

Manual No. 149
61-00-49
Revision 33
September 2025



Propeller Owner's Manual and Logbook

Models: HC-(D,E)4()-2()
HC-(D,E)4()-3()
HC-(D,E)4()-5()
HC-D3F-7()
HC-E5N-3()

Lightweight Turbine Propellers with Aluminum Blades

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2013, 2014, 2015, 2016, 2017, 2019, 2020, 2021, 2022, 2023, 2024, 2025 -
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HARTZELL PROPELLER OWNER'S MANUAL

149

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

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

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



JJ Frigge
President, Hartzell Propeller LLC

I WARNING (Rev. 5)

People who fly should recognize that various types of risks are involved; and they should take all precautions to minimize them, since they cannot be eliminated entirely.

The propeller is a vital component of the aircraft. A mechanical failure of the propeller could cause a forced landing or create vibrations sufficiently severe to damage the aircraft, possibly causing it to become uncontrollable.

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

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

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

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

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

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

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

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REVISION 33 HIGHLIGHTS

Revision 33, dated September 2025, 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

- Revised the section, "General"
- Revised the section, "Propeller Critical Parts"

- INSTALLATION AND REMOVAL

- Revised the section, "Pre-Installation"
- Revised Figure 3-1, "Calculating Torque When Using a Torque Wrench Adapter"

INSPECTION AND CHECK

- Added the section, "Post-Flight Checks"
- Revised the section, "Operational Checks"
- Revised the section, "Required Periodic Inspections and Maintenance"
- Revised the section, "Inspection Procedures"

- RECORDS

- Revised the section, "Record Keeping"

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REVISION 33 HIGHLIGHTS1. Introduction

A. General

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

B. Components

- (1) Revision No. indicates the revisions incorporated in this manual.
- (2) Issue Date is the date of the revision.
- (3) Comments indicates the level of the revision.
 - (a) New Issue is a new manual distribution. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.
 - (b) Reissue is a revision to an existing manual that includes major content and/or major format changes. The manual is distributed in its entirety. All the page revision dates are the same and no change bars are used.
 - (c) Major Revision is a revision to an existing manual that includes major content or minor content changes over a large portion of the manual. The manual is distributed in its entirety. All the page revision dates are the same, but change bars are used to indicate the changes incorporated in the latest revision of the manual.
 - (d) Minor Revision is a revision to an existing manual that includes minor content changes to the manual. Only the revised pages of the manual are distributed. Each page retains the date and the change bars associated with the last revision to that page.

HARTZELL PROPELLER OWNER'S MANUAL

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<u>Revision No.</u>	<u>Issue Date</u>	<u>Comments</u>
Revision 8	Nov/99	Reissue
Revision 9	July/03	Minor Revision
Revision 10	Sep/07	Minor Revision
Revision 11	Nov/09	Minor Revision
Revision 12	Apr/11	Minor Revision
Revision 13	Aug/12	Minor Revision
Revision 14	Nov/12	Minor Revision
Revision 15	Feb/13	Minor Revision
Revision 16	May/13	Minor Revision
Revision 17	Mar/14	Minor Revision
Revision 18	Apr/14	Minor Revision
Revision 19	May/14	Minor Revision
Revision 20	Dec/14	Minor Revision
Revision 21	Oct/15	Minor Revision
Revision 22	Feb/16	Minor Revision
Revision 23	Oct/17	Minor Revision
Revision 24	Jul/18	Minor Revision
Revision 25	Apr/19	Minor Revision
Revision 26	May/20	Major Revision
Revision 27	Jul/20	Minor Revision
Revision 28	Jun/21	Minor Revision
Revision 29	Oct/22	Minor Revision
Revision 30	Aug/23	Major Revision
Revision 31	Dec/23	Minor Revision
Revision 32	Sep/24	Minor Revision
Revision 33	Sep/25	Minor Revision

RECORD OF REVISIONS

This is a record of revisions inserted into this manual.
Revision 30 includes all prior revisions.

Revision Number	Issue Date	Date Inserted	Inserted By
30	Aug/23	Aug/23	HPI
31	Dec/23	Dec/23	HPI
32	Sep/24	Sep/24	Hartzell
33	Sep/25	Sep/25	Hartzell

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All Temporary Revisions are included in Revision 30,
up to and including TR-002.

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SERVICE DOCUMENTS LIST

CAUTION 1: DO NOT USE OBSOLETE OR OUTDATED INFORMATION. PERFORM ALL INSPECTIONS OR WORK IN ACCORDANCE WITH THE MOST RECENT REVISION OF 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
Service Bulletins:	
HC-SB-61-181A, Rev. 1	Rev. 10 Sep/07
HC-SB-61-181A, Rev. 4	Rev. 12 Apr/11
HC-SB-61-181A, Rev. 6	Rev. 24 Jul/18
HC-SB-61-225, Rev. 3	Rev. 10 Sep/07
HC-SB-61-312	Rev. 11 Nov/09

SERVICE DOCUMENTS LIST

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AIRWORTHINESS LIMITATIONS

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

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by: **Paul (Vu) Nguyen** date: 12/01/23

Manager, Central Certification Branch
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HARTZELL PROPELLER OWNER'S MANUAL**149**

Rev. No.	Description of Revision
11	Added airworthiness limitation information from Hartzell Propeller Inc. Overhaul Manual 141 (61-10-41), Hartzell Propeller Inc. Overhaul Manual 142 (61-10-42), and Hartzell Propeller Inc. Overhaul Manual 158A (61-10-58). Added hub unit limits and revised blade life limits for propeller model HC-D4N-5(C,E)/D9327K. Removed hub life limit and inspection for propeller model HC-E4W-5L/JE10305(B).
14	Added a hub unit life limit and a blade life limit for propeller model HC-E4A-2/E9673S
16	Added a blade life limit for propeller model HC-E4N-2D/E9512G(B)-1, removed the inspection requirement for propeller model HC-E4W-5L/JE10305(B)
18	Added a blade life limit and a hub unit life limit for propeller model HC-E5N-3A(L)/(H,L)E8492
20	Added additional Engine Exhaust Stubs for the HC-E5N-3(A)/HE8218 and the HC-E5N-3(A)/LE8218 propellers installed on the Piaggio P180.
24	Revised the periodic inspection for the HC-E5N-3(A)(L)/HE8218 propeller installed on the Piaggio P180 aircraft with Pratt & Whitney PT6A-66 engines. Added the Korea Aerospace Industries KT-1S Aircraft for a blade life limit on the HC-E4N-2D/E9512G(B)-1 propeller.
29	Revised the Military Aircraft for the HC-E4A-2(A)/E9612(K) propeller installed on the Hawker Beechcraft Model 3000 aircraft with Pratt & Whitney PT6A-68 engines.
31	Added hub and cylinder life limits on the HC-E4N-3KU/E9512S(K) propeller installed on the Fadea Pucara IA-58 aircraft with Pratt & Whitney PT6A-62 engines.
32	Added hub life limits on the HC-E4N-5KE/E9327(K) propeller installed on the Hindustan HTT-40 aircraft with Honeywell (Garrett) Model TPE331-12B engines. Removed references to "Hartzell Propeller Inc.". Revised to "Hartzell Propeller LLC", where applicable.

AIRWORTHINESS LIMITATIONS1. Replacement Time (Life Limits)

- A. The FAA establishes specific life limits for certain component parts, as well as the entire propeller. Such limits require replacement of the identified parts after a specified number of hours of use.
- B. The following data summarizes all current information concerning Hartzell Propeller LLC life limited parts as related to propeller models affected by this manual. These parts are not life limited on other installations; however, time accumulated toward life limit accrues when first operated on aircraft/engine/propeller combinations listed, and continues regardless of subsequent installations (which may or may not be life limited).

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AIRWORTHINESS LIMITATIONS

- (1) The following list specifies life limits for blades only. Associated hub parts are not affected. Blade models shown are life limited only on the specified applications.

