build stand and place the propeller assembly over a large bucket or container.

J. Break the torque on the pitch change rod.

K. Remove the pitch change rod and permit the oil to drain into the large bucket or container.

L. Place the propeller on the build bench stand.

M. Remove the headless pins.

N. Using a rubber hammer, put a delrin wedge between the cover plate and hub and gently tap the wedge to remove the cover plate.

O. Remove the anti-rotation rods.

P. Move the blades to the full forward position.

Q. Loosen the jam juts and set screws on the preload plate.

R. Move the blades to flat pitch.

S. Put the blade stands TE126, or equivalent, in place to support the blades.

T. Remove the inner hub clamping bolts.

U. Remove the hub clamping bolts and pitch lock brackets.

V. Remove the cylinder side hub half.

W. Remove two blades.

(1) Carefully wrap or tape the blade shank of each blade to keep the bearings and races together.

X. Remove the fork.

Y. Remove the remaining blades.

(1) Carefully wrap or tape the blade shank of each blade to keep the bearings and races together.

Z. Put a round cardboard template piece in each blade socket of the hub.

AA. Install the fork inside the hub.

AB. Put the anti-rotation rods in the fork to hold it in place.

AC. Attach the cylinder side hub half.

AD. Install the inner hub bolts in the hub and tighten until just snug.

AE. Install the cover plate on the hub, flush with the hub.

AF. Install the pitch change rod.

AG. Install the piston (left-hand threads).

AH. Turn the pitch change rod (left-hand threads) until the rod bottoms out on the fork.

AI. Install the cylinder.

AJ. Install the cylinder mounting bolts and tighten until snug.

AK. Install all remaining hub bolts and tighten until snug.

AL. Put the remaining components in a bag and tag accordingly.

AM. Carefully package all components for shipment.

TESTING AND TROUBLESHOOTING - CONTENTS

LIST OF FIGURES

(This page is intentionally blank.)

1. Operational Tests

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

A. Initial Run-Up

(1) Following propeller installation, and before use, the propeller hydraulic system must be purged of air and proper operation verified.

(2) Perform engine start and warm-up in accordance with the Hovercraft manufacturer's operating instructions.

NOTE: Air trapped in the propeller hydraulic cylinder will cause pitch control to be imprecise and may result in propeller surging.

(3) Cycle the propeller control throughout its operating blade angle range from reverse or low, to high (Hovercraft manufacturer's operating instructions).

(4) Repeat this procedure at least three times to purge air from the propeller hydraulic system and to introduce warmed oil to the cylinder.

(5) Verify proper operation from reverse pitch to forward pitch and throughout the operating range.

(6) Shut down the engine in accordance with the Hovercraft manufacturer's operating instructions.

B. Post-Run Check

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

2. Troubleshooting

A. Surging

(1) Surging is characterized by a large increase/decrease in engine speed, followed by a return to set speed after one or two occurrences.

(a) Check for trapped air in the propeller

1 Complete steps 1.A.(1) through 1.A.(6) under the Operational Tests section in this chapter to release trapped air from the propeller.

(b) Check the blades for excessive friction. If present:

1 Inspect the blade retention system.

(c) Check tachometer for oscillation. If present:

1 Inspect the tachometer and drive.

(d) Check for sludge and dirt deposits.

1 Inspect and clean the propeller, beta valve, cylinder, and oil tubes.

(e) Check the connection from the beta valve to the actuator.

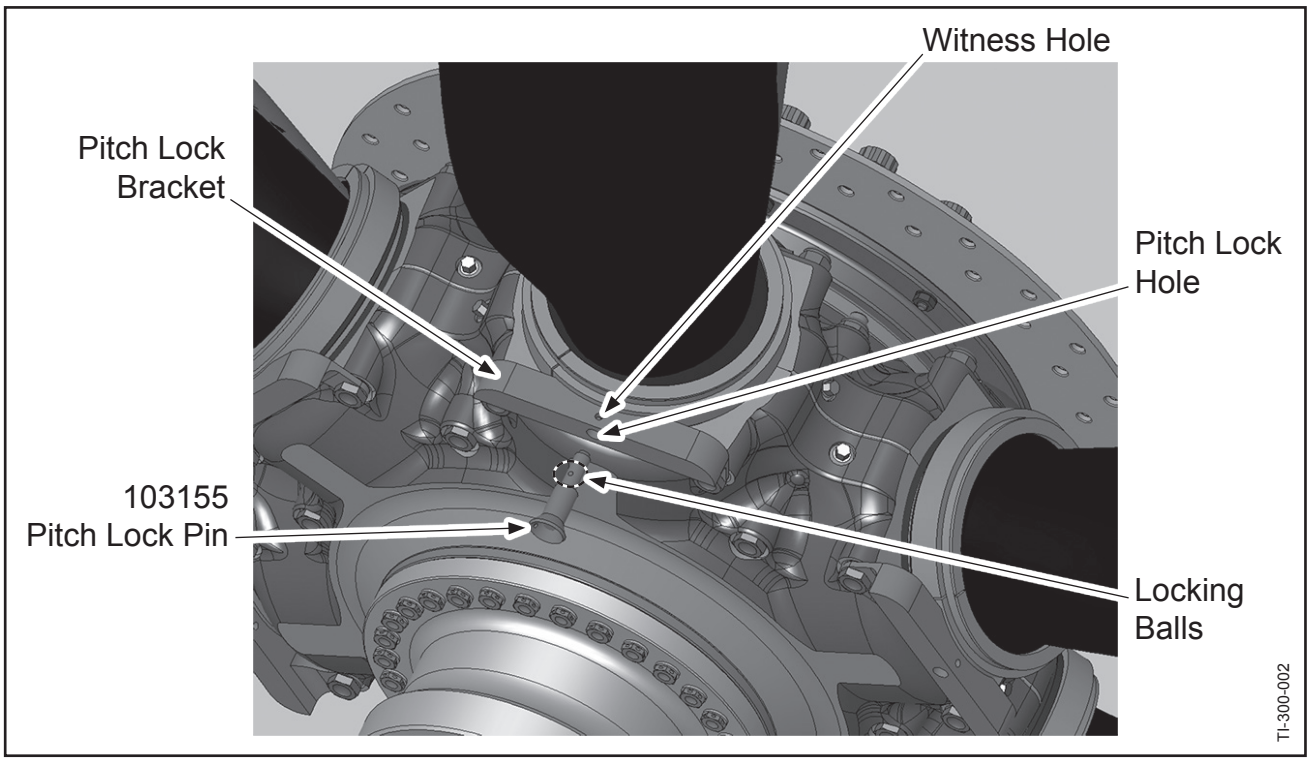
B. Pitch Change Sluggish

(1) Inspect the blade retention system for excessive friction.

(2) Check the oil pressure and flow (for low pressure).

(a) Inspect the oil supply and oil transfer openings.

(3) Inspect the beta tube passages for dirt deposits.



Pitch Lock Pin Installation
Figure 4-1

C. Loss of Thrust

(1) Inspect the hydraulic system for proper function.

WARNING: HOVERCRAFT OPERATION WITH THE 103155 PITCH LOCK PINS INSTALLED WILL NOT PERMIT THRUST REVERSING FUNCTION TO SLOW THE VEHICLE.

(a) If the hydraulic propeller pitch control system has failed, install the 103155 pitch lock pins to lock the propeller into a single pitch, permitting a restricted mode of operation. Refer to Figure 4-1.

1 Shut down propeller thrust engines.

2 Remove any ice (or debris) in/over pitch lock holes.

CAUTION: DO NOT DAMAGE THE LEADING OR TRAILING EDGES OF THE BLADE WHEN DOING THE FOLLOWING STEP.

3 Manually force the pitch of the propeller blades to a position where the pitch lock bracket hole lines up with the hole in the blade ring.

a This could require two crewmen to apply force to two separate blades at the same time.

4 Push and hold the button on the 103155 pitch lock pin while putting the pin into the pitch lock hole on the pitch lock bracket.

a Push the 103155 pitch lock pin into the pitch lock hole until the locking balls are lined up with the witness hole in the bracket, then release the button on the pin.

(1) After releasing the button on the 103155 pitch lock pin, move the pin until the locking balls "click" into the holes in the pitch lock bracket.

CAUTION: DO NOT PUSH THE BUTTON ON THE 103155 PITCH LOCK PIN WHEN CHECKING THE PIN INSTALLATION.

b Pull the 103155 pitch lock pin to make sure it is locked into the pitch lock bracket.

(1) If the 103155 pitch lock pin pulls out of the pitch lock bracket, repeat 2.C.(1)(a)4 through 2.C.(1)(a)4 b.

c Repeat steps 2.C.(1)(a)4 through 2.C.(1)(a)4 a(1) for each blade.

5 Re-start the propeller thrust engines.

6 Operate the Hovercraft propeller thrust engines within their limits of RPM range.

a Allow sufficient distance to slow and maneuver the Hovercraft.

D. Vibration

WARNING: ABNORMAL VIBRATION CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. BLADE SEPARATION CAN RESULT IN A CATASTROPHIC ACCIDENT.

CAUTION: ANY VIBRATION THAT CAN BE DESCRIBED AS APPEARING SUDDENLY, OR IS ACCOMPANIED BY UNEXPLAINED GREASE LEAKAGE, SHOULD BE INVESTIGATED IMMEDIATELY BEFORE FURTHER HOVERCRAFT OPERATION.

(1) Vibration problems due to propeller system imbalance are normally felt throughout the RPM range, with the intensity of vibration increasing with RPM.

(2) Check:

(a) Control surfaces and exhaust system, etc. for excessive play, which may be causing vibration unrelated to the propeller

(b) Uneven lubrication of the propeller

(c) Proper engine/propeller flange mating

(d) Blade track (Refer to the Inspection and Check chapter of this manual for procedure.)

(e) Static balance

(f) Airfoil profile identical between blades

1 Contact the Hartzell Propeller Inc. Product Support department for additional inspection criteria.

(g) Hub and blades for damage or cracking

(h) Grease or oil leakage from a seemingly solid surface of the hub or blade

(i) Blade delamination

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

E. Oil or Grease Leakage

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

CAUTION: GREASE LEAKAGE THAT CAN BE DESCRIBED AS EXCESSIVE AND APPEARING SUDDENLY, ESPECIALLY WHEN ACCOMPANIED BY VIBRATION, SHOULD BE INVESTIGATED IMMEDIATELY BEFORE FURTHER OPERATION OF THE HOVERCRAFT.

(2) Grease Leakage - 5 Blade Only - Probable Cause:

(a) Improperly torqued or loose lubrication fitting

(b) Defective lubrication fitting

(c) Faulty seal at the blade socket between the blade and hub - Contact the Hartzell Propeller Inc. Product Support department for replacement of the seal.

(d) Cracked hub - A cracked hub is often indicated by grease emerging from a seemingly solid surface, especially in the blade arm. Contact the Hartzell Propeller Inc. Product Support department.

(3) Oil Leakage - Probable Cause

(a) Leaks between the hub halves - Faulty seal(s) - Contact the Hartzell Propeller Inc. Product Support department for replacement of the seal.

(b) Leaks between the hub and engine - Faulty or missing seal between the propeller hub and the engine flange.

(This page is intentionally blank.)

INSPECTION AND CHECK - CONTENTS

LIST OF FIGURES

1. Pre-Operation Inspection

   A. The following inspections should be performed on a daily basis before attempting to operate the propeller.

      WARNING: ABNORMAL VIBRATION CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. A BLADE SEPARATION DURING PROPELLER OPERATION CAN RESULT IN A CATASTROPHIC HOVERCRAFT ACCIDENT.

      (1) Blades

         (a) Visually inspect the entire blade and the erosion strip for nicks, gouges, looseness of material, erosion, cracks, and debonds. Refer to the Maintenance Practices chapter of this manual for composite blade operable damage limits.

            1 Defects or damage discovered during daily inspection must be evaluated in accordance with allowables outlined in the Maintenance Practices chapter of this manual to determine if repairs are required before further operation.

         (b) Blades should turn smoothly and freely, but should not have excessive movement. If the blades do not turn freely, refer to the Testing and Troubleshooting chapter of this manual for information.

         (c) Check the blades for looseness or excessive movement. For acceptable limits, refer to the Loose Blades section of the Inspection Procedures section of this chapter.

      (2) Check for loose/missing hardware. Tighten or reinstall as necessary.

      (3) Inspect for grease and oil leakage and determine the source.

2. Required Periodic Inspections and Maintenance

A. Periodic Inspections

(1) Except for the blade and erosion shield coin-tap inspection in this section, perform a detailed inspection at 100 hour intervals not be greater than twelve (12) calendar months. Procedures involved in these inspections are detailed below.

NOTE: Inspection and maintenance specified by a Hovercraft manufacturer's maintenance program may not coincide with the inspection time intervals specified. In this situation, the Hovercraft manufacturer's schedule may be applied with the exception that the calendar limit for the inspection interval may be greater than twelve (12) months.

(a) Visually examine the blade and the erosion shield for nicks, gouges, looseness of material, erosion, cracks, and debonds or bubbles in the paint. Refer to the Composite Blade Repairs section in the Maintenance Practices chapter of this manual for additional information.

1 A cracked blade must be referred to Hartzell Propeller Inc. Product Support department. Do not attempt repair on a cracked blade.

(b) Visually examine the hub parts for cracks or wear. Refer to Grease and Oil Leaks in the Inspection Procedures section of this chapter for the procedure.

1 Contact the Hartzell Propeller Inc. Product Support department if a cracked hub is found. Do not attempt repair on a cracked hub.

(c) Check for grease or oil leaks. Refer to Grease and Oil Leakage in the Inspection Procedures section of this chapter.

B. Overhaul Periods

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

CAUTION 2: REFER TO THE LATEST REVISION OF HARTZELL PROPELLER INC. SERVICE LETTER HM-SL-001 FOR THE MOST CURRENT INFORMATION.

(1) HM-5V1-B1000-A propellers must be overhauled at 2000 flight hours or 36 months, whichever occurs first.

(2) HM-6V1-A1000-A propellers must be overhauled at 1000 flight hours or 36 months whichever occurs first.

(3) Overhaul the propeller in accordance with Hartzell Propeller Inc. Hovercraft Propeller Maintenance and Overhaul Manual 301.

(a) Contact the Hartzell Propeller Inc. Product Support Department for recommended propeller repair stations.

3. Inspection Procedures

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

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

A. Blade Damage

(1) Refer to the Blade Maintenance section in the Maintenance Practices chapter of this manual for information regarding blade damage.

B. Grease or Oil Leakage

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

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

1 A determination should be made as to the source of the leak.

2 The only leakage that is field repairable is the removal and replacement of the O-ring seal between the engine and propeller flange.

3 Contact the Hartzell Propeller Inc. Product Support Department for all other leakage repairs.

(2) An instance of abnormal grease or oil leakage should be inspected using the procedure below:

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

(a) Visually examine the hub for cracks.

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

2 A crack may be indicated by red stain from the red-dyed oil on the hub surface.

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

(b) Visually examine the hub, blades, and blade retention areas to locate the origin of leak.

(c) If the origin of the grease or oil leakage is determined to be a noncritical part, such as an O-ring, gasket, or sealant, repairs can be accomplished during scheduled maintenance, as long as operational safety is not compromised.

(d) If a crack is suspected, additional inspections must be performed before further operation. Contact the Hartzell Propeller Inc. Product Support department if a crack is suspected.

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

C. Vibration

WARNING: ABNORMAL VIBRATION CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. A BLADE SEPARATION DURING PROPELLER OPERATION CAN RESULT IN A CATASTROPHIC HOVERCRAFT ACCIDENT.

(1) Instances of abnormal vibration should be investigated immediately.

(2) If the cause of the vibration is not readily apparent, the propeller may be inspected following the procedure below:

NOTE: It may sometimes be difficult to readily identify the cause of abnormal vibration. Vibrations may originate in the engine, propeller, or Hovercraft. Troubleshooting procedures typically begin with an investigation of the engine. Components, such as engine mounts, can also be the source of vibration. When investigating an abnormal vibration, the possibility of a failing blade or blade retention component should be considered as a potential source of the problem.