PROPELLER MODELS ON FAA TYPE CERTIFIED AIRCRAFT	
Aircraft/Engine/Propeller	Blade Life Limit
Aircraft: Hawker Beechcraft Model 3000 (US Military T-6A) Engine: Pratt & Whitney Model PT6A-68 Propeller: HC-E4A-2(A)/E9612(K)	19,497 hours
Aircraft: Hawker Beechcraft Model 3000 (US Military T-6B) Engine: Pratt & Whitney Model PT6A-68 Propeller: HC-E4A-2(A)/E9612(K)	19,497 hours
Aircraft: Hawker Beechcraft Model AT-6 Engine: Pratt & Whitney Model PT6A-68D Propeller: HC-E4A-2/E9673S	7,400 hours
Aircraft: Shorts Model T Mk 1 Tucano Engine: Honeywell (Garrett) Model TPE331-12B Propeller: HC-D4N-5(C,E)/D9327K	41,300 hours

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HARTZELL PROPELLER OWNER'S MANUAL

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AIRWORTHINESS LIMITATIONS

PROPELLER MODELS ON FAA TYPE CERTIFIED AIRCRAFT, CONTINUED	
Aircraft/Engine/Propeller	Blade Life Limit
Aircraft: Piaggio P-180 Avanti that uses nacelles 80-336005-801 /80-336006-801 and exhaust stub 80-336013-801 Engine: Pratt & Whitney Model PT6A-66 Propeller: HC-E5N-3(A) (L)/(H,L)E8218	1,500 hours (For complete life limit criteria, refer to paragraph 2 in this section.)
Aircraft: Piaggio P-180 Avanti that uses nacelles 80-336213-801 /80-336214-801 and exhaust stub 80-336013-801 Engine: Pratt & Whitney Model PT6A-66 Propeller: HC-E5N-3(A) (L)/(H,L)E8218	3,000 hours (For complete life limit criteria, refer to paragraph 2 in this section.)
Aircraft: Piaggio P-180 Avanti that uses the following: <u>L/H Aft Nacelle/R/H Aft Nacelle</u> 80-336213-803/80-336214-803 80-336213-805/80-336214-805 80-336250-801/80-336251-801 80-336250-803/80-336251-803 <u>Exhaust Stub</u> 80-336013-803 or 80-336091-801 80-337984-801 80-336013-803 or 80-336091-801 80-336013-803 or 80-336091-801 Engine: Pratt & Whitney Model PT6A-66(B) Propeller: HC-E5N-3(A) (L)/(H,L)E8218	9,000 hours (For complete life limit criteria, refer to paragraph 2 in this section.)
Aircraft: Piaggio Aero Industries P-180 that uses rear nacelle 81-336033-801 and engine exhaust duct 81-336035-801 Engine: Pratt & Whitney Model PT6A-66B Propeller: HC-E5N-3A(L)/(H,L)E8492	9,000 hours

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AIRWORTHINESS LIMITATIONS

PROPELLER MODELS ON AIRCRAFT WITHOUT AN FAA TYPE CERTIFICATE	
Aircraft/Engine/Propeller	Blade Life Limit
Aircraft: Pilatus Model PC-9 Engine: Pratt & Whitney Model PT6A-62B Propeller: HC-D4N-2AA/D9512AE(K)	9,000 hours
Aircraft: Pilatus Model PC-9 Engine: Pratt & Whitney Model PT6A-62B Propeller: HC-D4N-2G/D9512AE(K)	9,000 hours
Aircraft: Pilatus Model PC7 MK II Engine: Pratt & Whitney Model PT6A-25C Propeller: HC-D4N-2D/D9512A(K)	11,500 hours
Aircraft: Pilatus Model PC7 MK II Engine: Pratt & Whitney Model PT6A-25C Propeller: HC-D4N-2E/D9512A(K)	11,500 hours
Aircraft: Pilatus Model PC-9 Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-D4N-2A/D9512A(B,K)	11,500 hours
Aircraft: Pilatus Model PC-9 Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-D4N-2F/D9512A(B,K)	11,500 hours

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AIRWORTHINESS LIMITATIONS

PROPELLER MODELS ON AIRCRAFT WITHOUT AN FAA TYPE CERTIFICATE, CONTINUED	
Aircraft/Engine/Propeller	Blade Life Limit
Aircraft: Korea Aerospace Industries Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-E4N-2/E9512CB-1	7,100 hours
Aircraft: Korea Aerospace Industries KO-1 Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-E4N-2B/E9512DB-1	7,600 hours
Aircraft: Korea Aerospace Industries KT-1C and KT-1T Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-E4N-2C/E9512CB-1	7,100 hours
Aircraft: Korea Aerospace Industries KT-1P and KT-1S Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-E4N-2D/E9512G(B)-1	7,100 hours
Aircraft: EADS-PZL Warszawa Okecie PZL-130TCII Engine: Pratt & Whitney Model PT6A-25C Propeller: HC-D4N-2DA/D9512AF	32,500 hours

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AIRWORTHINESS LIMITATIONS

- (2) The following list specifies life limits for propeller hubs only. Hubs listed are life limited only on the specified applications.

PROPELLER MODELS ON FAA TYPE CERTIFIED AIRCRAFT	
Aircraft/Engine/Propeller	Hub Unit Life Limit
Aircraft: Hawker Beechcraft Model 3000 (US Military T-6A) Engine: Pratt & Whitney Model PT6A-68 Propeller: HC-E4A-2(A)/E9612(K)	19,497 hours
Aircraft: Hawker Beechcraft Model 3000 IAUP (US Military T-6B) Engine: Pratt & Whitney Model PT6A-68 Propeller: HC-E4A-2(A)/E9612(K)	19,497 hours
Aircraft: Hawker Beechcraft Model AT-6 Engine: Pratt & Whitney Model PT6A-68D Propeller: HC-E4A-2/E9673S	19,497 hours
Aircraft: Shorts Model T Mk 1 Tucano Engine: Honeywell (Garrett) Model TPE331-12B Propeller: HC-D4N-5(C,E)/D9327K	59,600 hours

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PROPELLER MODELS ON FAA TYPE CERTIFIED AIRCRAFT, CONTINUED		
Aircraft/Engine/Propeller	Hub Life Limit	
Aircraft: Piaggio P-180 Avanti that uses nacelles 80-336005-801 /80-336006-801 and exhaust stub 80-336013-801 Engine: Pratt & Whitney Model PT6A-66 Propeller: HC-E5N-3(A) (L)/(H,L)E8218	1,500 hours (For complete life limit criteria, refer to paragraph 2 in this section.)	
Aircraft: Piaggio P-180 Avanti that uses nacelles 80-336213-801 /80-336214-801 and exhaust stub 80-336013-801 Engine: Pratt & Whitney Model PT6A-66 Propeller: HC-E5N-3(A) (L)/(H,L)E8218	3,000 hours (For complete life limit criteria, refer to paragraph 2 in this section.)	
Aircraft: Piaggio P-180 Avanti that uses the following: <u>L/H Aft Nacelle/R/H Aft Nacelle Exhaust Stub</u> 80-336213-803/80-336214-803 80-336013-803 or 80-336091-801 80-336213-805/80-336214-805 80-337984-801 80-336250-801/80-336251-801 80-336013-803 or 80-336091-801 80-336250-803/80-336251-803 80-336013-803 or 80-336091-801 Engine: Pratt & Whitney Model PT6A-66 Propeller: HC-E5N-3(A) (L)/(H,L)E8218	18,000 hours (For complete life limit criteria, refer to paragraph 2 in this section.)	
Aircraft: Piaggio Aero Industries P-180 that uses rear nacelle 81-336033-801 and engine exhaust duct 81-336035-801 Engine: Pratt & Whitney Model PT6A-66B Propeller: HC-E5N-3A(L)/(H,L)E8492	14,800 hours	

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AIRWORTHINESS LIMITATIONS

PROPELLER MODELS ON AIRCRAFT WITHOUT AN FAA TYPE CERTIFICATE	
Aircraft/Engine/Propeller	Hub Life Limit
Aircraft: EADS-PZL Warszawa Okecie PZL-130TCII Engine: Pratt & Whitney Model PT6A-25C Propeller: HC-D4N-2DA/D9512AF	5,500 hours
Aircraft: Fadea Pucara IA-58 Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-E4N-3KU/E9512S(K)	21,000 hours
Aircraft: Hindustan HTT-40 Engine: Honeywell (Garrett) Model TPE331-12B Propeller: HC-E4N-5KE/E9327(K)	23,569 hours

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date: 09/04/2024

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

AIRWORTHINESS LIMITATIONS

PROPELLER MODELS ON AIRCRAFT WITHOUT AN FAA TYPE CERTIFICATE	
Aircraft/Engine/Propeller	Cylinder Life Limit
Aircraft: F4U Corsair IA-58 Engine: Pratt & Whitney Model PT6A-62 Propeller: HC-E4N-3KU/E9512S(K)	33,333 hours

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Roy E Boffo III For

by: Paul (Vu) Nguyen

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AIRWORTHINESS LIMITATIONS2. HC-E5N-3(A)(L)/(H.L)E8218

- A. Propeller hub and blades of HC-E5N-3() (), for Piaggio P-180 aircraft with Pratt & Whitney PT6A-66 engines, are life limited at 1500 hours and must be retired from service if they have ever been installed on an aircraft with nacelle p/n 80-336005-801 and 80-336006-801 and exhaust stub p/n 80-336013-801 before incorporation of Piaggio Service Bulletin SB-80-0022.
- B. Propeller hub and blades of HC-E5N-3() (), for Piaggio P-180 aircraft with Pratt & Whitney PT6A-66 engines, are life limited at 3000 hours and must be retired from service if they have ever been installed on an aircraft with nacelle p/n 80-336213-801 and 80-336214-801 and exhaust stub p/n 80-336013-801 before incorporation of Piaggio Service Bulletin SB-80-0022.
- C. Propeller hub of HC-E5N-3() (), for Piaggio P-180 aircraft with Pratt & Whitney PT6A-66(B) engines, is life limited at 18,000 hours and must be retired from service if it has been installed on an aircraft since new with:
- 1) Nacelle p/n 80-336213-803 and 80-336214-803 and exhaust stub p/n 80-336013-803 or 80-336091-801; or
 - 2) Nacelle p/n 80-336213-805 and 80-336214-805 and exhaust stub p/n 80-337984-801; or
 - 3) Nacelle p/n 80-336250-801 and 80-336251-801 and exhaust stub p/n 80-336013-803 or 80-336091-801; or
 - 4) Nacelle p/n 80-336250-803 and 80-336251-803 and exhaust stub p/n 80-336013-803 or 80-336091-801; or
 - 5) Incorporates Piaggio Service Bulletin SB-80-0022 since new.

Any propeller that was operated on an aircraft before incorporation of SB-80-0022 is not eligible for the 18,000 hour hub service life.

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AIRWORTHINESS LIMITATIONS

- D. Propeller blades of HC-E5N-3() (), for Piaggio P-180 aircraft with Pratt & Whitney PT6A-66(B) engines, are life limited at 9000 hours and must be retired from service if they have been installed on an aircraft since new with:
- 1) Nacelle p/n 80-336213-803 and 80-336214-803 and exhaust stub p/n 80-336013-803 or 80-336091-801; or
 - 2) Nacelle p/n 80-336213-805 and 80-336214-805 and exhaust stub p/n 80-337984-801; or
 - 3) Nacelle p/n 80-336250-801 and 80-336251-801 and exhaust stub p/n 80-336013-803 or 80-336091-801; or
 - 4) Nacelle p/n 80-336250-803 and 80-336251-803 and exhaust stub p/n 80-336013-803 or 80-336091-801; or
 - 5) Incorporates Piaggio Service Bulletin SB-80-0022 since new.

Any propeller that was operated on an aircraft before incorporation of SB-80-0022 is not eligible for the 9000 hour blade service life.

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for
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AIRWORTHINESS LIMITATIONS3. Periodic Inspections

A. For propeller model HC-E5N-3(A)(L)/(H,L)E8218 used on Piaggio P-180 aircraft with Pratt & Whitney PT6A-66 engines:

- (1) Beginning with an inspection at 1500 hours time in service, propeller blades that have part numbers HE8218 and LE8218, must be inspected for corrosion/paint every 12 months or 200 hours of operation, whichever occurs first, in accordance with Hartzell Propeller Service Bulletin HC-SB-61-181A.

B. For propeller model HC-E5N-3A(L)/(H,L)E8492 used on Piaggio P-180 aircraft with Pratt & Whitney PT6A-66 engines:

- (1) Propeller blade corrosion/paint inspections must be performed at regular intervals as specified in Hartzell Propeller Service Bulletin HC-SB-61-181A.

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by: date: 8/8/18

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Compliance & Airworthiness Division, AIR-7CO
Federal Aviation Administration

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1. General (Rev. 2)

A. Statement of Purpose

- (1) This manual has been reviewed and accepted by the FAA. Additionally, the Airworthiness Limitations section of this manual has been approved by the FAA.

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

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

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

- (3) This manual may include multiple design types.

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

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

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

B. Maintenance Practices

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

- (2) Never attempt to move the aircraft by pulling on the propeller.
- (3) Avoid the use of blade paddles. If blade paddles must be used, use at least two paddles. Do not put the blade paddle in the area of the de-ice or anti-icing boot when applying torque to a blade assembly. Put the blade paddle in the thickest area of the blade, just outside of the de-ice or anti-icing boot. Use one blade paddle per blade.
- (4) Use only the approved consumables, e.g., cleaning agents, lubricants, etc.
- (5) Observe applicable torque values during maintenance.
- (6) Propellers must be statically balanced before installing on the engine.
 - (a) Hartzell Propeller statically balances all new propellers.
 - (b) Overhauled propellers must be statically balanced by a certified propeller repair station with the appropriate rating before return to service.
- (7) Dynamic balance is recommended, but may be accomplished at the discretion of the operator, unless specifically required by the airframe or engine manufacturer.
 - (a) Perform dynamic balancing in accordance with the Maintenance Practices chapter of this manual.
 - (b) Additional procedures may be found in the aircraft maintenance manual.
- (8) As necessary, use a soft, non-graphite pencil or crayon to make identifying marks on components.
- (9) As applicable, follow military standard NASM33540 for safety wire, safety cable, and cotter pin general practices. Use 0.032 inch (0.81 mm) diameter stainless steel safety wire unless otherwise indicated.
- (10) The information in this manual revision supersedes data in all previously published revisions of this manual.

- (11) The airframe manufacturer's manuals should be used in addition to the information in this manual due to possible special requirements for specific aircraft applications.
- (12) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller, applicable instructions and technical information for the components can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).
- (13) Propeller ice protection system components not supplied by Hartzell Propeller are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (14) Approved corrosion protection followed by approved paint must be applied to all aluminum blades.
 - (a) For information about the application of corrosion protection and paint, refer to the Maintenance Practices chapter of this manual. Operation of blades without the specified coatings and finishes, i.e., "polished blades", is not permitted.

2. Airframe or Engine Modifications (Rev. 2)

A. Propeller Stress Levels

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

B. Engine Modifications

- (1) Engine modifications can affect the propeller. The two primary categories of engine modifications are those that affect structure and those that affect power. An example of a structural engine modification is the alteration of the crankshaft or damper of a piston engine. Any change to the weight, stiffness, or tuning of rotating components could result in a potentially dangerous resonant condition that is not detectable by the pilot. Most common engine modifications affect the power during some phase of operation. Some modifications increase the maximum power output, while others improve the power available during hot and high operation (flat rating) or at off-peak conditions.
 - (a) Examples of turbine engine modifications include, but are not limited to: changes to the compressor, power turbine or hot section of a turboprop engine.
 - (b) Examples of reciprocating engine modifications include, but are not limited to: the addition or alteration of a turbocharger or turbonormalizer, increased compression ratio, increased RPM, altered ignition timing, electronic ignition, full authority digital electronic controls (FADEC), or tuned induction or exhaust.
- (2) All such modifications must be reviewed and approved by the propeller manufacturer prior to obtaining approval on the aircraft.