(a) Troubleshoot and evaluate possible sources of vibration in accordance with engine or Hovercraft manufacturer's instructions.

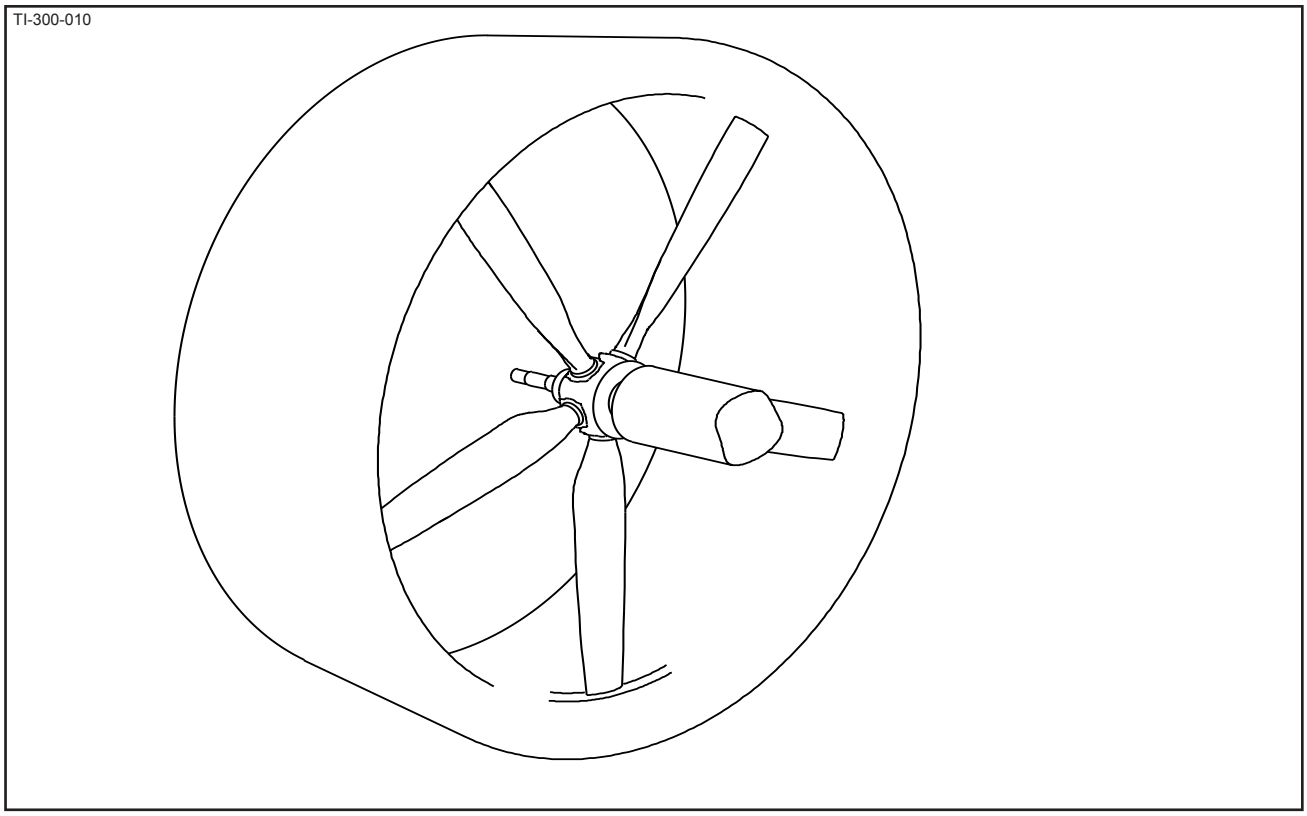
(b) Check the blade play in accordance with section 3.D. of this chapter.

(c) Check to determine the possible cause of the vibration. If no cause is found, then consider that the origin of the problem could be the propeller and proceed with the remaining steps in this section.

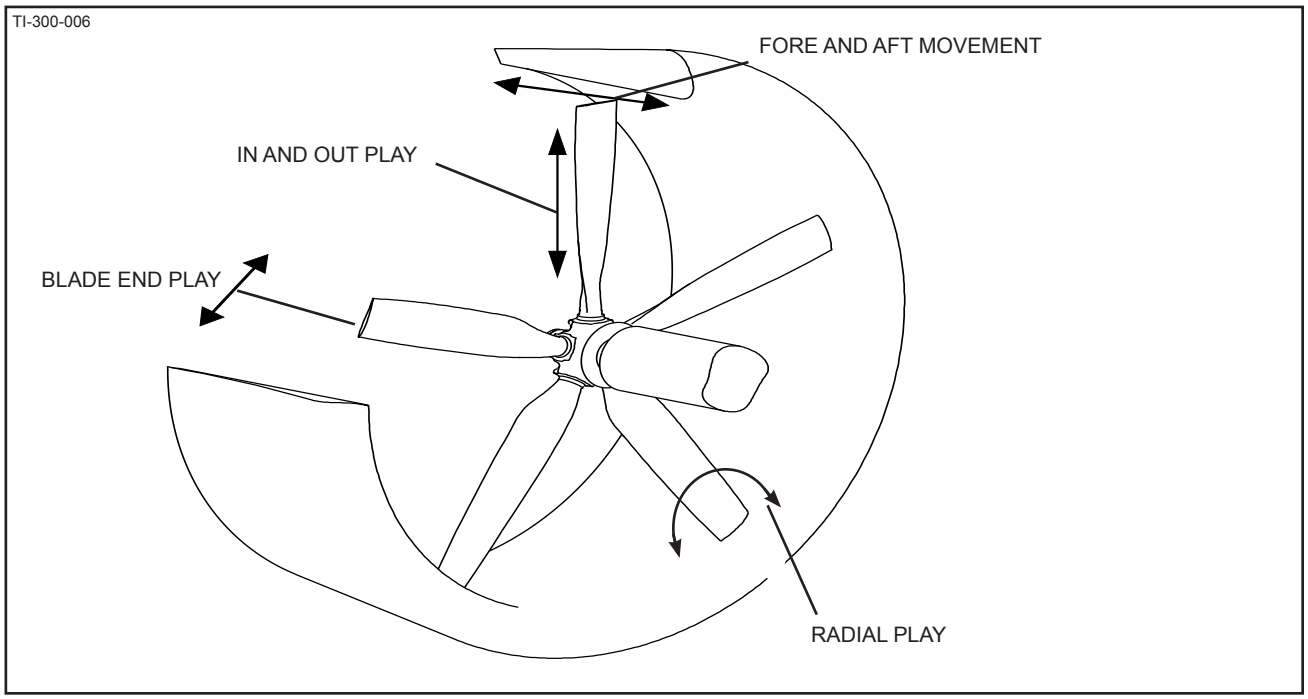
(3) Visually examine the hub and blades for cracks. Pay particular attention to the blade retention areas of the hub.

NOTE: A crack may be readily visible or may be indicated by grease leaking from a seemingly solid surface or red stain from the red-dyed oil on the hub surface.

(4) If a crack is suspected, additional inspections must be performed before further operation. Contact the Hartzell Propeller Inc. Product Support department for additional inspection criteria. Such inspections typically include disassembly of the propeller, followed by inspection of parts, using nondestructive methods in accordance with published procedures.



Checking Blade Track
Figure 5-1



Blade Play
Figure 5-2

(5) Check the blades and compare blade-to-blade differences.

(a) Inspect the propeller blades for unusual looseness or movement. Refer to Loose Blades in this chapter.

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

(b) Manually (by hand) attempt to turn the blades. Do not use blade paddles.

(c) Visually check for damaged blades.

(6) If abnormal blade conditions or damage are found, contact the Hartzell Propeller Inc. Product Support department for additional inspection criteria.

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

D. Blade Track

(1) If a blade track problem is suspected, examine the blade track as follows.

(a) Refer to Figure 5-1. Place a fixed reference point beneath the propeller, within 0.25 inch (6.4 mm) of the lowest point of the propeller arc.

NOTE: This reference point may be a flat board with a sheet of paper attached to it.

(b) Rotate the propeller by hand in the direction of normal rotation until a blade points directly at the paper.

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

(d) Repeat this procedure with the remaining blades.

(e) Tracking tolerance is ± 0.125 inch (3.18 mm) or 0.25 inch (6.4 mm) total.

(2) Possible Correction

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

1 Examine the engine and propeller flanges for damage.

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

(b) If no foreign matter is present, contact the Hartzell Propeller Inc. Product Support department for additional inspection criteria.

E. Loose Blades

(1) Refer to Figure 5-2. Limits for blade looseness are as follows.

End Play	See Note Below
Fore & Aft Movement	See Note Below
In & Out Play	None
Radial Play (pitch change)	± 0.5 degree (1 degree total) measured at reference station

NOTE: Blades are intended to be tight in the propeller, however slight movement is acceptable if the blade returns to its original position when released. Blades with excessive movement, or that do not return to their original position when released may indicate internal wear or damage which should be referred to an appropriately certified propeller repair station with the appropriate rating.

F. Preload Plate Set Screw

(1) Manually rotate the propeller and listen for possible noise caused by a broken set screw that may be in the propeller hub.

(2) If there is noise indicating a loose part, remove the propeller and contact the Hartzell Propeller Inc. Product Support department for additional inspection criteria.

(3) If a broken set screw is found, the propeller must be inspected for damage that may have been caused by the broken set screw.

(4) Report any such incidents to the Hartzell Propeller Inc. Product Support department.

G. Corrosion

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

(1) If heavy corrosion that results in severe pitting is found, contact the Hartzell Propeller Inc. Product Support department.

4. Special Inspections

A. Foreign Object Strike

(1) General

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

(b) A foreign object strike is defined as:

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

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

3 A sudden RPM drop while impacting a yielding medium where propeller blade damage is not normally incurred

(2) Procedure

(a) In the event of a foreign object strike, an inspection is required before further operation. If the inspection reveals one or more of the following indications, the propeller must be removed from the Hovercraft. Contact the Hartzell Propeller Inc. Product Support Department for additional inspection criteria:

1 A loose blade in the hub

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

3 Any blade diameter reduction

4 A bent, cracked, or failed engine shaft

5 Vibration during operation that was not present before the event

(b) Perform a thorough visual and coin tap inspection of the exposed portion of each blade, including the erosion strip (leading edge). Refer to the Blade Maintenance section in the Maintenance Practices chapter of this manual.

(c) If the blade damage is beyond limits, the blade must be repaired before further operation. If the blade damage is beyond major repair limits, the blade must either be returned to the Hartzell Propeller Inc. factory for evaluation or removed from service.

B. Overspeed

(1) An overspeed has occurred when the propeller RPM has exceeded the maximum RPM.

(2) The duration of time at overspeed for a single event determines the corrective action that must be taken to make sure no damage to the propeller has occurred.

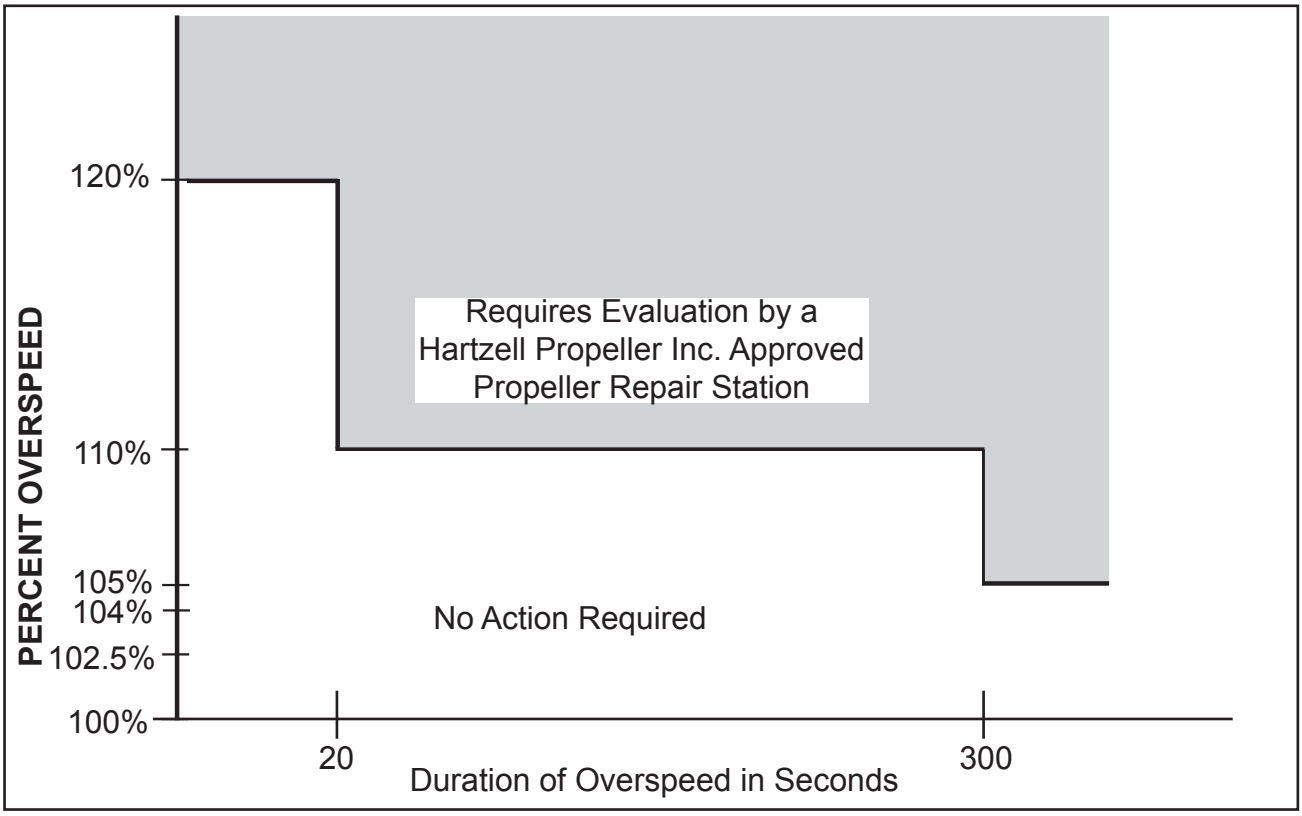
(3) The criteria for determining the required action after an overspeed are based on many factors.

(a) The additional centrifugal forces that occur during overspeed are not the only concern.

(b) Stresses at RPMs above the maximum rated for the frame/engine/ propeller combination.

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

2 Make an entry in the propeller logbook to document the overspeed event.



Engine Overspeed Limits
Figure 5-3

C. Fire Damage or Heat Damage

WARNING 1: EXPOSING COMPOSITE BLADES TO HIGH TEMPERATURES MAY LEAD TO FAILURE THAT MAY CAUSE PERSONAL INJURY AND DEATH. COMPOSITE BLADES ARE SUBJECT TO DELAMINATIONS DUE TO HIGH TEMPERATURES.

WARNING 2: HUBS ARE MANUFACTURED FROM HEAT TREATED FORGINGS AND ARE SHOT PEENED. EXPOSURE TO HIGH TEMPERATURES CAN DESTROY THE FATIGUE RESISTANCE BENEFITS OBTAINED FROM THESE PROCESSES.

(1) On rare occasions a propeller may be exposed to fire or heat damage, such as an engine or hangar fire. In the event of such an incident, contact the Hartzell Propeller Inc. Product Support Department before further Hovercraft operation.

5. Packaging and Storage

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

A. Overview

(1) When parts are shipped from the Hartzell Propeller Inc. factory, the "standard" packaging or shipping container is not designed for use as a container for long term storage.

(2) Hartzell Propeller Inc. can, at the customer’s request (and at an additional cost), provide parts in "special" packaging.