3. Restrictions and Placards (Rev. 1)

A. Important Information

- (1) The propellers covered by this manual may have a restricted operating range that requires a cockpit placard.
 - (a) The restrictions, if present, will vary depending on the propeller, blade, engine, and/or aircraft model.
 - (b) Review the propeller and aircraft type certificate data sheet (TCDS), Pilot Operating Handbook (POH), and any applicable Airworthiness Directives for specific information.

4. Reference Publications

A. Hartzell Propeller Publications

- (1) Information published in Service Bulletins, Service Letters, Service Advisories, and Service Instructions may supersede information published in this manual. The reader must consult active Service Bulletins, Service Letters, Service Advisories, and Service Instructions for information that may have not yet been incorporated into the latest revision of this manual.
- (2) Some manuals are available on the Hartzell Propeller website at www.hartzellprop.com. The complete Hartzell Propeller Technical Library is available by subscription.
- (3) In addition to this manual, one or more of the following publications are required for information regarding specific recommendations and procedures to maintain propeller assemblies that are included in this manual.

Manual No. (ATA No.)	Hartzell Propeller Manual Title
n/a	Active Hartzell Propeller Service Bulletins, Service Letters, Service Instructions, and Service Advisories
Manual 127 (61-16-27)	Metal Spinner Maintenance Manual
Manual 133C (61-13-33)	Aluminum Blade Overhaul Manual
Manual 141 (61-10-41)	Four Blade Lightweight Turbine Propeller Overhaul Manual
Manual 142 (61-10-42)	Four Blade Lightweight Turbine Propeller Overhaul Manual
Manual 143A (61-10-43)	Four Blade Lightweight Turbine Propeller Overhaul Manual

Manual No. (ATA No.)	Hartzell Propeller Manual Title
Manual 158A (61-10-58)	Five Blade Lightweight Turbine Propeller Overhaul Manual
Manual 159 (61-02-59)	Application Guide
Manual 165A (61-00-65)	Illustrated Tool and Equipment Manual
Manual 180 (30-61-80)	Ice Protection System Manual
Manual 202A (61-01-02)	Standard Practices Manual, Volumes 1 through 11

B. Vendor Publications
None.

5. Personnel Requirements (Rev. 3)

A. Service and Maintenance Procedures in this Manual

- (1) Personnel performing the service and maintenance procedures in this manual are expected to have the required equipment/tooling, training, and certifications (when required by the applicable Aviation Authority) to accomplish the work in a safe and airworthy manner.
- (2) Compliance to the applicable regulatory requirements established by the Federal Aviation Administration (FAA) or international equivalent is mandatory for anyone performing or accepting responsibility for the inspection and/or repair of any Hartzell Propeller LLC product.
 - (a) Maintenance records must be kept in accordance with the requirements established by the Federal Aviation Administration (FAA) or international equivalent.
 - (b) Refer to Title 14 Code of Federal Regulations (CFR) Part 43 for additional information about general aviation maintenance requirements.

6. Special Tooling and Consumable Materials (Rev. 2)

A. Special Tooling

(1) Special tooling may be required for procedures in this manual. For further tooling information, refer to Hartzell Propeller Illustrated Tool and Equipment Manual 165A (61-00-65).

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

B. Consumable Materials

(1) Consumable materials are referenced in certain sections throughout this manual. Specific approved materials are listed in the Consumable Materials chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

(a) Consumable material reference numbers appear with the prefix "CM" directly following the material to which they apply. For example, an adhesive that is reference number 16 will appear as: adhesive CM16. Only the material(s) specified can be used.

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

A. Instructions for Use

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

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

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

8. Calendar Limits and Long Term Storage (Rev. 3)**A. Calendar Limits**

- (1) The effects of exposure to the environment over a period of time create a need for propeller overhaul regardless of flight time.
- (2) A calendar limit between overhauls is specified in Hartzell Propeller Service Letter HC-SL-61-61Y.
- (3) Experience has shown that special care, such as keeping an aircraft in a hangar, is not sufficient to permit extension of the calendar limit.
- (4) The start date for the calendar limit is when the propeller is first installed on an engine.
- (5) The calendar limit is not interrupted by subsequent removal and/or storage.
- (6) The start date for the calendar limit must not be confused with the warranty start date, that is with certain exceptions, the date of installation by the first retail customer.

B. Long Term Storage

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

9. Component Life and Overhaul (Rev. 3)

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

A. Component Life

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

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

- (2) Time Since New (TSN) and Time Since Overhaul (TSO) records for the propeller hub and blades must be maintained in the propeller logbook.
- (3) Both TSN and TSO are necessary for defining the life of the component. Certain components, or in some cases an entire propeller, may be "life limited", which means that they must be replaced after a specified period of use (TSN).
- (a) It is a regulatory requirement that a record of the Time Since New (TSN) be maintained for all life limited parts.
- (b) Refer to the Airworthiness Limitations chapter in the applicable Hartzell Propeller Owner's Manual for a list of life limited components.

- (4) When a component or assembly undergoes an overhaul, the TSO is returned to zero hours.
- (a) Time Since New (TSN) can never be returned to zero.
 - (b) Repair without overhaul does not affect TSO or TSN.
- (5) Blades and hubs are sometimes replaced while in service or at overhaul.
- (a) Maintaining separate TSN and TSO histories for a replacement hub or blade is required.
 - (b) Hub replacement
 - 1 If the hub is replaced, the replacement hub serial number must be recorded (the entry signed and dated) in the propeller logbook.
 - 2 The propeller will be identified with the serial number of the replacement hub.

NOTE: Propeller assembly serial numbers are impression stamped on the hub. For stamping information, refer to the Parts Identification and Marking chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).
 - 3 The TSN and TSO of the replacement hub must be recorded and maintained in the propeller logbook.
 - 4 If tracking any component(s) other than the hub/blades, maintain these TSN/TSO records separately in the propeller logbook.

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

B. Overhaul

- (1) Overhaul is the periodic disassembly, cleaning, inspecting, repairing as necessary, reassembling, and testing in accordance with approved standards and technical data approved by Hartzell Propeller LLC.
- (2) The overhaul interval is based on hours of service, i.e., flight time, or on calendar time.
 - (a) Overhaul intervals are specified in Hartzell Propeller Service Letter HC-SL-61-61Y.
 - (b) At such specified periods, the propeller hub assembly and the blade assemblies must be completely disassembled and inspected for cracks, wear, corrosion, and other unusual or abnormal conditions.
- (3) Overhaul must be completed in accordance with the latest revision of the applicable component maintenance manual and other publications applicable to, or referenced in, the component maintenance manual.
 - (a) Parts that are not replaced at overhaul must be inspected in accordance with the check criteria in the applicable Hartzell Propeller component maintenance manual.
 - (b) Parts that must be replaced at overhaul are identified by a "Y" in the O/H column of the Illustrated Parts List in the applicable Hartzell Propeller component maintenance manual.
- (4) The information in this manual supersedes data in all previously published revisions of this manual.

10. Damage/Repair Types (Rev. 2)**A. Airworthy/Unairworthy Damage**

- (1) Airworthy damage is a specific condition to a propeller component that is within the airworthy damage limits specified in the applicable Hartzell Propeller component maintenance manual.
 - (a) Airworthy damage does not affect the safety or flight characteristics of the propeller and conforms to its type design.
 - (b) Airworthy damage does not require repair before further flight, but should be repaired as soon as possible to prevent degradation of the damage.
- (2) Unairworthy damage is a specific condition to a propeller component that exceeds the airworthy damage limits specified in the applicable Hartzell Propeller component maintenance manual.
 - (a) Unairworthy damage can affect the safety or flight characteristics of the propeller and does not conform to its type design.
 - (b) Unairworthy damage must be repaired before the propeller is returned to service.

B. Minor/Major Repair**(1) Minor Repair**

- (a) Minor repair is that which may be done safely in the field by a certified aircraft mechanic.
 - 1 For serviceable limits and repair criteria for Hartzell propeller components, refer to the applicable Hartzell Propeller component maintenance manual.