(a) Such special packaging is suitable for a storage period of up to six months assuming the following:

1 Use of the part at the first or second destination

2 Environmental exposure during shipping and transfers is minimal

3 Container is stored in warehouse conditions where environmental elements are at a minimum, i.e., dry

(b) Hartzell Propeller Inc. will guarantee a part stored in original special packaging for up to six months from the factory shipping date. Hartzell Propeller Inc. is not responsible for a part stored using standard packaging or for an item repackaged and stored.

(c) Propellers leaving Hartzell Propeller Inc. that have special packaging for long term storage have undergone the following:

1 The propeller is wrapped in poly material that is impregnated with a corrosion inhibitor.

2 A desiccant bag is enclosed inside the poly material with the propeller.

3 The poly material is then heat shrink sealed.

4 The propeller is then protected by foam and put in a plywood box.

(d) If the container is opened and the sealed poly material is opened, the poly material and desiccant must be removed.

1 To put the propeller back into long term storage, refer to the guidelines in section 5.B. of this chapter.

(e) If storage is expected to be longer than six months, visually inspect each part for corrosion or other damage at six month intervals. Repackaging may be required using the guidelines in section 5.B. of this chapter.

B. Guidelines

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.

(1) Refer to Table 3-2, Consumable Materials List.

(a) Solvent CM23

(b) Solvent CM109

(c) Corrosion preventative CM108, or equivalent

(2) Packaging of Assembled Propellers

(a) Using solvent CM23, clean all surfaces.

(b) Permit the solvent CM23 to dry.

(c) Protect parts that are not plated, anodized, or painted using corrosion preventative CM108, or equivalent in conjunction with grease-proof paper, MIL-B-121, Grade A, Type II.

(d) Wrap the entire propeller assembly in metal foil-backed paper, MIL-B-131, Grade B.

(e) Put the propeller assembly, accompanied by a moisture retardant, in a suitable storage container.

(3) Packaging of Disassembled or Partially Disassembled Propellers

(a) Using solvent CM23, thoroughly clean all surfaces.

(b) Permit CM23 to dry.

(c) Dip the blade butt in corrosion preventative CM108 or equivalent, and then wrap in grease-proof paper, MIL-B-121, Grade A, Type II.

1 Put the grease-proof paper over the butt of the blade and up the blade shank for approximately 6 inches (152 mm).

(d) Parts that are not plated, anodized, or painted must be protected using corrosion preventative CM108 or equivalent, in conjunction with grease-proof paper, MIL-B-121, Grade A, Type II.

(e) Wrap all the parts in metal foil backed paper, MIL-B-131, Grade B.

(f) Put all the parts accompanied by a moisture retardant in a suitable storage container.

(4) Containers

(a) Make sure that the blades are held securely in their containers.

(5) Inspection

(a) Hartzell Propeller Inc. requires the stored parts to be inspected every six months to make sure that corrosion is not developing.

(b) The moisture retardant must be replaced at the time of the inspection.

6. Activating a Propeller Assembly After Long Term Storage

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

A. General

(1) An operating hour/calendar limit between overhaul or MPI is 36 calendar months. Contact the Hartzell Propeller Inc. Product Support Department concerning propeller overhaul requirements.

(a) The start date for the operating hour/calendar limit is when the propeller is first installed on an engine.

(2) These procedures apply to new propellers, propellers with zero hours since overhaul, and propellers with time-in-service that have been in long-term storage.

(3) The start date for long-term storage begins at the date of manufacture, the date of overhaul, or the date the propeller was removed from the Hovercraft, whichever occurs last.

B. If storage period is less than two (2) years:

(1) Using a clean cloth soaked with solvent CM109, remove the corrosion preventative CM108 or equivalent that may have been added at the time of storage.

(2) Make a general visual inspection of the condition of the parts. As necessary, investigate and correct any questionable conditions.

(3) For a propeller with time-in-service, if the TBO calendar limit has been exceeded for the stored propeller, the propeller must be overhauled before further operation.

(a) New propellers or propellers with zero hours do not require overhaul.

(4) Check current Hartzell Propeller Inc. Hovercraft service documentation. There may be documents issued since the date the propeller was put into storage that require compliance.

C. If storage is greater than two (2) years:

(1) The requirements in this section must be accomplished by an MCA certified or a Hartzell Propeller Inc. approved (or foreign equivalent) propeller repair station in accordance with the applicable Hartzell Propeller Inc. instruction or overhaul manual.

(2) Comply with the requirements in section 2.B. and in addition:

(a) Inspect the propeller internally and externally for damage or corrosion.

1 Paint and plating need not be removed.

2 Total disassembly of the propeller (such as removing counterweights) is not necessary unless corrosion or damage warrants.

(b) Replace all seals and gaskets.

(c) Replace parts as necessary.

(d) Repaint and/or replate components as required.

(e) After accomplishing required procedures, the propeller may be released for the remaining TBO and calendar life.

MAINTENANCE PRACTICES - CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. General

   A. References used throughout this section for parts, consumable materials, and tooling are defined in the Introduction chapter of this manual.

   B. If a propeller assembly will not be immediately installed and must be stored for a period of time, package and store the propeller in accordance with the procedure specified in the Inspection and Check chapter of this manual.

   C. Before placing a propeller into service after a lengthy storage, inspect the propeller in accordance with the procedure specified in the Inspection and Check chapter of this manual.

   D. Safety using 0.025 inch (0.64 mm) or 0.032 inch (0.82 mm) safety wire, per specifications MS-33540, unless otherwise specified.

   E. Table 3-3, Torque Values, is a summary of torque values used during the installation and maintenance of the Hovercraft propeller.

   F. Table 3-1, Special Tools and Equipment, is a summary of special tools required for the installation, removal, and maintenance of the Hovercraft propeller.

   G. Table 3-2, Consumable Materials List, is a summary of consumable materials used during the maintenance of the Hovercraft propeller.

2. Cleaning

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

A. General Cleaning

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

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

(1) Wash the propeller with a noncorrosive soap solution.

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

(2) To remove grease or oil from propeller surfaces, apply Stoddard Solvent or equivalent to a clean cloth and wipe the part clean.

(3) Thoroughly rinse in water and allow the part to dry.

3. Lubrication

NOTE: The 6 bladed propeller is oil-filled. This propeller model does not allow or require lubrication.

A. Lubrication Intervals - 5 Blade Propeller Only

(1) The propeller must be lubricated at intervals not to exceed 400 hours or at 12 calendar months, whichever occurs first.

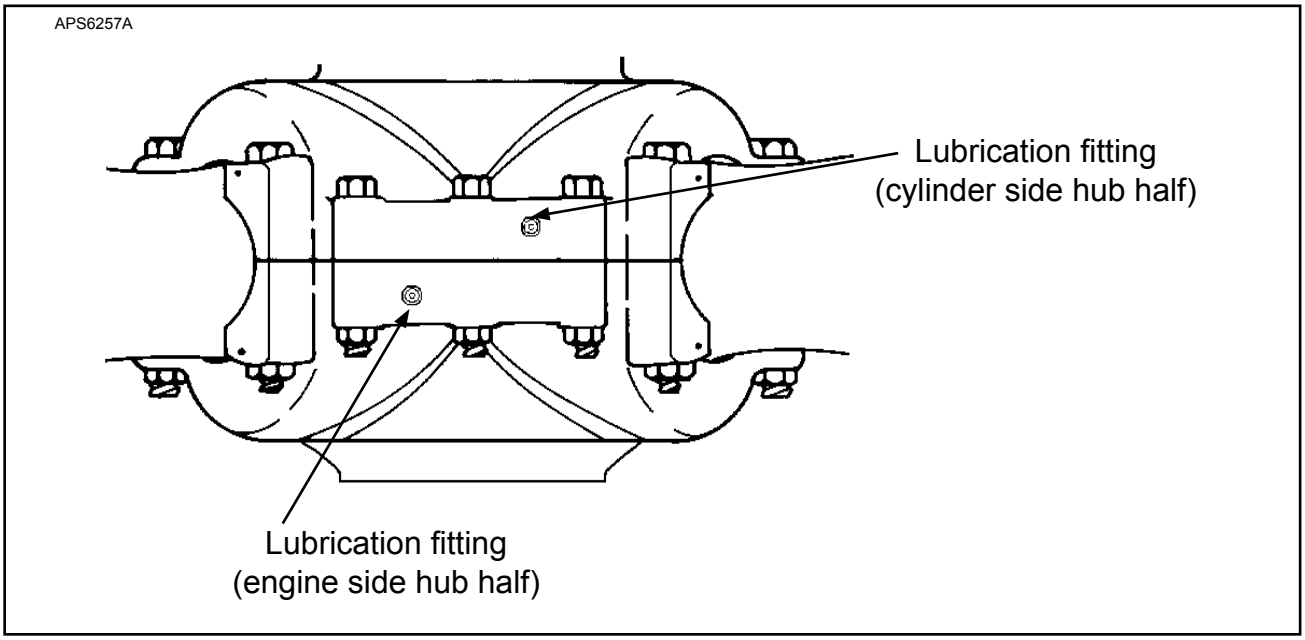
(a) If annual operation is significantly less than 400 hours, calendar lubrication intervals should be reduced to six months.

(b) If the Hovercraft is operated or stored under adverse atmospheric conditions, e.g., high humidity, salt air, calendar lubrication intervals should be reduced to six months.

(2) Hartzell Propeller Inc. recommends that new or newly overhauled propellers be lubricated after the first one or two hours of operation because centrifugal loads will pack and redistribute grease, which may result in a propeller imbalance. Redistribution of grease may also result in voids in the blade bearing area where moisture can collect.

(a) Purchasers of a new Hovercraft should check the propeller logbook to verify whether the propeller was lubricated by the manufacturer during testing.

(b) If it was not lubricated, the propeller should be serviced at the earliest convenience.



Lubrication Fitting - 5 Blade Propeller Only
Figure 6-1

B. Lubrication Procedure - 5 Blade Propeller Only

CAUTION: FOLLOW LUBRICATION PROCEDURES CORRECTLY TO MAINTAIN ACCURATE BALANCE OF THE PROPELLER ASSEMBLY.

(1) Refer to Figure 6-1. Each blade socket has two (cylinder and engine) lubrication fittings. Remove the lubrication fitting caps from both sides of the hub assembly.

(2) Remove the lubrication fittings from either the engine side or the cylinder side of the hub assembly.

NOTE 1: It is preferable to apply grease to the fitting located nearest the leading edge. Lubricating at this location reduces the possibility of grease bypassing the bearing area and entering the hub cavity.

(3) Use a piece of safety wire to loosen any blockage or hardened grease at the threaded holes where the lubrication fitting was removed.

WARNING: WHEN MIXING AEROSHELL GREASES 5 AND 6, AEROSHELL GREASE 5 MUST BE INDICATED ON THE LABEL (HARTZELL PROPELLER INC. P/N A-3594) AND THE HOVERCRAFT MUST BE PLACARDED TO INDICATE THAT OPERATION IS PROHIBITED IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN -40°F (-40°C).

CAUTION: USE HARTZELL PROPELLER INC. APPROVED GREASE ONLY. EXCEPT IN THE CASE OF AEROSHELL GREASES 5 AND 6, DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE.

(4) Aeroshell greases 5 and 6 both have a mineral oil base and have the same thickening agent; therefore, mixing of these two greases is acceptable in Hartzell Propeller Inc. propellers.

(5) A label (Hartzell Propeller Inc. P/N A-3494) is normally applied to the propeller to indicate the type of grease previously used (Figure 6-2).

(a) This grease type should be used during re-lubrication unless the propeller has been disassembled and the old grease removed.

(b) Purging of old grease through lubrication fittings is only about 30 percent effective.

(c) To completely replace one grease with another, the propeller must be disassembled in accordance with the applicable overhaul manual.

CAUTION 1: OVER LUBRICATING AN ALUMINUM HUB PROPELLER MAY CAUSE THE GREASE TO ENTER THE HUB CAVITY, LEADING TO EXCESSIVE VIBRATION AND/OR SLUGGISH OPERATION. THE PROPELLER MUST THEN BE DISASSEMBLED TO REMOVE THIS GREASE.

CAUTION 2: IF A PNEUMATIC GREASE GUN IS USED, EXTRA CARE MUST BE TAKEN TO AVOID EXCESSIVE PRESSURE BUILDUP.

CAUTION 3: GREASE MUST BE APPLIED TO ALL BLADES OF A PROPELLER ASSEMBLY AT THE TIME OF LUBRICATION.

(6) Pump 1 fl. oz. (30 ml) grease into the fitting located nearest the leading edge of the blade, or until grease emerges from the hole where the lubrication fitting was removed - whichever occurs first.

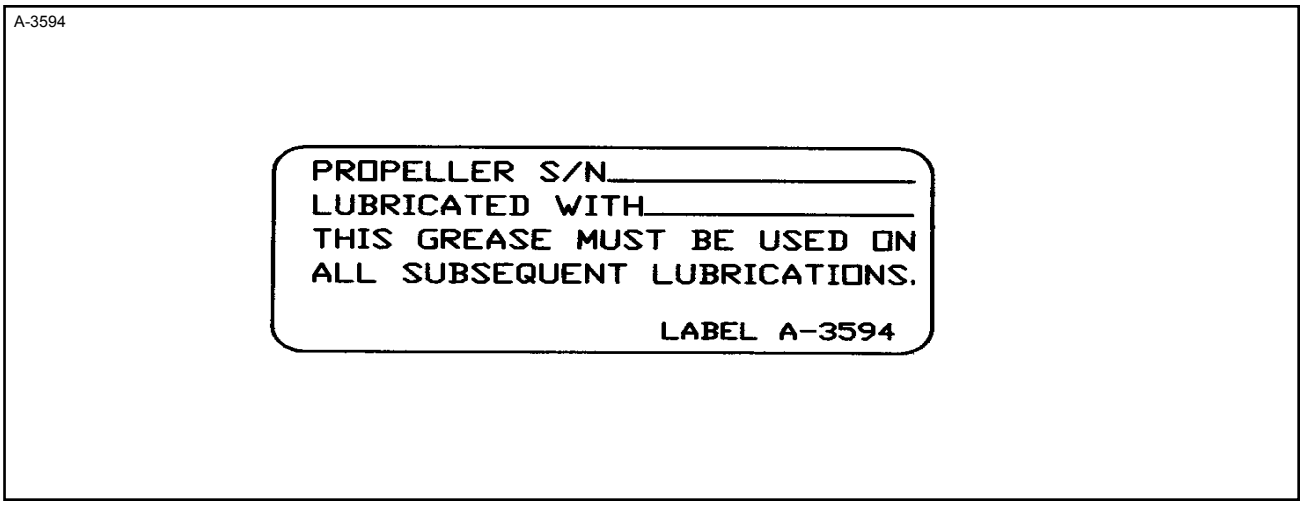
NOTE: 1 fl. oz. (30 ml) is approximately 6 pumps with a hand-operated grease gun.

(7) Reinstall the lubrication fittings.

(8) Torque the lubrication fittings in accordance with Table 3-1 in the Installation and Removal chapter of this manual.

(a) Make sure the ball of each lubrication fitting is properly seated.

(9) Install a lubrication fitting cap on each lubrication fitting.



Lubrication Label - 5 Blade Propeller Only
Figure 6-2

C. Approved Lubricants - 5 Blade Propeller Only

(1) The following lubricants are approved for use in Hartzell Propeller Inc. propellers:

Aeroshell 6 - Recommended "all purpose" grease. Used in most new production propellers since 1989. Higher leakage/oil separation than Aeroshell 5 at higher temperatures (approximately 100°F [38°C]).

Aeroshell 5 - Good high temperature qualities, very little oil separation or leakage. Cannot be used in temperatures colder than -40°F (-40°C). Hovercraft serviced with this grease must be placarded to indicate that operation is prohibited if the outside air temperature is less than -40°F (-40°C).

Aeroshell 7 - Good low temperature grease, but high leakage/oil separation at higher temperatures. This grease has been associated with sporadic problems involving seal swelling.

Aeroshell 22 - Qualities similar to Aeroshell 7.

Royco 22CF - Not widely used. Qualities similar to Aeroshell 22.

4. Blade Maintenance

A. Component Life and Service

(1) Composite Blade Life

(a) Blade life is expressed, and must be tracked in the Propeller Logbook as the following periods indicate:

1 Time Since New (TSN)

2 Time Between Overhauls (TBO)

3 Hours of Service Since Overhaul (TSO, or Time Since Overhaul).

(b) Both TSN and TSO references are necessary in defining the life of the component. Some parts are "life limited" which means that they must be replaced after a specified amount of use (TSN). TBO is usually stated as an allowable time that may accumulate prior to the performance of a function, i.e., overhaul or replacement.

(c) When a component or assembly undergoes an overhaul, the TSO is returned to zero hours. TSN can never be returned to zero.

NOTE: Repair without overhaul does not affect TBO or TSO.

(2) Overhaul or Major Periodic Inspection (MPI)

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

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

(b) At such specified periods, the blade assemblies are completely disassembled and inspected for cracks, wear, corrosion, and other unusual or abnormal conditions. As specified, some blades are refinished, and other blades are replaced. The blades can then be reassembled and balanced.

(c) Refer to the section, "Overhaul Periods" in the Inspection and Check chapter of this manual for information about overhaul periods.

B. Composite Blade Inspection Requirements

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

(1) Required Record-Keeping

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

(2) Maintenance Inspections

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

(b) Review the blade logbook records and carefully inspect areas of damage and previously repaired areas for growth.

1 If the damaged areas have grown larger, estimate if they will be greater than the damage limits before the next overhaul.

2 If this is the case, make arrangements to repair the damage at the earliest practical time to prevent further damage to the blade.

(c) Defects or damage discovered during scheduled inspections must be evaluated in accordance with allowables outlined later in this section, to determine if repairs are required before further operation.

1 Although repair of “Operable damage” is not essential before further operation, such damage should always be repaired as soon as possible, to avoid further degradation.

2 In most cases, “Inoperable damage” must be repaired before further operation.

(3) Record the details of all damage and/or repairs in the propeller logbook.

C. Coin-Tap Inspection

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

(1) Composite blades are inspected for delaminations and debonds by tapping the blade with a washer-shaped metal tapper or "coin". Refer to Figure 6-3.

(2) Using a washer-shaped metal tapper, approximately 2.5 inches (64 mm) OD x 1.25 inches (32 mm) ID x 0.25 inch (6.4 mm) thick, and weighing no less than 3 oz. (85.05 g), tap the entire surface of the blade. If an audible change is apparent, sounding hollow or dead, a debond or delamination is likely.

(3) “Mapping” of the area to be coin-tapped is desirable to make sure that the entire surface is sufficiently inspected.

(a) During scheduled Hovercraft inspections, make a coin-tap inspection within an imaginary grid or matrix consisting of 2.0 inch (51 mm) squares.

(b) A careful coin-tapping of the erosion shield is necessary because of its size and shape.

1 Tap in a smaller grid pattern up and down the length of the erosion shield.

2 Look and feel for a slight deformation of the erosion shield that may indicate a debonded area.

3 If a deformation is found, use more care in that area when doing the coin-tap inspection.

(c) If a suspected delamination or debond is discovered, a localized, careful coin-tap inspection is required to define the precise area of delamination or debond.

(d) Using a pencil, outline the suspect area to determine the approximate size of the damage.

(4) If a debond is found, contact the Hartzell Propeller Inc. Product Support department.

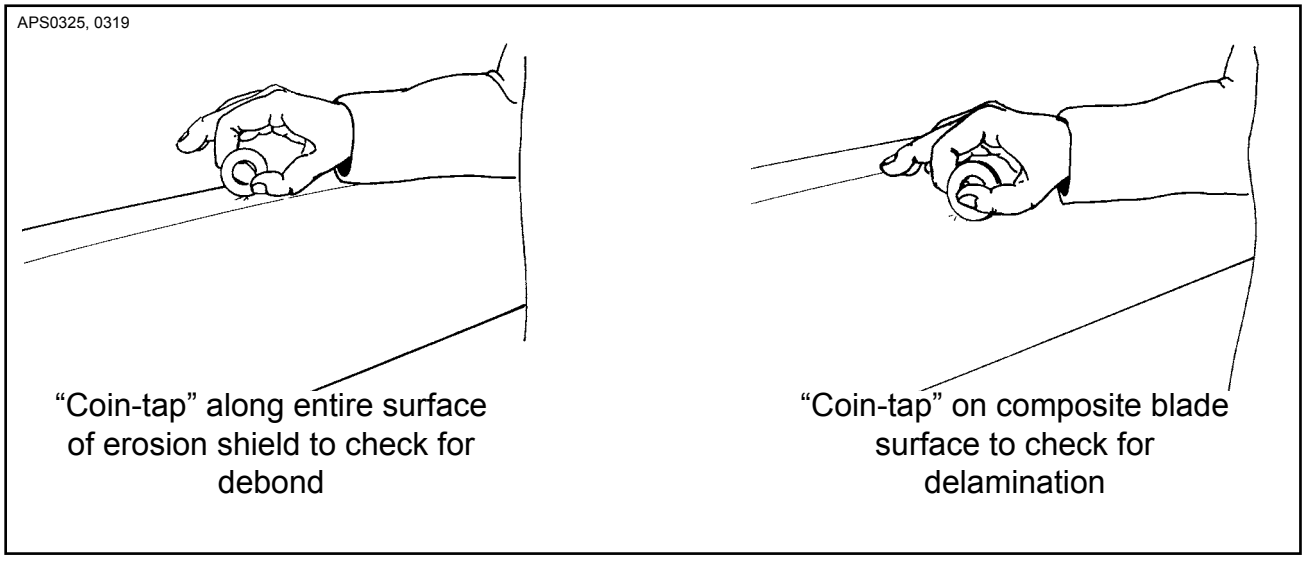
D. Composite Blade Operable Damage

CAUTION: ALTHOUGH A BLADE MAY CONTINUE IN SERVICE WITH OPERABLE DAMAGE, THIS TYPE OF DAMAGE SHOULD BE MONITORED AND REPAIRED AT THE EARLIEST PRACTICAL TIME TO PREVENT FURTHER DAMAGE TO THE BLADE.

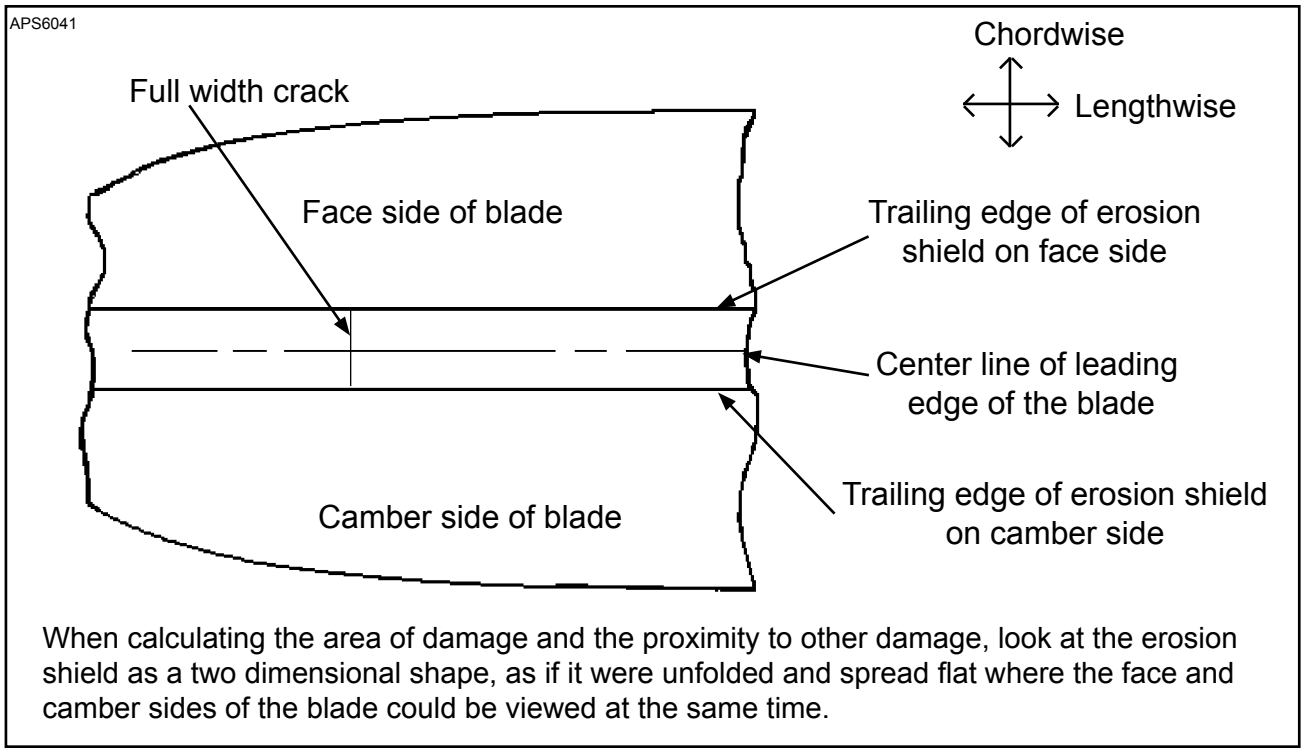
(1) Operable damage is damage that does not exceed the following limits. This type of damage will not affect the safety characteristics of the propeller.

NOTE 1: Due to the infinite types of damage possible, not all types of damage that can be considered operable are covered in this manual. If there is any doubt as to operability of the blade, contact the Hartzell Propeller Inc. Product Support department.

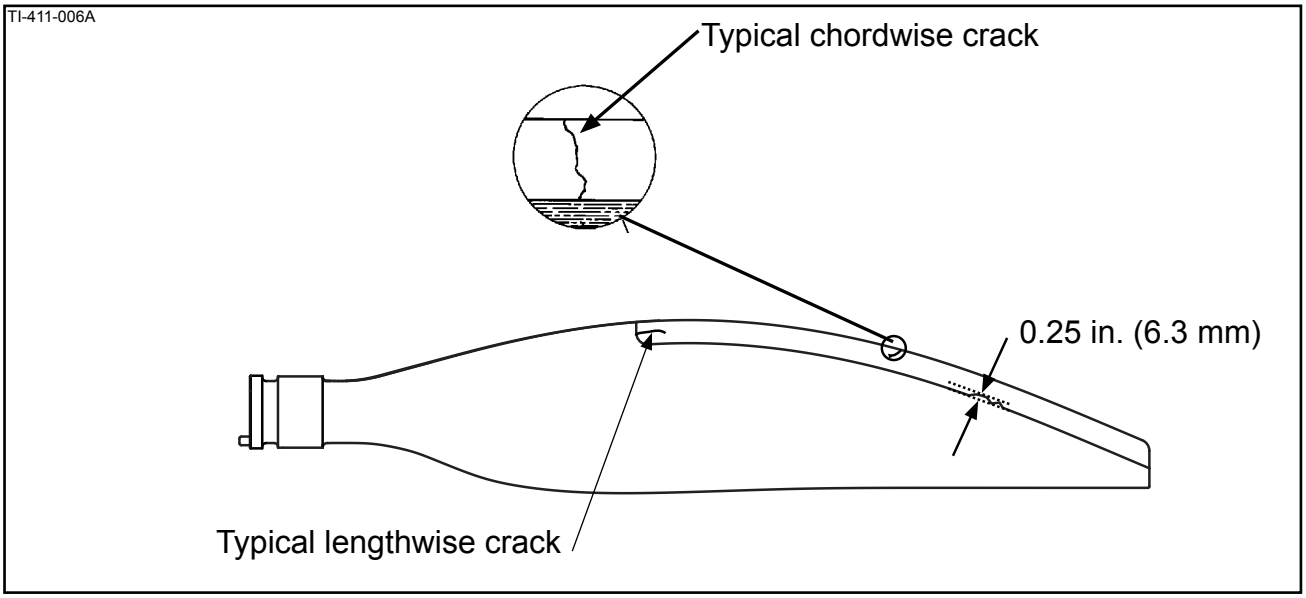
NOTE 2: The damage types in this chapter correspond with the numbered damage types in the Hartzell Propeller Inc. Composite Blade Maintenance Manual 135F (61-13-35), for consistency only. The damage types that do not apply to the affected blades in this manual have been omitted from this chapter.



Using "Coin-tap" Test to Check for Debond and Delamination
Figure 6-3



Interpretation of Erosion Shield Damage
Figure 6-4



Missing Portions of Nickel Erosion Shield (Trail Side) and Typical Cracks
Figure 6-5

E. Composite Blade Operable Damage Limits

(1) For repair of damage greater than the Operable Damage Limits specified, refer to the Hartzell Propeller Inc. Maintenance Manual for Composite Blades 135F (61-13-35) or contact Hartzell Propeller Inc. Product Support department.

(2) Nickel Erosion Shield - Minor Deformation - Damage Type (1) - for the entire erosion shield (refer to Figure 6-4)

(a) Operable Damage Limits:

1 Deformed material not associated with a crack or missing material less than 10 percent of the leading edge radius or no more than 0.080 inch (2.03 mm) deep that is caused by impact damage or erosion is operable.

(3) Nickel Erosion Shield - Gouge - for the entire erosion shield - Damage Type (2) (refer to Figure 6-4)

(a) Operable Damage Limits:

1 The maximum permitted total accumulated area of gouges through the erosion shield is 0.25 sq. inch (161.2 sq. mm).

2 The maximum permitted depth of damage to the blade surface below the erosion shield is 0.020 inch (0.50 mm). Exposed foam is not permitted.

3 This damage cannot be permanently repaired without replacement of the erosion shield.

NOTE: The 0.020 inch (0.50 mm) below the erosion shield is two layers of fibrous material.

(4) Nickel Erosion Shield - Area Missing Along the Trailing Edge of the Erosion Shield - for the entire erosion shield - Damage Type (3) (refer to Figure 6-4 and Figure 6-5)

(a) Operable Damage Limits:

1 Pieces of material from the trailing edge of the erosion shield may be missing because of erosion or sanding performed during the erosion shield installation procedure.

2 The missing area must be no farther than 0.25 inch (6.3 mm) from the trailing edge of the erosion shield. Refer to Figure 6-5 for an example of permitted missing material.

3 This damage cannot be permanently repaired without replacement of the erosion shield.

(5) Nickel Erosion Shield - Debond - Damage Type (4) (refer to Figure 6-4)

(a) Operable Damage Limits:

1 A maximum of 20 percent of the erosion shield may be debonded in any 6.0 inch (153 mm) length of the erosion shield.

(6) Nickel Erosion Shield - Chordwise Crack - Damage Type (5) (refer to Figure 6-4 and Figure 6-5)

(a) Operable Damage Limits:

1 Two full width, chordwise cracks may not be within 6.0 inches (153 mm) of each other.

2 A chordwise crack may not be within 6.0 inches (153 mm) of the blade tip.

3 A chordwise crack may not be within 6.0 inches (153 mm) of the inboard end of the erosion shield.

(7) Nickel Erosion Shield - Lengthwise Cracks (refer to Figure 6-4, Figure 6-5, Figure 6-6, and Figure 6-7)

(a) Operable Damage Limits:

1 The maximum permitted length of a crack is 2.0 inches (50 mm).

2 Two lengthwise cracks may not be within the same linear length on the erosion shield.

3 This includes cracks on opposite sides of the blade. Refer to Figure 6-8 for an example of violation of this limit.

(8) Nickel Erosion Shield - Debonds Bounded by a Lengthwise Crack - Damage Type (7) (refer to Figure 6-4, Figure 6-5, Figure 6-7, and Figure 6-8)

(a) Operable Damage Limits:

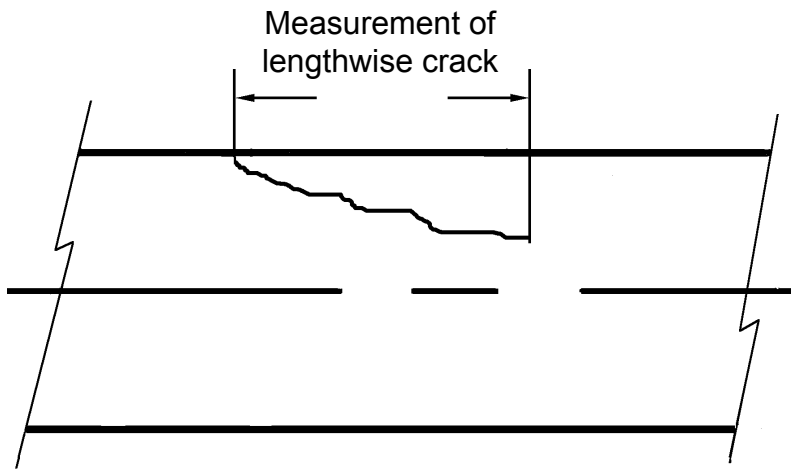
1 In the area bounded by a lengthwise crack and the trailing edge of the erosion shield, the maximum permitted area that may be debonded is 40 percent.