(2) Major Repair

- (a) Major repair cannot be done by elementary operations.
- (b) Major repair work must be accepted by an individual that is certified by the Federal Aviation Administration (FAA) or international equivalent.
 - 1 Hartzell recommends that individuals performing major repairs also have a Factory Training Certificate from Hartzell Propeller LLC.
 - 2 The repair station must meet facility, tooling, and personnel requirements and is required to participate in Hartzell Propeller Sample Programs as defined in the Approved Facilities chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02).

11. Propeller Critical Parts (Rev. 2)

A. Important Information

- (1) Procedures in this manual may involve Propeller Critical Parts (PCP).
 - (a) These procedures have been substantiated based on Engineering analysis that expects this product will be operated and maintained using the procedures and inspections provided in the Instructions for Continued Airworthiness (ICA) for this product.
 - (b) Refer to the Illustrated Parts List chapter in the applicable Hartzell Propeller maintenance manual to identify the Propeller Critical Parts.
- (2) Numerous propeller system parts can produce a propeller Major or Hazardous effect, even though those parts may not be considered as Propeller Critical Parts.
 - (a) The operating and maintenance procedures and inspections provided in the ICA for this product are, therefore, expected to be accomplished for all propeller system parts.

12. Warranty Service (Rev. 2)

A. Warranty Claims

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

13. Hartzell Propeller Contact Information (Rev. 3)

A. Product Support Department

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

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

- (a) The Product Support Department may be reached during business hours (8:00 a.m. through 5:00 p.m., United States Eastern Time) at (937) 778-4379 or at (800) 942-7767, toll free from the United States and Canada.
- (b) The Product Support Department can also be reached by fax at (937) 778-4215, and by e-mail at techsupport@hartzellprop.com.

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

- 1 A technical representative will contact you during normal business hours.
- 2 Urgent AOG support is also available 24 hours per day, seven days per week via this message service.

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

B. Technical Publications Department

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

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

Telephone: 937.778.4200

Fax: 937.778.4215

E-mail: manuals@hartzellprop.com

C. Recommended Facilities

- (1) Hartzell Propeller LLC recommends using Hartzell-approved distributors and repair facilities for the purchase, repair, and overhaul of Hartzell propeller assemblies or components.
- (2) Information about the Hartzell Propeller LLC worldwide network of aftermarket distributors and approved repair facilities is available on the Hartzell website at www.hartzellprop.com.

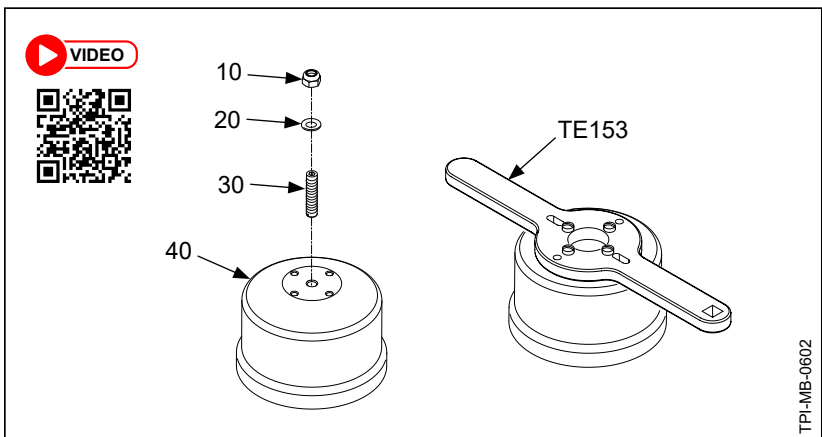
14. "Video" Icon/QR Code

A. Instructions for Use

- (1) The "Video" icon/QR code (refer to Figure 1) that appears in this manual allows you to access a video or animated demonstration of the applicable procedure.

CAUTION: THESE VIDEOS/ANIMATIONS ARE INTENDED TO SUPPLEMENT THE APPLICABLE INSTRUCTIONS. THEY SHOULD NOT BE USED WITHOUT FIRST READING AND UNDERSTANDING THE LATEST REVISION OF THE PROCEDURE AND ANY APPLICABLE WARNINGS/CAUTIONS.

- (2) To access the video/animated demonstration:
 - (a) If viewing the document file digitally:
 - 1 Click on the QR code
 - (b) From a printed copy of the page:
 - 1 Scan the QR code from any mobile device equipped with a QR reader application.



"Video" Icon/QR Code
Figure 1

15. **Definitions** (Rev. 5)

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

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

Term	Definition
Blade Centerline	An imaginary reference line through the length of a blade around which the blade rotates
Blade Station	Refers to a location on an individual blade for blade inspection purposes. It is a measurement from the blade “zero” station to a location on a blade, used to apply blade specification data in blade overhaul manuals. <u>NOTE:</u> Do not confuse <i>blade station</i> with <i>reference blade radius</i> ; they may not originate at the same location.
Blemish	An imperfection with visible attributes, but having no impact on safety or utility
Brinelling	A depression caused by failure of the material in compression
Bulge	An outward curve or bend
Camber	The surface of the blade that is directed toward the front of the aircraft. It is the low pressure, or suction, side of the blade. The camber side is convex in shape over the entire length of the blade.
Chord	A straight line between the leading and trailing edges of an airfoil
Chordwise	A direction that is generally from the leading edge to the trailing edge of an airfoil
Co-bonded	The act of bonding a composite laminate and simultaneously curing it to some other prepared surface

Term	Definition
Composite Material	Kevlar®, carbon, or fiberglass fibers bound together with, or encapsulated within an epoxy resin
Compression Rolling	A process that provides improved strength and resistance to fatigue
Constant Force	A force that is always present in some degree when the propeller is operating
Constant Speed	A propeller system that employs a governing device to maintain a selected engine RPM
Corrosion (Aluminum)	The chemical or electrochemical attack by an acid or alkaline that reacts with the protective oxide layer and results in damage of the base aluminum. Part failure can occur from corrosion due to loss of structural aluminum converted to corrosion product, pitting, a rough etched surface finish, and other strength reduction damage caused by corrosion.
Corrosion (Steel)	Typically, an electrochemical process that requires the simultaneous presence of iron (component of steel), moisture and oxygen. The iron is the reducing agent (gives up electrons) while the oxygen is the oxidizing agent (gains electrons). Iron or an iron alloy such as steel is oxidized in the presence of moisture and oxygen to produce rust. Corrosion is accelerated in the presence of salty water or acid rain. Part failure can occur from corrosion due to loss of structural steel converted to corrosion product, pitting, a rough etched surface finish and other strength reduction damage caused by corrosion.

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

Term	Definition
Depression	Surface area where the material has been compressed but not removed
Distortion	Alteration of the original shape or size of a component
Edge Alignment	Distance from the blade centerline to the leading edge of the blade
Erosion	Gradual wearing away or deterioration due to action of the elements
Exposure	Leaving material open to action of the elements
Face	The surface of the blade that is directed toward the rear of the aircraft. The face side is the high pressure, or thrusting, side of the blade. The blade airfoil sections are normally cambered or curved such that the face side of the blade may be flat or even concave in the midblade and tip region.
Face Alignment	Distance from the blade centerline to the highest point on the face side perpendicular to the chord line
Feathering	The capability of blades to be rotated parallel to the relative wind, thus reducing aerodynamic drag
Fraying	A raveling or shredding of material
Fretting	Damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface
Galling	To fret or wear away by friction

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

Term	Definition
Monocoque	A type of construction in which the outer skin carries all or a major part of the load
Nick	Removal of paint and possibly a small amount of material
Non-Aviation Certified	Intended for non-aircraft application, such as Hovercraft or Wing in Ground effect (WIG) applications. These products are certificated by an authority other than FAA. The hub and blades will be stamped with an identification that is different from, but comparable to TC and PC.
Non-Aviation Experimental	Intended for non-aircraft application, such as Hovercraft or Wing-In-Ground effect (WIG) applications. Products marked with an "X" at or near the end of the model number or part number are not certified by any authority and are not intended for use on certificated craft.
Onspeed	Condition in which the RPM selected by the pilot through the propeller control/condition lever and the actual engine (propeller) RPM are equal
Open Circuit	Connection of high or infinite resistance between points in a circuit which are normally lower
Outboard	Toward the tip of the blade
Overhaul	The periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly to maintain airworthiness