2 Refer to Figure 6-7 for an example of a debond that is within the permitted limits.

3 Refer to Figure 6-8 for an example of a debond that is greater than the permitted limits.

4 For crack limits, refer to the applicable damage in 4.E.(5) and 4.E.(6).

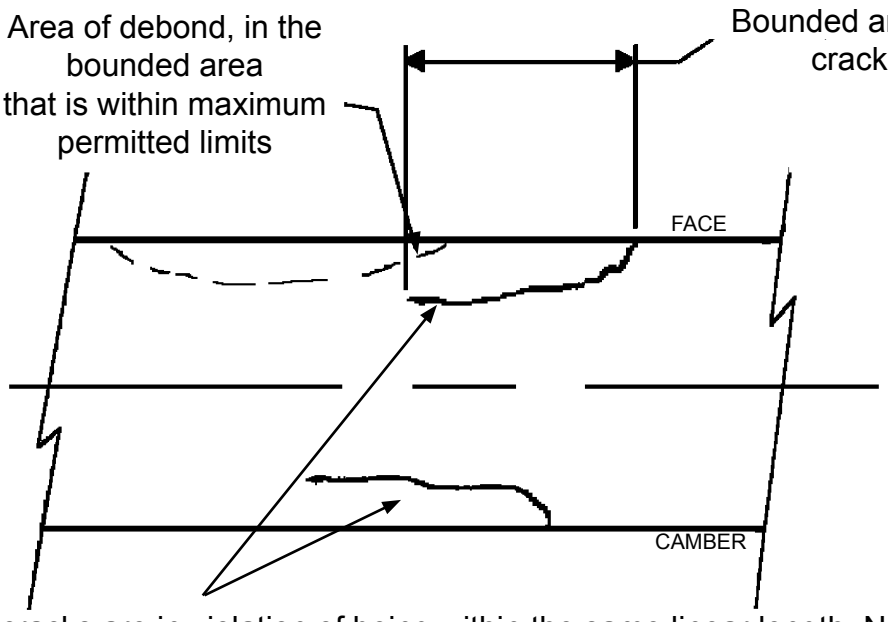
W10001



"Lengthwise crack" refers only to the length of the crack. To determine the length, measure parallel to the pitch axis of the blade from the most inboard location to the most outboard location.

Measuring Lengthwise Crack
Figure 6-6

APS6042

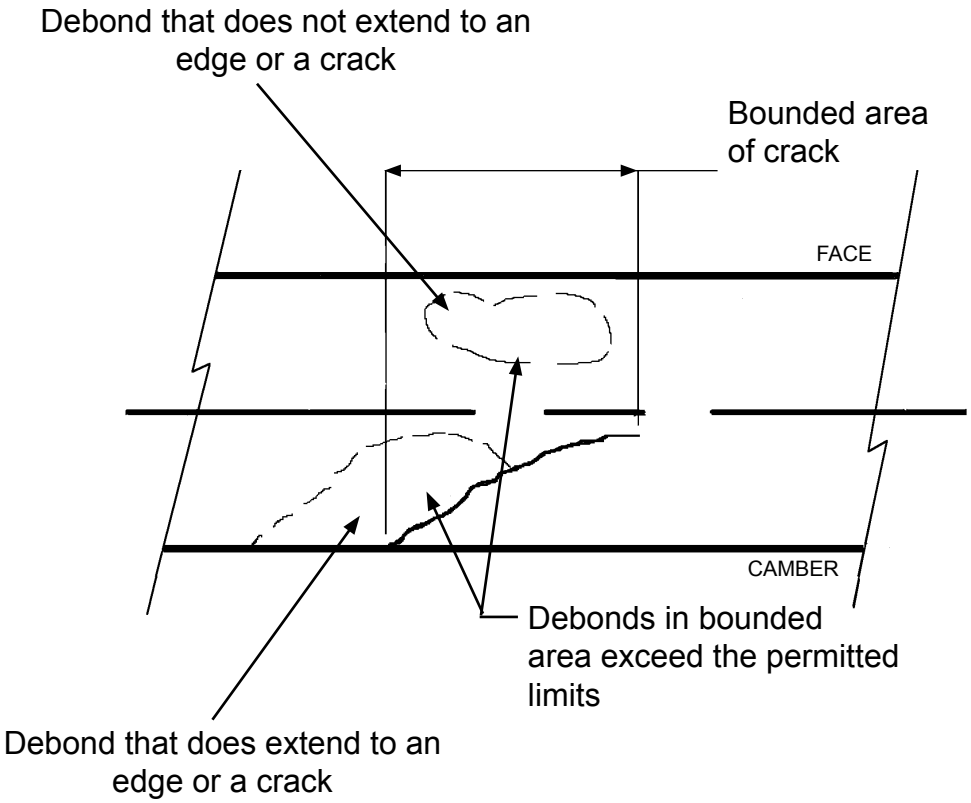


These two cracks are in violation of being within the same linear length. Note that the cracks are on opposite sides of the blade

NOTE: The bounded area of a crack extends to both edges of the erosion shield.

Acceptable Erosion Shield Debond, Non-acceptable Crack Location
Figure 6-7

APS6043



Debonds in Excess of Serviceable Damage Limits
Figure 6-8

(9) Nickel Erosion Shield - Debonds - Damage Type (8) (refer to Figure 6-4)

(a) Operable Damage Limits:

1 A maximum of 40 percent of the erosion shield may be debonded in any 6.0 inches length (153 mm) section of the erosion shield.

(10) Nickel Erosion Shield - Debonds Bounded by Two Chordwise Cracks - Damage Type (9) (refer to Figure 6-4)

(a) Operable Damage Limits:

1 Any number of chordwise cracks are permitted, even full width; but, in each area bounded by chordwise cracks the maximum total area of debond is 40 percent.

2 For crack limits, refer to the applicable damage in 4.E.(5) and 4.E.(6).

(11) Gouge or Loss of Composite Material - Outboard Region of the Blade - Damage Type (21)

(a) Operable Damage Limits:

1 The maximum permitted diameter of the gouge or loss of material is 0.500 inch (12.70 mm) or an equivalent area of 0.20 sq. inch (129 sq. mm).

2 The maximum permitted length of damage is 2.5 inches (63 mm). Do not include paint when measuring the depth of a gouge or loss of composite material.

3 The maximum permitted depth of a gouge or loss of composite material is 0.020 inch (0.50 mm).

(12) Gouge or Loss of Composite Material - Inboard Region of the Blade - Damage Type (23)

(a) Operable Damage Limits:

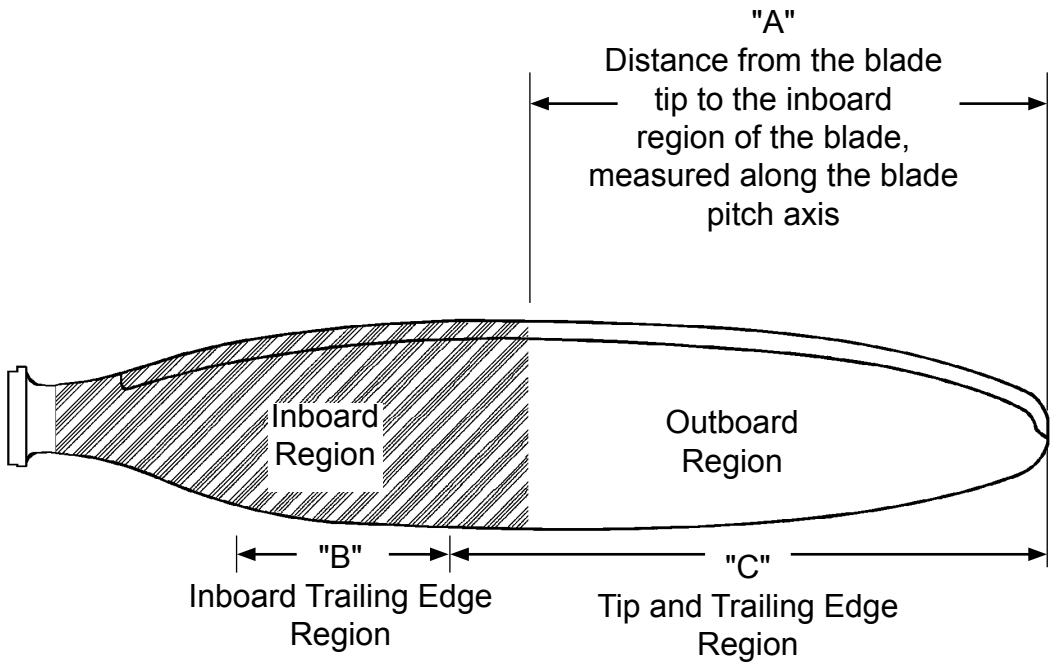
1 A gouge or loss of composite material on the inboard region of the blade is inoperable damage. Refer to Figure 6-9. Repair is required before further operation.

(13) Delamination - Outboard Region of the Blade - for all areas that **are not** covered by erosion screen - Damage Type (24)

(a) Operable Damage Limits:

1 The maximum permitted area of delamination is 2.0 square inches (1290 sq. mm).

TI-135002



Blade Model	"A"	"B"	"C"
108MH92	33.12 inches (841.2 mm)	An Inboard Trailing Edge Region has not been defined for this blade	33.12 inches (841.2 mm)
138MH91	33.12 inches (841.2 mm)	An Inboard Trailing Edge Region has not been defined for this blade	33.12 inches (841.2 mm)

Repair Regions for Composite Blades
Figure 6-9

(14) Delamination - Inboard Region of the Blade - Damage Type (27)

(a) Operable Damage Limits:

1 A delamination on the inboard region of the blade is inoperable damage. Repair is required before further operation.

(15) Split Trailing Edge - Tip and Trailing Edge Regions of the Blade - Damage Type (28)

(a) Operable Damage Limits:

1 The maximum permitted depth of a split area is 0.25 inch (6.3 mm).

2 The maximum permitted length of a split area is 2.0 inches (50 mm).

3 Damaged fibers or exposed foam are not permitted. Repair should be made as soon as practical to prevent degradation of the condition.

(16) Split Trailing Edge - Inboard Region of the Blade - Damage Type (29)

(a) Operable Damage Limits:

1 A split trailing edge on the inboard region of the blade is inoperable damage. Repair is required before further operation.

(17) Crushed or Cracked Trailing Edge - Inboard Region of the Blade - Damage Type 30)

(a) Operable Damage Limits:

1 A crushed or cracked trailing edge on the inboard region of the blade is inoperable damage. Repair is required before further operation.

(18) Crushed or Cracked Trailing Edge - Outboard and Tip Regions of the Blade - Damage Type (31)

(a) Operable Damage Limits:

1 The maximum permitted depth of a crushed or cracked area is 0.25 inch (6.3 mm).

2 The maximum permitted length of a crushed or cracked area is 2.0 inches (50 mm).

3 Damage should be repaired as soon as practical to prevent degradation of the condition.

(19) Paint Erosion - for the entire blade - Damage Type (33)

(a) Operable Damage Limits:

1 For areas of the blade where there is composite material, the maximum permitted exposure of the composite material and/or of the primer filler is 5.0 square inches (3225 sq. mm).

NOTE: This limit does not refer to the primer sealer (gray layer).

a For areas of the blade where there is an erosion shield, paint may be missing from the entire area of the erosion shield and the blade is operable.

b For maintenance scheduling purposes, propellers with blades that show more than 5.0 square inches (3225 sq. mm) of paint erosion may continue operation for an additional 250 hours or 1 (one) month, whichever occurs first.

c Refer to Section 5. Painting After Repair of this chapter for blade painting procedures.

(20) Missing Expanded Foil Mesh - Damage Type (35)

(a) Operable Damage Limits:

1 The expanded foil mesh may be completely missing, but the expanded foil mesh is there to minimize damage from a lightning strike. If a blade without expanded foil mesh is struck by lightning, damage will be more extensive. Damage should be repaired as soon as practical to prevent degradation of the condition.

5. Painting After 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 CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

A. General

(1) Propeller blades are painted with a durable specialized coating that is resistant to abrasion. If this coating becomes eroded over an area of more than 10 square inches (6451.6 square mm), it is necessary to repaint the entire blade to provide proper environmental and erosion protection. If the eroded area is greater than 10 square inches (6451.6 square mm), contact the Hartzell Propeller Inc. Product Support Department.

(2) For paint erosion over an area of less than 10 square inches (6451.6 square mm), aerosol paint can be used to touch-up the blades when the paint is applied in accordance with the section, "Painting of Composite Blades" in this chapter.

(3) Refer to Table 6-1 for paints approved for blade touch-up.

(4) The paint manufacturers can be contacted via the information below:

Tempo Products Co.
A Plasti-Kote Company
1000 Lake Road
Medina, OH 44256
Tel: 800.321.6300
Fax: 216.349.4241
Cage Code: 07708

Sherwin Williams Co.
Refer to the Sherwin-WIlliams Product Finishes Global Finishes Group website at http://oem.sherwin-williams.com to find the nearest location.

B. Painting of Composite Blades

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

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

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

CAUTION: EXCESSIVE SANDING WILL CAUSE "FUZZING" OF THE KEVLAR MATERIAL, RESULTING IN A ROUGH FINISH.

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

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

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

(4) Apply masking material for the erosion shield.

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

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

(5) Apply sufficient finish coating to achieve 2 to 4 mils thickness when dry.

(a) Re-coat before 30 minutes, or after 48 hours.

(b) If the paint is permitted to dry longer than four (4) hours, it must be lightly sanded before another coat is applied.

(6) Optionally, perform dynamic balancing in accordance with the procedures and limitations specified in Section 6. Dynamic Balance of this chapter.

6. Dynamic Balance

A. Overview

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

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

(2) The number of balance weights installed must not be greater than the limits specified in this chapter.

(3) Follow the Hovercraft manufacturer's or the dynamic balance equipment manufacturer’s instructions for dynamic balance, in addition to the specifications of this section.

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

Vendor	Color/Type	Vendor P/N	Hartzell Propeller Inc. P/N
Tempo	Epoxy Black	A-150	A-6741-145-2
Sherwin-Williams	Black	F75KXB9958-4311	A-6741-145-1

Approved Touch-up Paints
Table 6-1

7. Tachometer Calibration

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

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

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

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

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

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

B. The accuracy of the tachometer is critical to the safe operation of the craft.

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

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

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

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

C. Tachometer Calibration

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

(2) Contact Hartzell Propeller Inc. if it is determined that a propeller was operated in a restricted RPM range because of a tachometer error.

(This page is intentionally blank.)

RECORDS - CONTENTS

(This page is intentionally blank.)

1. Introduction

   A. Record every inspection, maintenance action, and repair operation on the applicable pages of this chapter.

   B. All entries must be made in the section of the chapter that corresponds to the component being addressed.

   C. The following entries must be completed for the propeller assembly:

      (1) The Hovercraft manufacturer must record serial numbers and revision letter of all new component parts at the time of installation.

      (2) The operator must record serial number, revision letter, and date of all replacement components.

      (3) Service History cards must be maintained for the following components:

         (a) Aluminum Hub

         (b) Composite Blades

   D. This Records chapter contains a section for the propeller assembly, including blades.

      (1) There are individual history cards for each of the major serialized components of the propeller.

      (2) Any maintenance that is performed on a component must be noted on the component history card.

   E. If a component is removed and replaced, the component history card must be removed from this manual and sent with the component.

      (1) The component history card of the replacement component must be inserted in this manual in the correct location.

      (2) If a replacement component is installed, note the new component serial number on the following page as a quick reference.

2. Blade Damage Repair Sheets

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

(This page is intentionally blank.)

PROPELLER SYSTEM INSTALLATION HISTORY

PROPELLER MODEL NO:. . . . . .

PROPELLER S/N: . . . . . .

INSTALLED ON ENGINE SERIAL NO. AND LOCATION

1. . . . . 5.. . . . . .

2. . . . . 6.. . . . . .

3. . . . . 7.. . . . . .

4. . . . . 8.. . . . . .

INSTALLED ON HOVERCRAFT MODEL:

1. . . . . 5.. . . . . .

2. . . . . 6.. . . . . .

3. . . . . 7.. . . . . .

4. . . . . 8.. . . . . .

OPERATOR

NAME AND . . . . . .
ADDRESS. . . . . .

NAME AND . . . . . .
ADDRESS. . . . . .

NAME AND . . . . . .
ADDRESS. . . . . .

NAME AND . . . . . .
ADDRESS. . . . . .

(This page is intentionally blank.)

PROPELLER ASSEMBLY COMPONENT CONTROL CARD

Propeller Model No. _____ Propeller Serial No. _____

Blade Design _____

	New/Date	Replaced/Date	Replaced/Date
Hub Part No.			
Hub Serial No.			
Fork Part No.			
Fork Serial No.			
Blade No. 1 Serial No.			
P/C/Knob Dash No./Serial No.			
Blade No. 2 Serial No.			
P/C/Knob Dash No./Serial No.			
Blade No. 3 Serial No.			
P/C/Knob Dash No./Serial No.			
Blade No. 4 Serial No.			
P/C/Knob Dash No./Serial No.			
Blade No. 5 Serial No.			
P/C/Knob Dash No./Serial No.			

RECORD OF SERVICE BULLETIN OR SERVICE LETTER COMPLIANCE

DATE	TSN CSN	TSO CSO	SERVICE BULLETIN OR SERVICE LETTER	SIGNATURE (CERT. NO.)

RECORD OF INSPECTIONS, REPAIRS, AND ADJUSTMENTS

DATE	TSN CSN	TSO CSO	DESCRIPTION OF INSPECTION REPAIR OR ADJUSTMENT	SIGNATURE (CERT. NO.)

RECORD OF INSPECTIONS, REPAIRS, AND ADJUSTMENTS

DATE	TSN CSN	TSO CSO	DESCRIPTION OF INSPECTION REPAIR OR ADJUSTMENT	SIGNATURE (CERT. NO.)

ALUMINUM HUB SERVICE HISTORY

HUB PART NO.:		HUB SERIAL NO.:		DATE NEW	
INSPECTION					
PROPELLER MODEL					
PROPELLER SERIAL NUMBER					
VISUAL INSPECTION					
DYE PENETRANT					
ANODIZE					
SHOT PEEN					
HELI-COILS REPLACED					
RETENTION RADIUS REWORK					
PAINT					
BUSHINGS REPLACED					
IN ACCORDANCE WITH MANUAL NO.					
TSN					
CSN					
TSO					
CSO					
INSPECTOR					
DATE					

THIS CARD IS TO ACCOMPANY THE HUB THROUGHOUT ITS SERVICE LIFE AND SHOULD REMAIN WITH THE HUB DURING OVERHAUL, REPAIR, OR WARRANTY CLAIM.

(This page is intentionally blank)

COMPOSITE BLADE SERVICE HISTORY

BLADE DESIGN:		BLADE SERIAL NO.:		DATE NEW	
INSPECTION	NEW	O/H REP	O/H REP	O/H REP	
PROPELLER MODEL					
PROPELLER SERIAL NUMBER					
BLADE POSITION					
MAJOR REPAIRS					
LEAD EDGE REPLACED					
COIN TAP					
RETENTION BEARING RACES					
WIDTH					
THICKNESS					
FACE ALIGNMENT					
TSN					
CSN					
TSO					
CSO					
INSPECTOR					
DATE					

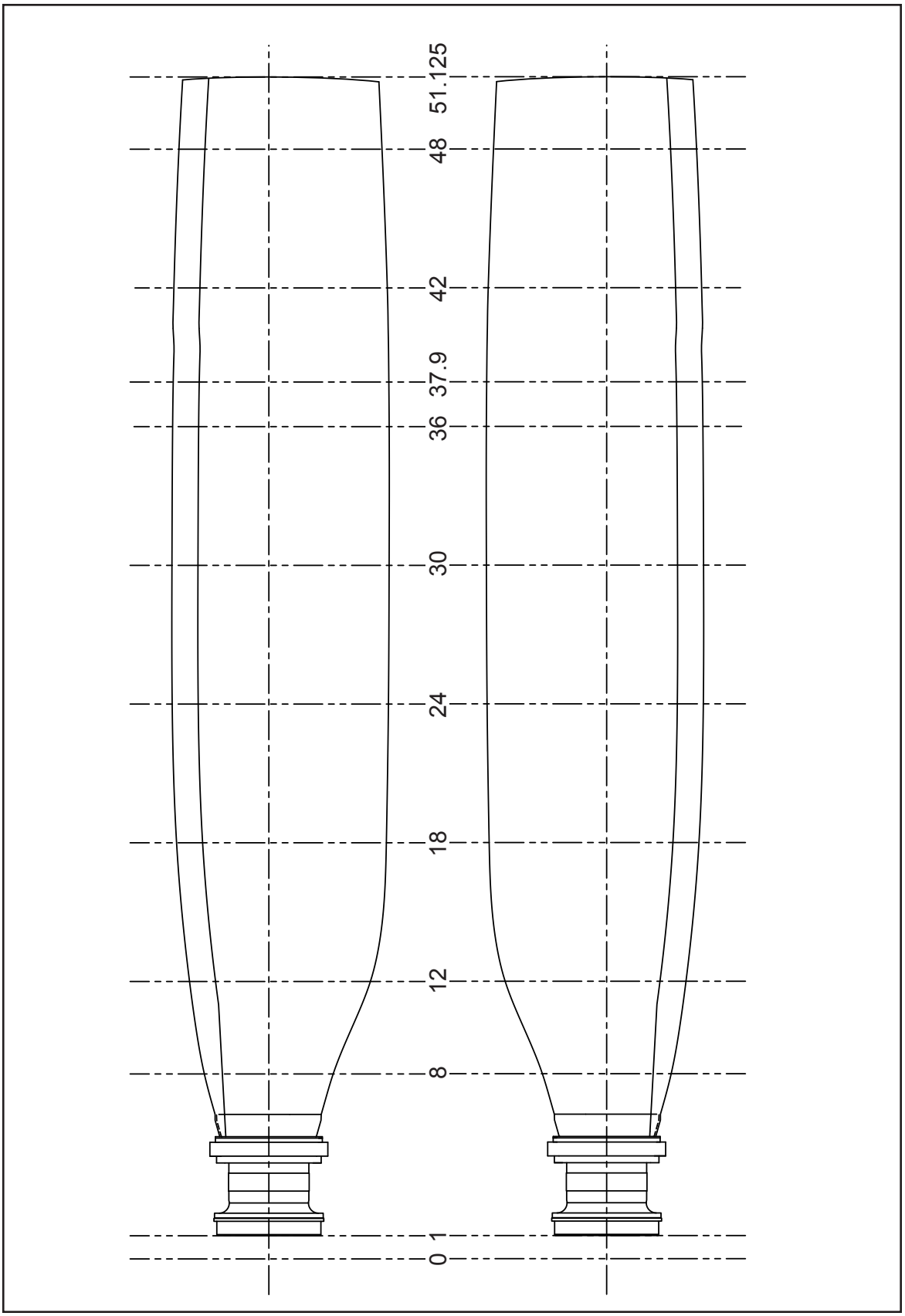
SEVICE BULLETIN NO.:	METHOD OF COMPLIANCE	RECURS AT (date/hours)

THIS CARD IS TO ACCOMPANY THE HUB THROUGHOUT ITS SERVICE LIFE AND SHOULD REMAIN WITH THE HUB DURING OVERHAUL, REPAIR, OR WARRANTY CLAIM.

(This page is intentionally blank)

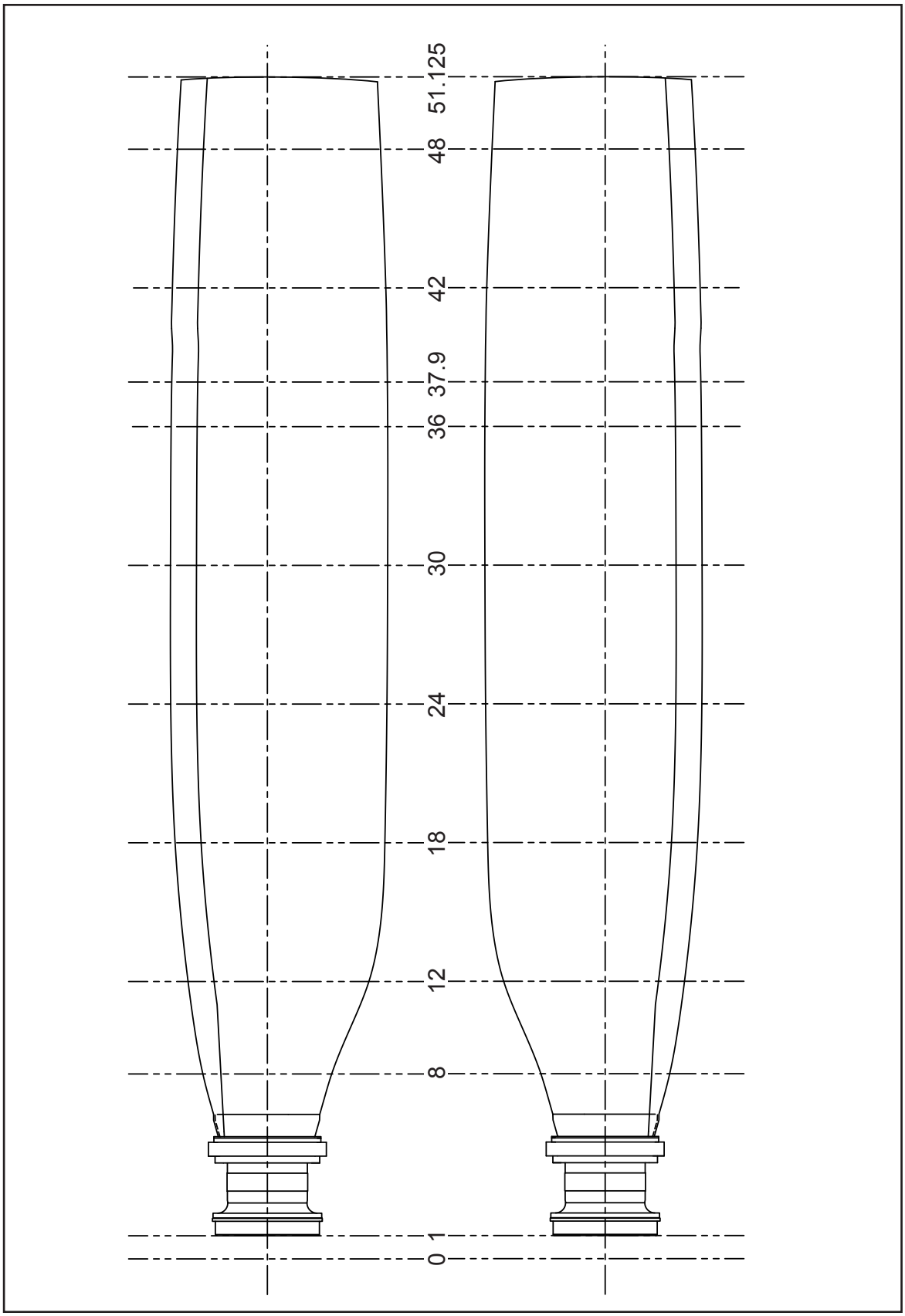
Record of Repairs for Damage to 108MH92 Composite Blade - 5 Blade Propeller

Blade Serial No._____



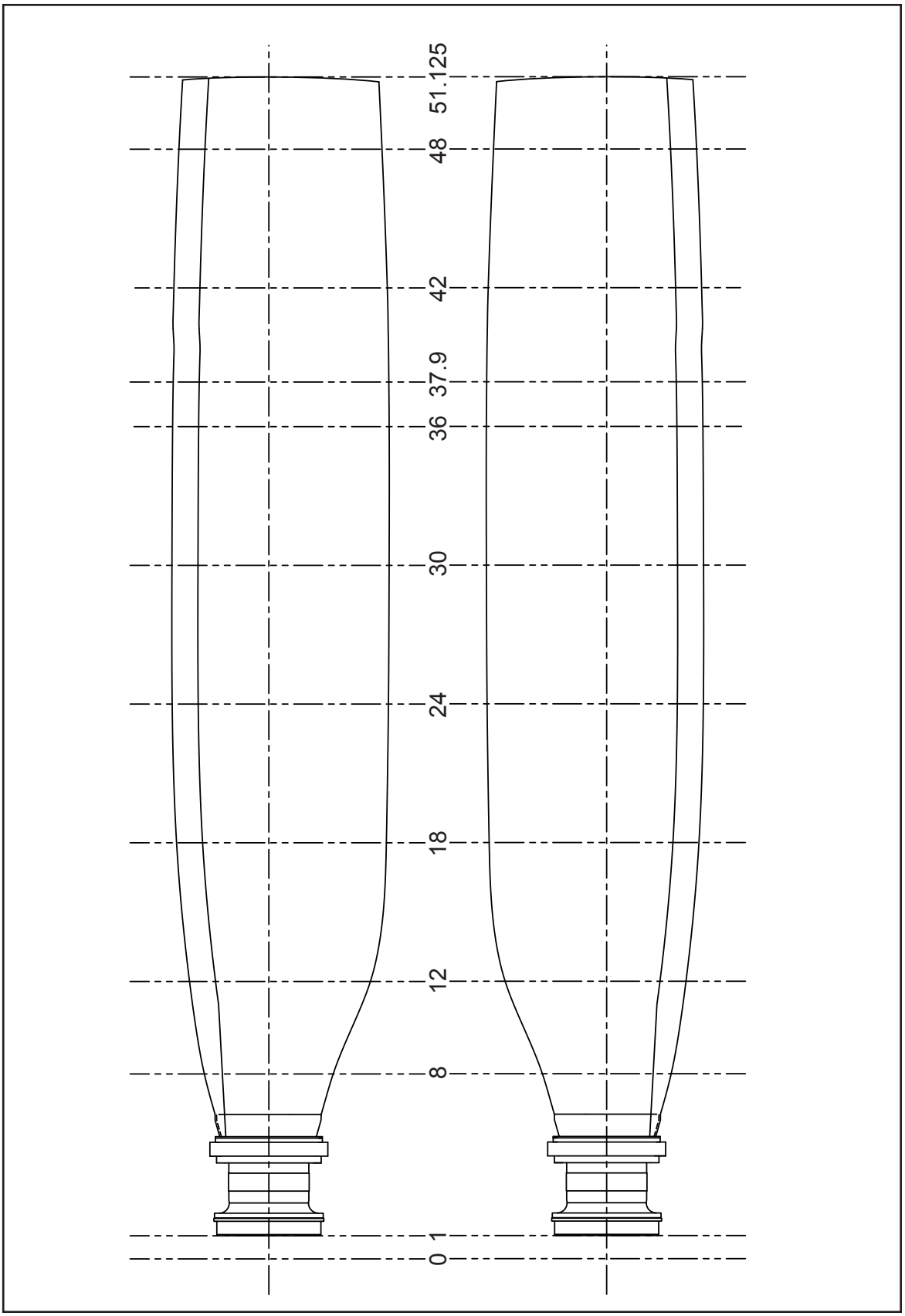
Record of Repairs for Damage to 108MH92 Composite Blade - 5 Blade Propeller