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/condition lever
Pitch	Same as “Blade Angle”
Pitting	Formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear
Pitting (Linear)	The configuration of the majority of pits forming a pattern in the shape of a line
Porosity	An aggregation of microvoids. See “voids”.
Propeller Critical Parts	A part on the propeller whose primary failure can result in a hazardous propeller effect, as determined by the safety analysis required by Title 14 CFR section 35.15
Reference Blade Radius	Refers to the propeller reference blade radius in an assembled propeller, e.g., 30-inch radius. A measurement from the propeller hub centerline to a point on a blade, used for blade angle measurement in an assembled propeller. An adhesive stripe (blade angle reference tape CM160) is usually located at the reference blade radius location. <u>NOTE:</u> Do not confuse <i>reference blade radius</i> with <i>blade station</i> ; they may not originate at the same point.
Reversing	The capability of rotating blades to a position to generate reverse thrust to slow the aircraft or back up

Term	Definition
Scratch	Same as "Nick"
Short Circuit	Connection of low resistance between points on a circuit between which the resistance is normally much greater
Shot Peening	Process where steel shot is impinged on a surface to create compressive surface stress, that provides improved strength and resistance to fatigue
Single Acting	Hydraulically actuated propeller that utilizes a single oil supply for pitch control
Split	Delamination of blade extending to the blade surface, normally found near the trailing edge or tip
Station Line	See "Blade Station"
Synchronizing	Adjusting the RPM of all the propellers of a multi-engine aircraft to the same RPM
Synchrophasing	A form of propeller synchronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other
Ticking	A series of parallel marks or scratches running circumferentially around the diameter of the blade
Track	In an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly

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

16. Abbreviations (Rev. 2)

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

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

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

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1. Description of Propellers and Systems

A. Feathering Propeller HC-(D,E)4()-2() Series

The propellers described in this section are constant speed and feathering. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. The propellers have four blades and are used primarily on Pratt & Whitney turbine engines.

A two piece aluminum hub retains each propeller blade on a thrust bearing. A cylinder is threaded onto the hub and contains a feathering spring and piston. The hydraulically actuated piston transmits linear motion through a pitch change rod and fork to each blade to result in blade angle change.

While the propeller is operating, the following forces are constantly present: 1) spring force, 2) counterweight force, 3) centrifugal twisting moment of each blade and 4) blade aerodynamic twisting forces. The spring and counterweight forces attempt to rotate the blades to higher blade angle while the centrifugal twisting moment of each blade is generally toward lower blade angle. Blade aerodynamic twisting force is generally very small in relation to the other forces and can attempt to increase or decrease blade angle.

The summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump that is mounted on and driven by the engine. The oil from the governor is supplied to the propeller and hydraulic piston through a hollow engine shaft. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM. Decreasing the volume of oil will increase blade angle and decrease propeller RPM. By changing the blade angle, the governor can vary the load on the engine and maintain constant engine RPM (within limits), independent of where the power lever is set. The governor uses engine speed sensing mechanisms that allow it to supply or drain oil as necessary to maintain constant engine speed (RPM).

If governor supplied oil is lost during operation, the propeller will increase pitch and feather. Feathering occurs because the summation of internal propeller forces causes the oil to drain out of the propeller until the feather stop position is reached.

Normal in-flight feathering is accomplished when the pilot retards the propeller condition lever past the feather detent. This allows control oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

Normal in-flight unfeathering is accomplished when the pilot positions the propeller condition lever into the normal flight (governing) range and restarts the engine. As engine speed increases, the governor supplies oil to the propeller and the blade angle decreases.

B. Feathering and Reversing Propellers
HC-(D,E)(4,5)()-3() Series

The propellers described in this section are constant speed, feathering, and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. The propellers may have four or five blades and are used primarily on Pratt & Whitney turbine engines.

A two piece aluminum hub retains each propeller blade on a thrust bearing. A cylinder is attached to the hub and contains a feathering spring and piston. The hydraulically actuated piston transmits linear motion through a pitch change rod and fork to each blade to result in blade angle change.

While the propeller is operating the following forces are constantly present, 1) spring force, 2) counterweight force, 3) centrifugal twisting moment of each blade and 4) blade aerodynamic twisting forces. The spring and counterweight forces attempt to rotate the blades to higher blade angle while the centrifugal twisting moment of each blade is generally toward lower blade angle. Blade aerodynamic twisting force is generally very small in relation to the other forces and can attempt to increase or decrease blade angle.

Summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump that is mounted on and driven by the engine. The oil from the governor is supplied to the propeller and hydraulic piston through a hollow engine shaft. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM.

Decreasing the volume of oil will increase blade angle and decrease propeller RPM. By changing the blade angle, the governor can vary the load on the engine and maintain constant engine RPM (within limits), independent of where the power lever is set. The governor uses engine speed sensing mechanisms that allow it to supply or drain oil as necessary to maintain constant engine speed (RPM).

If governor supplied oil is lost during operation, the propeller will increase pitch and feather. Feathering occurs because the summation of internal propeller forces causes the oil to drain out of the propeller until the feather stop position is reached.

Normal in-flight feathering is accomplished when the pilot retards the propeller condition lever past the feather detent. This allows control oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

Normal in-flight unfeathering is accomplished when the pilot positions the propeller condition lever into the normal flight (governing) range and restarts the engine. As engine speed increases, the governor supplies oil to the propeller and the blade angle decreases.

In reverse mode of operation, the governor operates in an underspeed condition to act strictly as a source of pressurized oil, without attempting to control RPM. Control of the propeller blade angle in reverse is accomplished with the beta valve.

NOTE: The beta valve is normally built into the base of the governor.

The propeller is reversed by manually repositioning the cockpit-control to cause the beta valve to supply oil from the governor pump to the propeller. Several external propeller mechanisms, which include a beta ring and carbon block assembly, communicate propeller blade angle position to the beta valve.

When the propeller reaches the desired reverse position, movement of the beta ring and carbon block assembly initiated by the propeller piston, causes the beta valve to shut off the flow of oil to the propeller. Any additional unwanted movement of the propeller toward reverse, or any movement of the manually positioned beta valve control toward high pitch position will cause the beta valve to drain oil from the propeller to increase pitch.

C. Feathering and Reversing Propellers

HC-(D,E)4()-5() Series

The propellers described in this section are constant speed, feathering and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. These propellers have four blades and are used primarily on Garrett (Allied Signal) turbine engines.

A two piece aluminum hub retains each propeller blade on a thrust bearing. A cylinder is attached to the hub and contains a feathering spring and piston. The hydraulically actuated piston transmits linear motion through a pitch change rod and fork to each blade to result in blade angle change.

While the propeller is operating, the following forces are constantly present: 1) spring force, 2) counterweight force, 3) centrifugal twisting moment of each blade and 4) blade aerodynamic twisting forces. The spring and counterweight forces attempt to rotate the blades to higher blade angle, while the centrifugal twisting moment of each blade is generally toward lower blade angle. Blade aerodynamic twisting force is usually very small in relation to the other forces and can attempt to increase or decrease blade angle.

The summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump, which is mounted on and driven by the engine. The oil from the governor is supplied to the propeller and hydraulic piston through a hollow engine shaft. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM. Decreasing the volume of oil will increase blade angle and decrease propeller RPM. By changing blade angle the governor can vary the load on the engine and maintain constant engine RPM (within limits), independent of where the power lever is set. The governor uses engine speed sensing mechanisms that allow it to supply or drain oil as necessary to maintain constant engine speed (RPM).

If governor supplied oil is lost during operation, the propeller will increase pitch and feather. Feathering occurs because the summation of internal propeller forces causes the oil to drain out of the propeller until the feather stop position is reached.