Blade Serial No._____



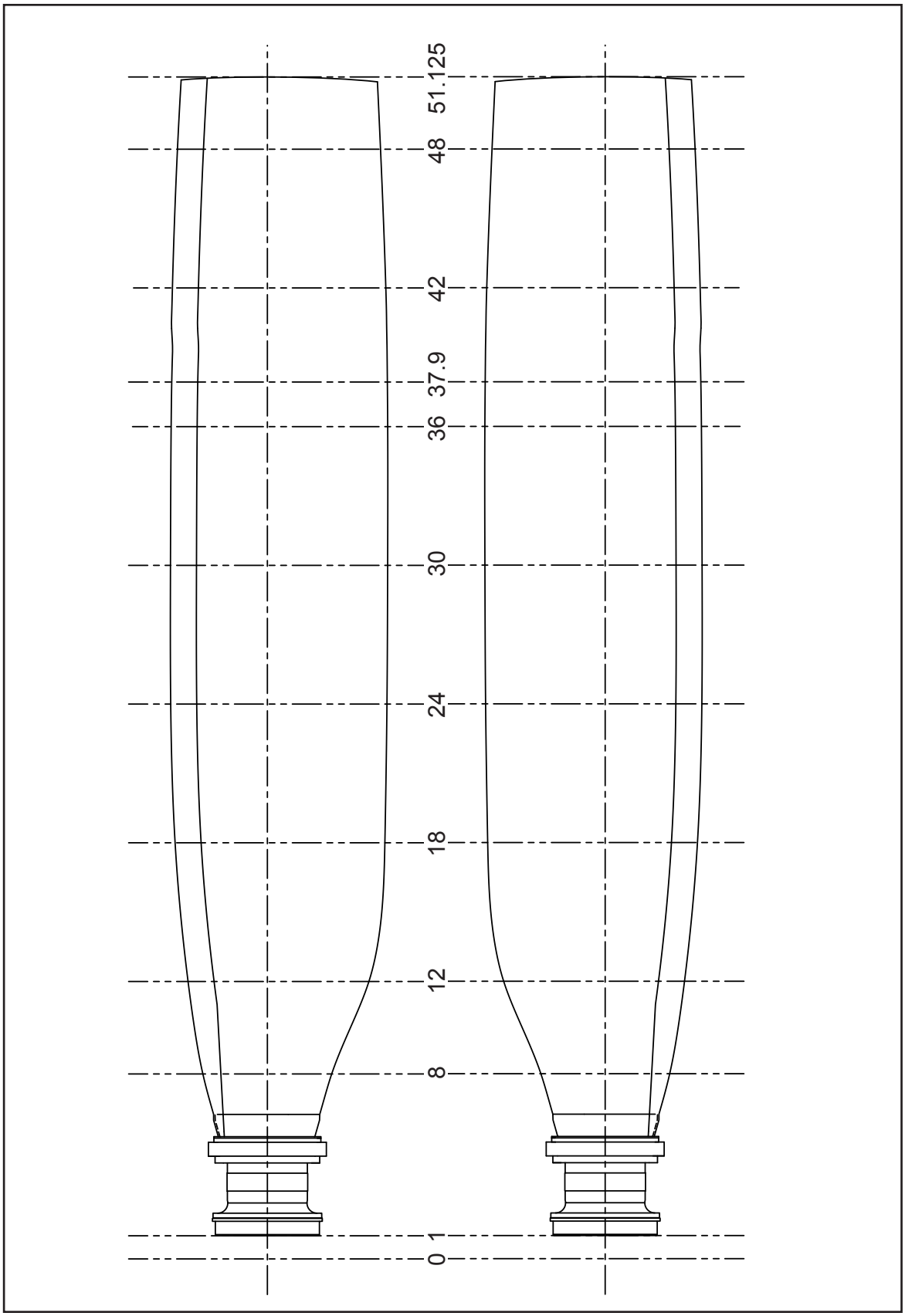
Record of Repairs for Damage to 108MH92 Composite Blade - 5 Blade Propeller

Blade Serial No._____



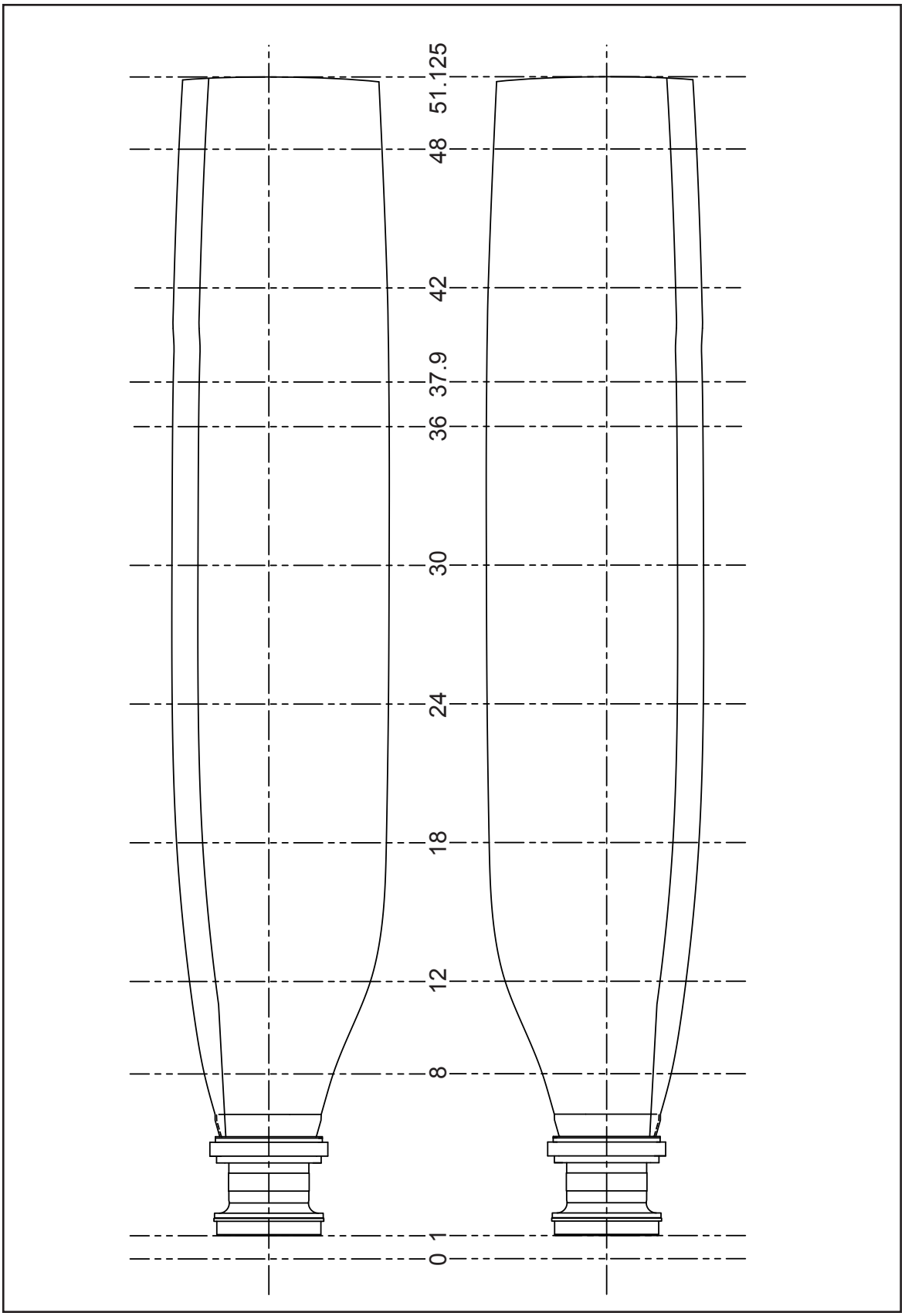
Record of Repairs for Damage to 108MH92 Composite Blade - 5 Blade Propeller

Blade Serial No._____



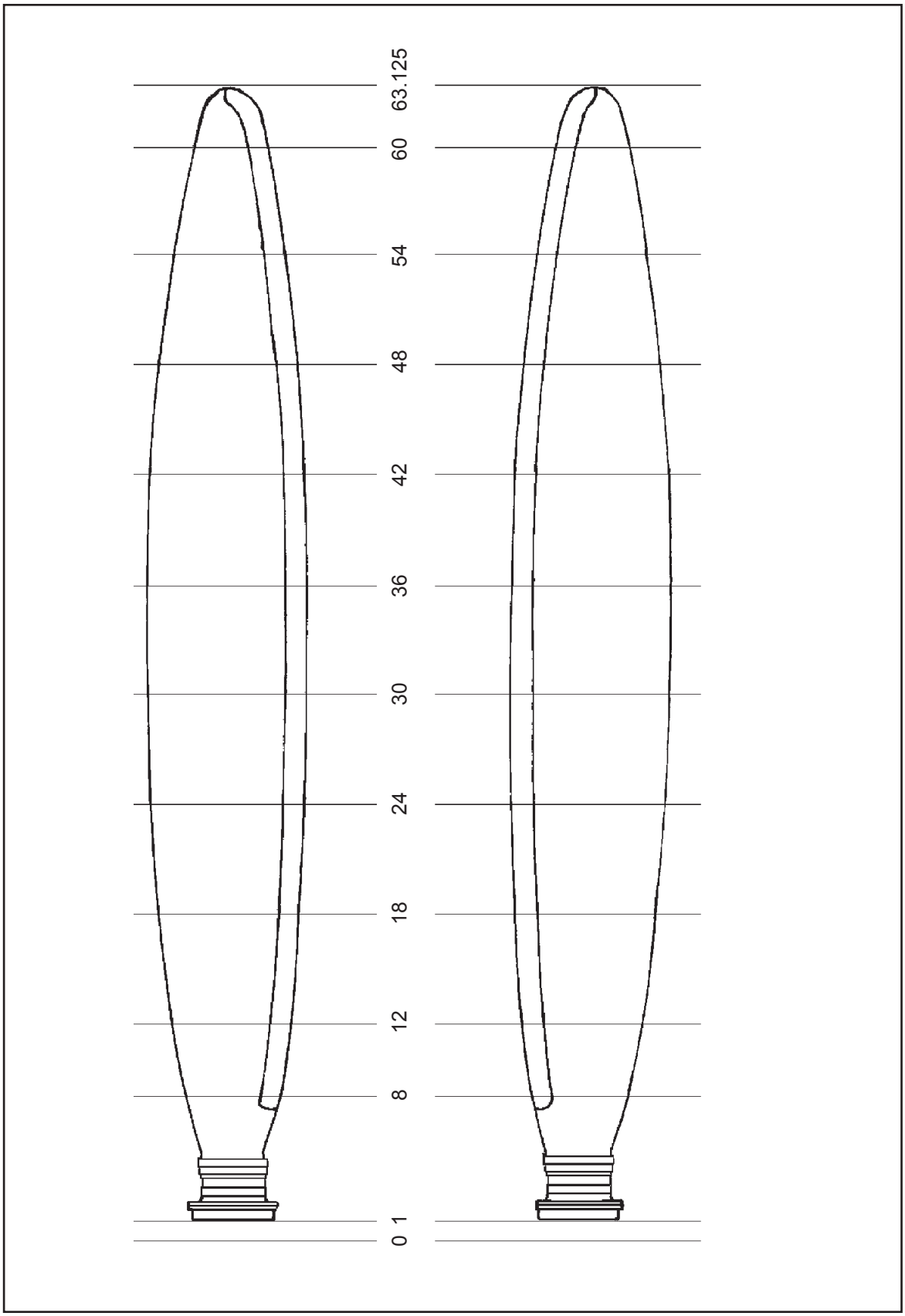
Record of Repairs for Damage to 108MH92 Composite Blade - 5 Blade Propeller

Blade Serial No._____



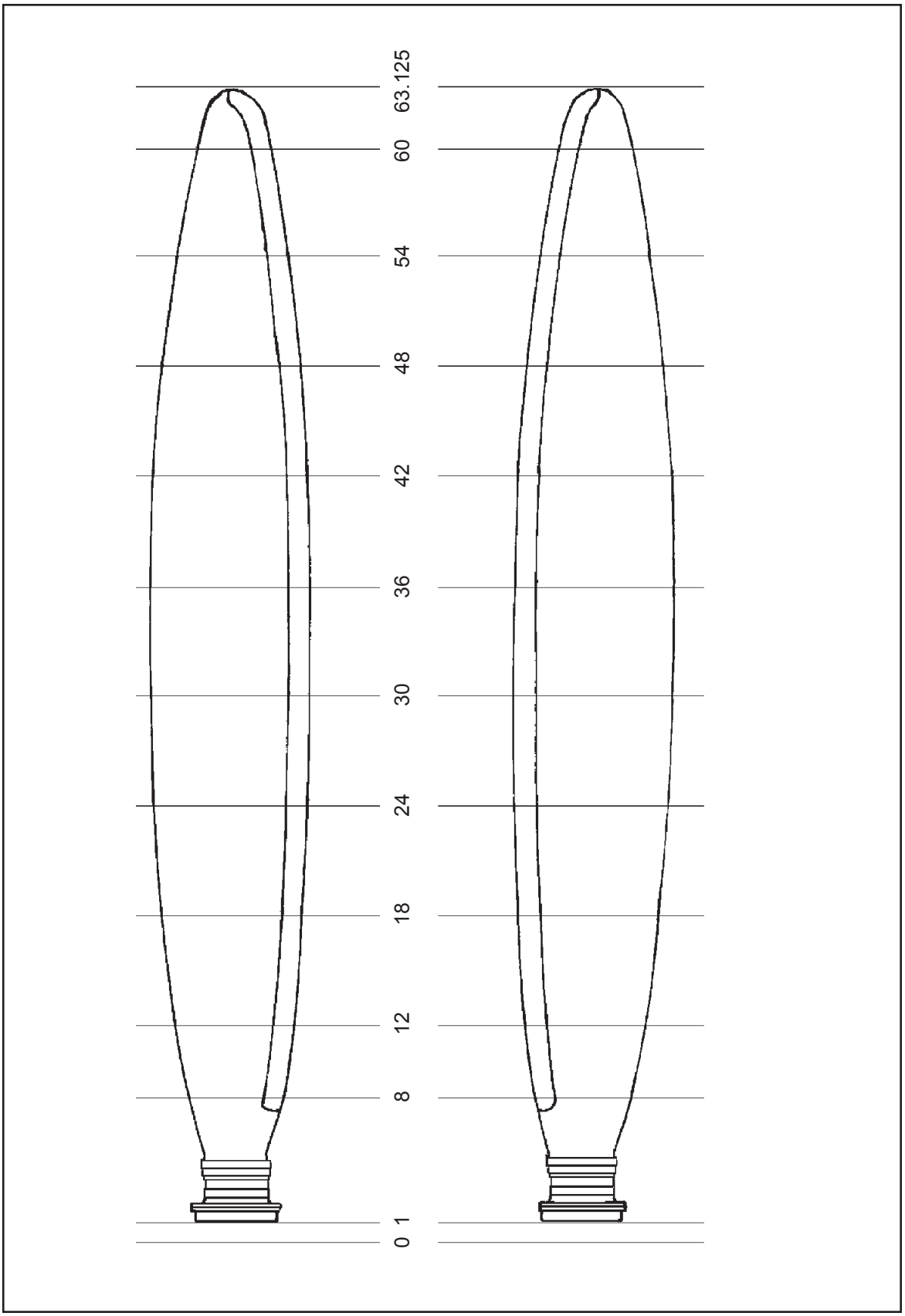
Record of Repairs for Damage to 138MH91 Composite Blade - 6 Blade Propeller

Blade Serial No._____



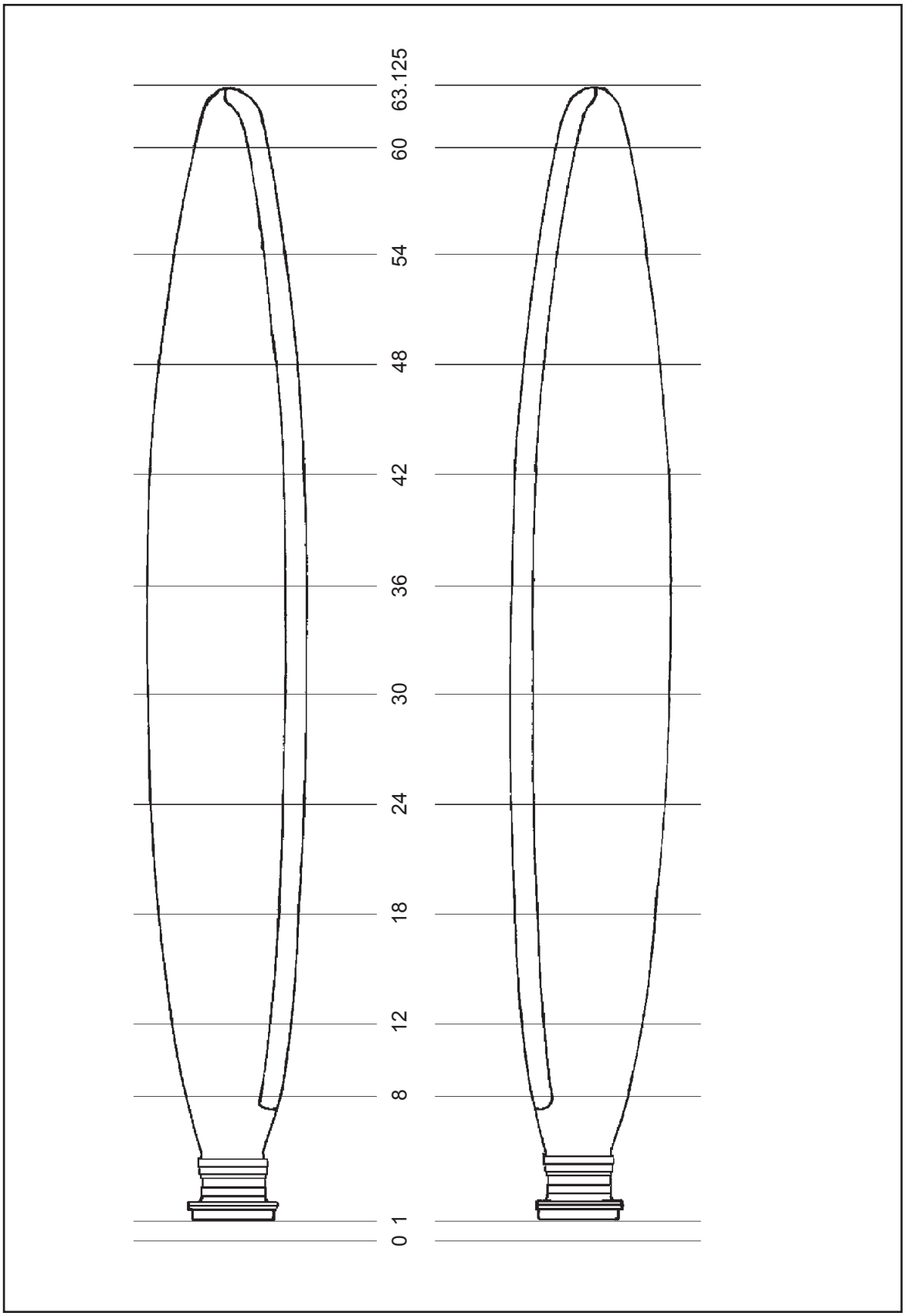
Record of Repairs for Damage to 138MH91 Composite Blade - 6 Blade Propeller

Blade Serial No._____



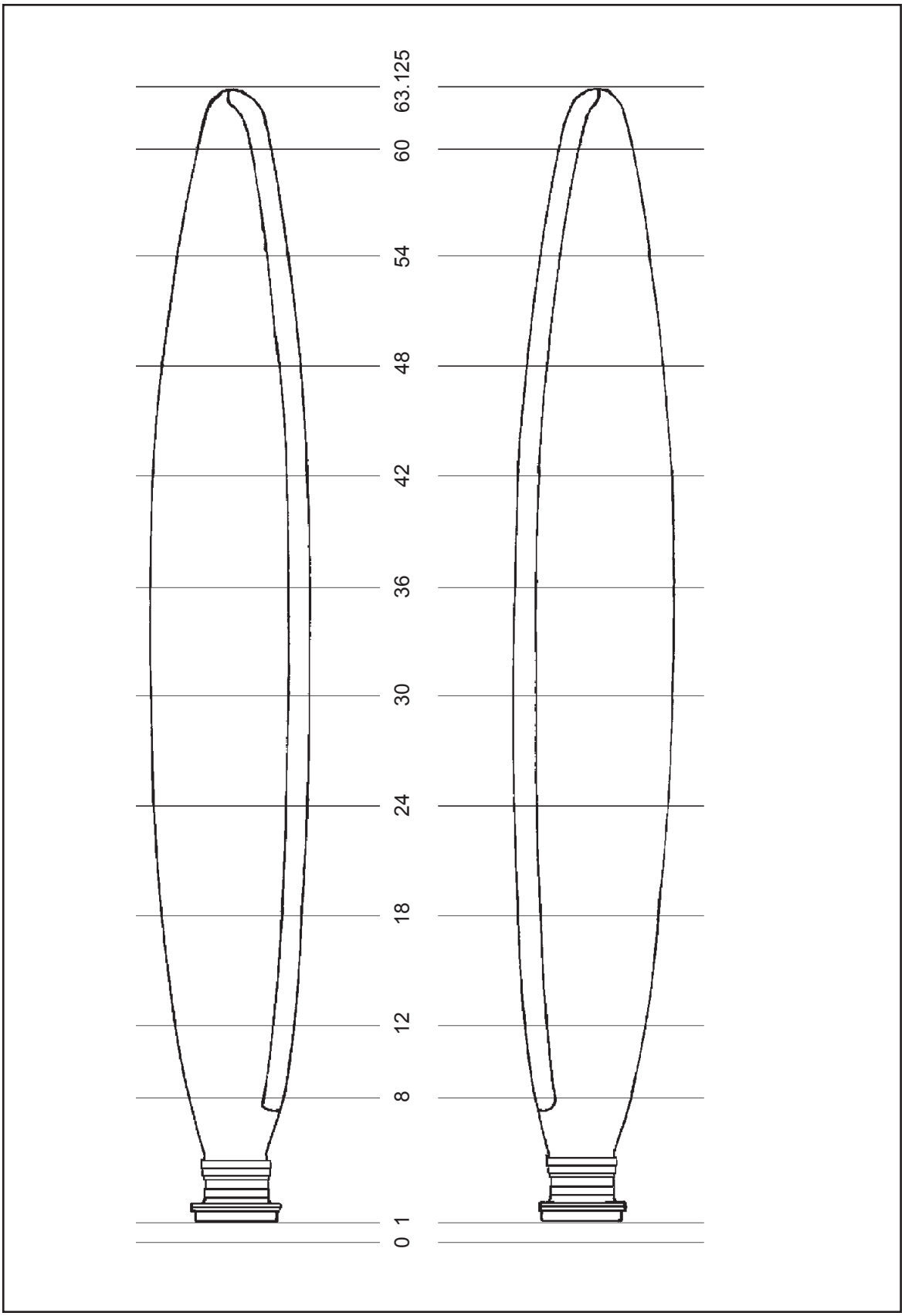
Record of Repairs for Damage to 138MH91 Composite Blade - 6 Blade Propeller

Blade Serial No._____



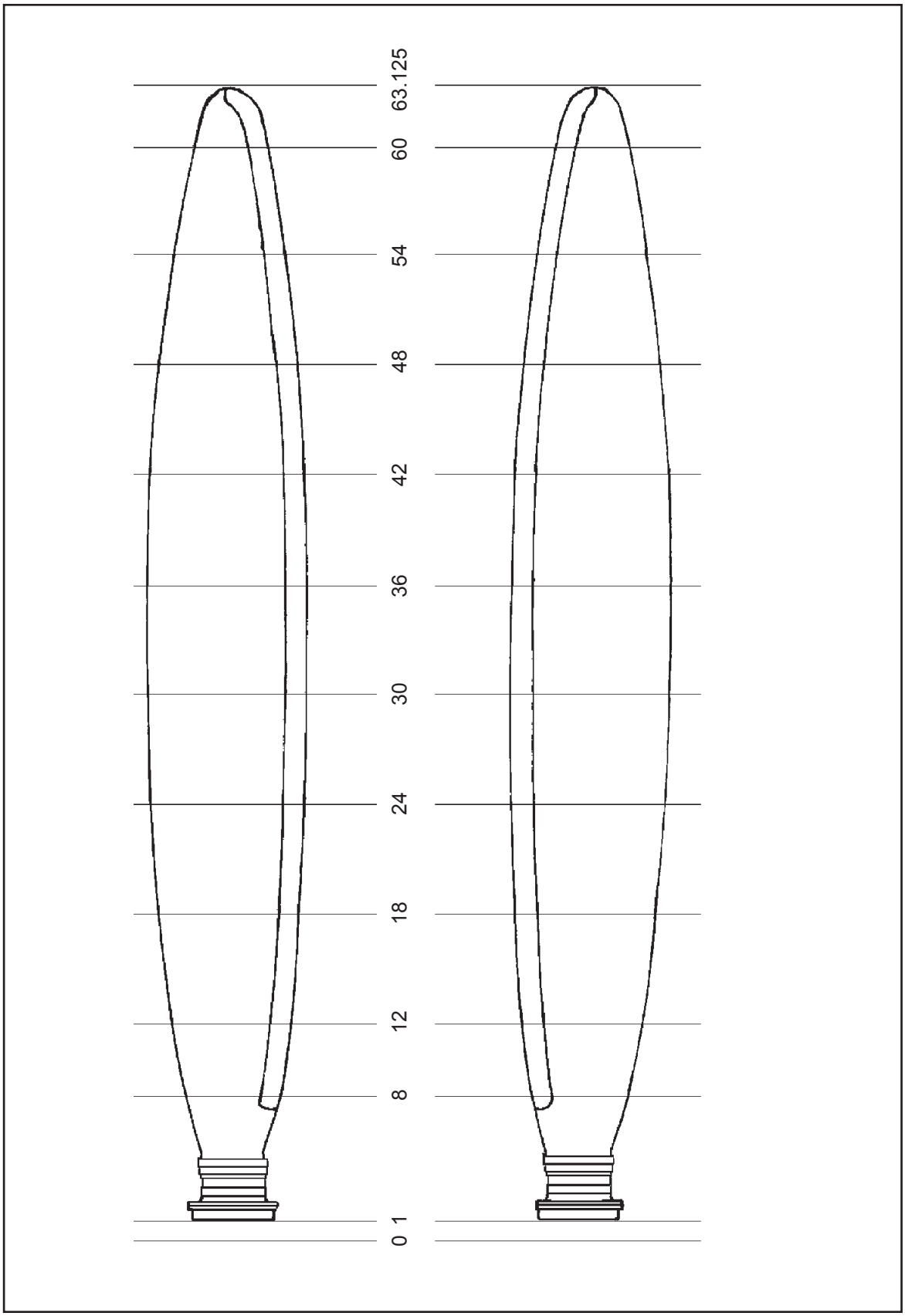
Record of Repairs for Damage to 138MH91 Composite Blade - 6 Blade Propeller

Blade Serial No._____



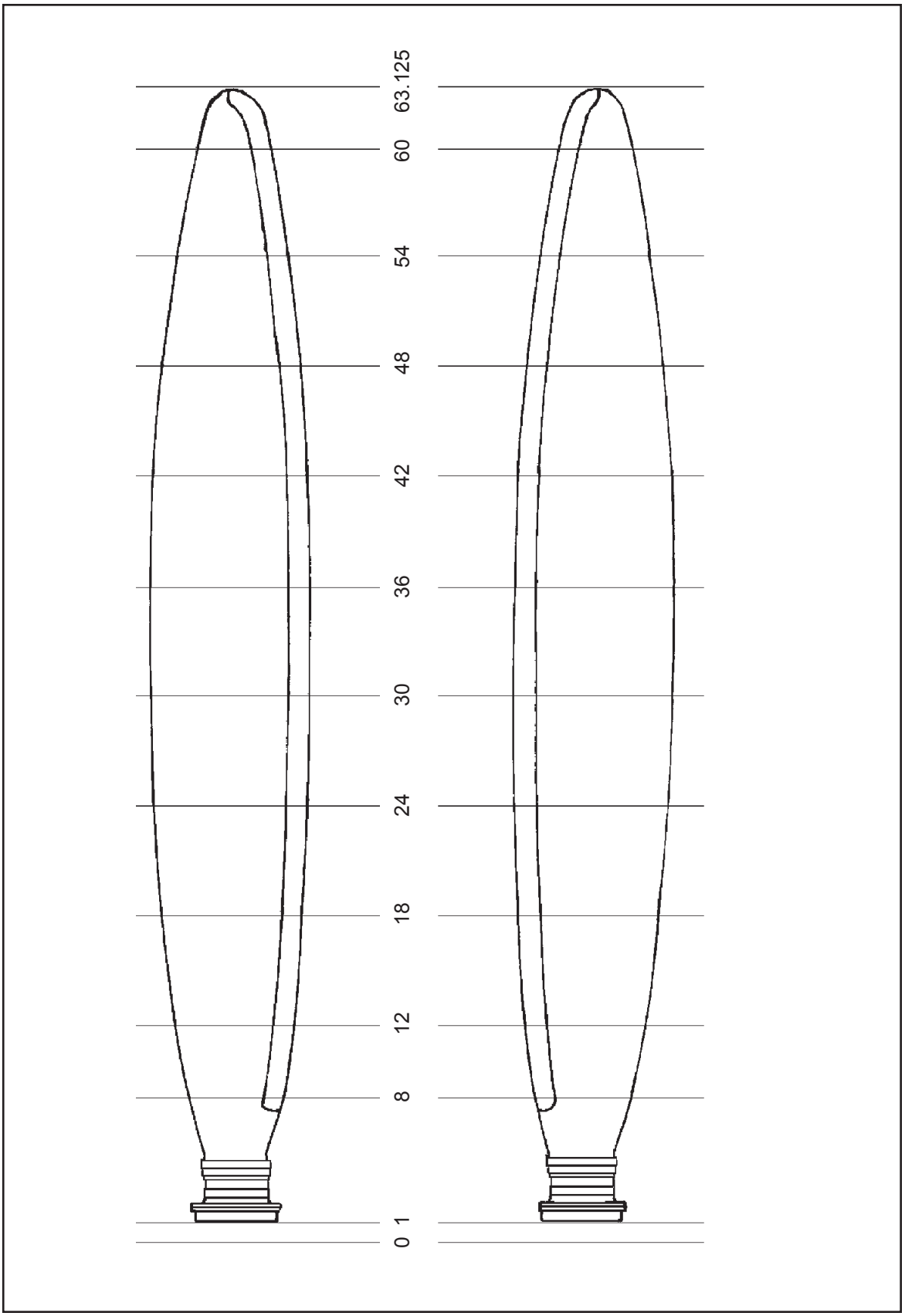
Record of Repairs for Damage to 138MH91 Composite Blade - 6 Blade Propeller

Blade Serial No._____



Record of Repairs for Damage to 138MH91 Composite Blade - 6 Blade Propeller

Blade Serial No._____



(This page is intentionally blank.)