Normal in-flight feathering is accomplished when the pilot retards the propeller condition lever past the feather detent. This allows control oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

Normal in-flight unfeathering is accomplished when the pilot positions the propeller condition lever into the normal flight (governing) range, activates the auxiliary pump to decrease blade pitch and restarts the engine. As engine speed increases, the governor supplies oil to the propeller and the blade angle decreases.

In reverse mode of operation the governor is operates in an underspeed condition to act strictly as a source of pressurized oil, without attempting to control RPM. Control of the propeller blade angle then becomes the responsibility of the beta valve.

NOTE: The beta valve is normally located on the gearbox side opposite the propeller.

The propeller is reversed by manually repositioning the cockpit-control to cause the beta valve to supply oil from the governor pump to the propeller. A beta rod inserted into the front of the propeller communicates propeller blade angle position to the beta valve.

When the propeller reaches the desired reverse position, movement of the beta rod, initiated by the propeller piston, will cause the beta valve to shut off flow of oil to the propeller. Any additional unwanted movement of the propeller toward reverse or any movement of the manually positioned beta valve control toward high pitch position will cause the beta valve to drain oil from the propeller to increase pitch.

It is undesirable to feather the propeller when the engine is stopped after landing the aircraft. This propeller type is normally installed on a fixed shaft engine that causes the propeller to rotate during an engine start process. If the propeller is in feather position, an overload on the electric engine starter will occur.

To prevent feathering during normal engine shutdown, the propeller incorporates spring-energized latch pins, called start locks. Two units are installed the cylinder. If propeller rotation is approximately 800 RPM or above, the start locks disengage from the piston by centrifugal force acting on the latch pins to compress the spring (within the units). When RPM drops below 800 RPM, the springs overcome the centrifugal force and move the latch pins to engage the piston, preventing blade angle movement to feather.

Shortly after start up with the propeller RPM above 800 the latch pins in the start locks will still retain the blade angle. To release the latch pins, it is necessary to manually actuate the propeller slightly toward reverse. This will move the piston, allowing the latch pins to slide freely. Centrifugal force will compress the springs and disengage the pins from the piston.

D. Feathering and Reversing Propellers HC-D3F-7() Series

The propellers described in this section are constant speed, feathering and reversing. They use a single oil supply from a governing device to hydraulically actuate a change in blade angle. These propellers have three blades and are used primarily on Allison 250-B17() series turbine engines.

A two piece aluminum hub retains each propeller blade on a thrust bearing. A cylinder is attached to the hub and contains a feathering spring and piston. The hydraulically actuated piston transmits linear motion through a pitch change rod and fork to each blade to result in blade angle change.

While the propeller is operating, the following forces are constantly present: 1) spring force, 2) counterweight force, 3) centrifugal twisting moment of each blade and 4) blade aerodynamic twisting forces. The spring and counterweight forces attempt to rotate the blades to higher blade angle, while the centrifugal twisting moment of each blade is generally toward lower blade angle. Blade aerodynamic twisting force is usually very small in relation to the other forces and can attempt to increase or decrease blade angle.

The summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor with an internal pump, which is mounted on and driven by the engine. The oil from the governor is supplied to the propeller and hydraulic piston through a hollow engine shaft. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM. Decreasing the volume of oil will increase blade angle and decrease propeller RPM. By changing blade angle the governor can vary the load on the engine and maintain constant engine RPM (within limits), independent of where the power lever is set. The governor uses engine speed sensing mechanisms that allow it to supply or drain oil as necessary to maintain constant engine speed (RPM).

If governor supplied oil is lost during operation, the propeller will increase pitch and feather. Feathering occurs because the summation of internal propeller forces causes the oil to drain out of the propeller until the feather stop position is reached.

Normal in-flight feathering is accomplished when the pilot retards the propeller condition lever past the feather detent. This allows control oil to drain from the propeller and return to the engine sump. Engine shutdown is normally accomplished during the feathering process.

Normal in-flight unfeathering is accomplished when the pilot positions the propeller condition lever into the normal flight (governing) range, activates the auxiliary pump to decrease blade pitch and restarts the engine. As engine speed increases, the governor supplies oil to the propeller and the blade angle decreases.

In reverse mode of operation the governor is operates in an underspeed condition to act strictly as a source of pressurized oil, without attempting to control RPM. Control of the propeller blade angle then becomes the responsibility of the beta valve.

NOTE: The beta valve is located inside the propeller and engine propeller shaft and protrudes from the gearbox on the side opposite from the propeller for control input connection.

The propeller is reversed by manually repositioning the cockpit-control to cause the beta valve to supply oil from the governor pump to the propeller. A rod that protrudes from the propeller piston communicates propeller blade angle position to the beta valve.

When the propeller reaches the desired reverse position, movement of the beta rod, initiated by the propeller piston, will cause the beta valve to shut off flow of oil to the propeller. Any additional unwanted movement of the propeller toward reverse or any movement of the manually positioned beta valve control toward high pitch position will cause the beta valve to drain oil from the propeller to increase pitch.

HC - D 4 N - 5 AL

MINOR MODIFICATIONS
SEE NEXT PAGE

- 2 - CONSTANT SPEED, FEATHERING, PT6A
3 - CONSTANT SPEED, FEATHERING, REVERSING
EXTERNAL BETA RING for P & W PT6A APPLICATIONS
5 - CONSTANT SPEED, FEATHERING, REVERSING,
INTERNAL BETA, START LOCKS, TPE-331
7 - CONSTANT SPEED, FEATHERING, REVERSING,
ALLISON ENGINES, BETA VALVE D-751

	BOLT CIRCLE	NO.	DOWELS DIA.	NO. OF BOLTS OR STUDS
A	5.125 in.	2	5/8	12 (9/16")
B	5.125 in.	2	5/8	12 (9/16")
F	4.00 in.	2	1/2	6 (1/2")
N	4.25 in.	2	1/2	8 (9/16")
P	4.25 in.	4	1/2	8 (9/16")
W	4.25 in.	4	1/2	8 (9/16")*

*HC-E4W-3() requires the use of a C-7620 spacer.

*HC-E4W-5L requires the use of 101058 propeller mounting shim

NO. OF BLADES 3, 4, or 5

- D - 3.4 INCH DIAMETER BLADE SHANK
E - SAME AS "D" EXCEPT DIFFERENT SHANK DIMENSIONS AND
INTERNAL BLADE BEARING

HC HARTZELL CONTROLLABLE

Propeller Model Designations
Table 2-1

HC - D 4 N - 5 AL

MINOR MODIFICATIONS
(up to 5 characters)

D3F-7:

BLANK - INITIAL PRODUCTION MODEL
H - INTEGRAL 4.25 SHAFT EXTENSION

D4N-2:

A - INITIAL PRODUCTION MODEL
AA - SAME AS "A" EXCEPT AIRCRAFT APPLICATION
D - SAME AS "A" EXCEPT ANGLE SETTING (SI 210)
DA - SAME AS "D" EXCEPT AIRCRAFT APPLICATION
E - SAME AS "D" EXCEPT HAS COMPRESSOR PULLEY
F - SAME AS "A" EXCEPT HAS COMPRESSOR PULLEY
G - SAME AS "AA" EXCEPT HAS COMPRESSOR PULLEY

D4N-3:

A - INITIAL PRODUCTION MODEL
C - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
E - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
G - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
N - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
Q - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
P - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
R - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
T - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION

D4N-5:

C - INITIAL PRODUCTION MODEL
E - SAME AS "C" EXCEPT FOR CYLINDER
AL - SAME AS "C" EXCEPT BLADE, CTWT, APPLICATION

D4P-5:

BLANK - INITIAL PRODUCTION MODEL
L - LEFT HAND ROTATION

E4A-2:

BLANK - INITIAL PRODUCTION MODEL
A - SAME AS -2 EXCEPT BLADE, APPLICATION

E4A-3:

D - INITIAL PRODUCTION MODEL
M - SAME AS "D" EXCEPT BLADE, HUB UNIT, CTWT, APPLICATION

E4N-2:

BLANK - INITIAL PRODUCTION MODEL

E4N-3:

BLANK - INITIAL PRODUCTION MODEL
A - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
G - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
H - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
I - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
J - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
K - PRESSED IN PROPELLER MOUNTING BOLTS
N - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
P - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
PY - SAME AS -3 EXCEPT OPTIONAL START LOCKS
Q - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
U - SAME AS K EXCEPT HUB, CYLINDER

E4N-5:

A - INITIAL PRODUCTION MODEL
B - SAME AS "A" EXCEPT PITCH ROD
C - COUNTERWEIGHT
D - SAME AS "A" EXCEPT BLADE, CTWT, APPLICATION
E - SAME AS "K" EXCEPT HUB
F - BETA TUBE SEAL
K - PRESSED IN PROPELLER MOUNTING BOLTS
L - LEFT HAND ROTATION

E4W-3:

BLANK - INITIAL PRODUCTION MODEL
A - SAME AS -3 EXCEPT BLADE SHANK
D - SAME AS -3 EXCEPT BLADE, CTWT, APPLICATION
K - PRESSED IN PROPELLER MOUNTING BOLTS

E4W-5:

L - LEFT HAND ROTATION

E5N-3:

BLANK - INITIAL PRODUCTION MODEL
L - SAME AS -3 EXCEPT LEFT HAND ROTATION
A - SAME AS -3 EXCEPT HUB UNIT
AL - SAME AS "A" EXCEPT LEFT HAND ROTATION

Propeller Model Designations, Continued
Table 2-1

NOTE: Parentheses in the model designation system indicates that an option or modification may or may not be included in the blade assembly.

prop model/E9512CB-1

Dash Number (or + number), diameter reduction (or increase) from basic design. In this example, the nominal 95 inch diameter has been reduced 1 inch = 94 inch dia. (with some exceptions) there may be a letter following the dash number:

R - specifically rounded tip
T - specifically rounded tip
Q - Q-tip, factory 90 degree bent tip
A - slightly thinner & narrower tip fairing
E - elliptical tip

Suffix letters:

A - blade cuff modification or; 0 degree sweepback or; for 8433 blades a 1 degree sweepback; or Y shank pitch knob
B - anti-icing boot (alcohol) or de-ice boot (wire element)
C - modified blade, dimensional or blade twist modification from initial blade design
D - modified blade, blade twist or thickness change
E - de-ice boot (foil element) or internal de-ice element (composite blade)
F - modified blade, dimensional modification (width/thickness)
G - E9512 blade, different life limit
H - hard alloy ("76" stamped on blade butt)
H - leading edge erosion coating (all other blade models)
K - de-ice boot installed (foil element, different PN from B above)
N - shank modification (pilot tube hole), thickness added
R - rounded tips
S - square tips or; shot peening of blade surface
blank - original design, no changes

The first 2 or 3 numbers indicate initial design diameter (in inches), the last 2 numbers indicate basic model or template (there are some exceptions to this definition)

Prefix of up to 3 letters:

H - right hand rotation, pusher
J - left hand rotation, tractor
L - left hand rotation, pusher
D,E - shank design

Aluminum Blade Model Designation
Table 2-2

E. Propeller Model Designation

- (1) Hartzell Propeller LLC uses a model number designation system to identify specific propeller and blade assemblies. The propeller model number and blade model number are separated by a slash (/).
 - (a) Example: *propeller model number / blade model number*
- (2) The propeller model number is impression stamped on the propeller hub.
- (3) Refer to Table 2-1 for a description of the characters used in the propeller model number.

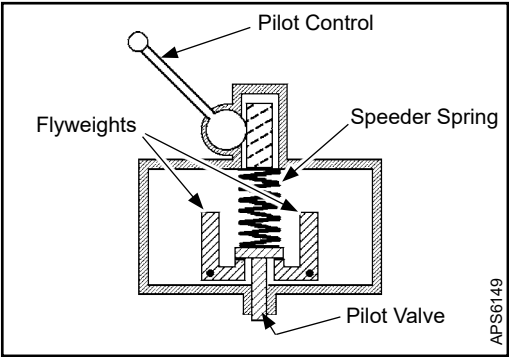
2. Propeller Blades

A. Description of Aluminum Blades

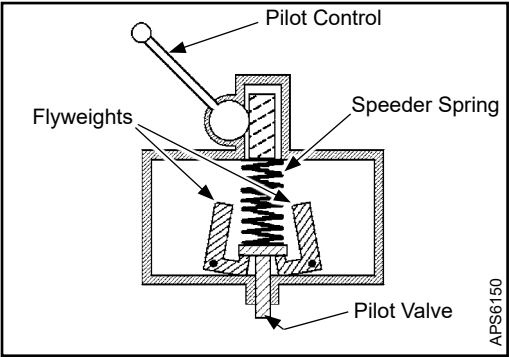
- (1) Aluminum propeller blades are manufactured from one solid piece of aluminum that has been forged and heat-treated prior to manufacture.
- (2) Aluminum blades are identified by shank design, propeller diameter, tip configurations, and other blade characteristics.
 - (a) Refer to the section, "Blade Model Designation" in this chapter.

B. Blade Model Designation

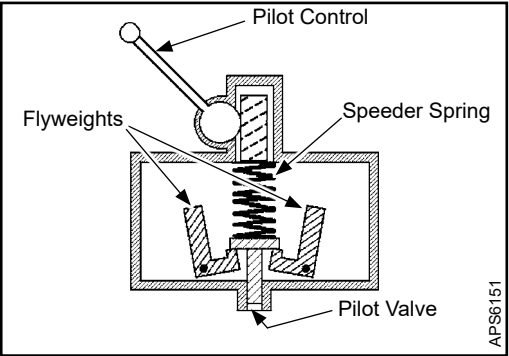
- (1) Hartzell Propeller LLC uses a model number designation system to identify specific propeller and blade assemblies. The propeller model number and blade model number are separated by a slash (/).
 - (a) Example: *propeller model number / blade model number*
- (2) The blade model number is impression stamped on the butt end of the blade, and also identified by a label on the cylinder.
- (3) Refer to Table 2-2 for a description of the characters used in the aluminum blade model number.



Governor in Onspeed Condition
Figure 2-1



Governor in Underspeed Condition
Figure 2-2



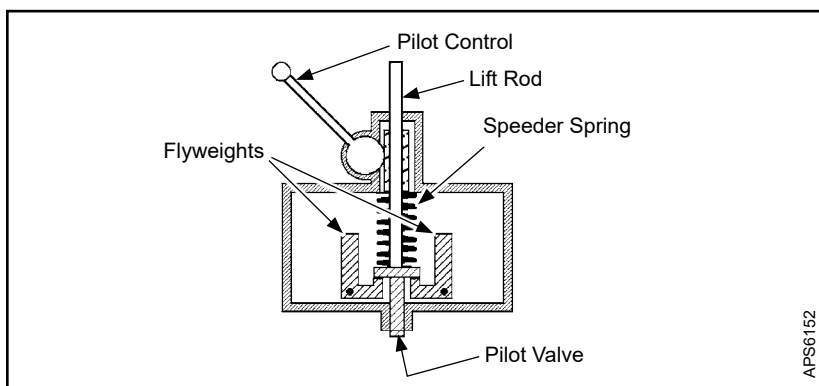
Governor in Overspeed Condition
Figure 2-3

3. Governors (Rev. 3)

A. Theory of Operation

- (1) A governor is an engine RPM sensing device and high pressure oil pump. In a constant speed propeller system, the governor responds to a change in engine RPM by directing oil under pressure to the propeller hydraulic cylinder or by releasing oil from the hydraulic cylinder. The change in oil volume in the hydraulic cylinder changes the blade angle and maintains the propeller system RPM to the set value. The governor is set for a specific RPM via the cockpit propeller control that compresses or releases the governor speeder spring.
- (2) When the engine is operating at the RPM set by the pilot using the cockpit control, the governor is operating **onspeed**. Refer to Figure 2-1. In an onspeed condition, the centrifugal force acting on the flyweights is balanced by the speeder spring, and the pilot valve is neither directing oil to nor from the propeller hydraulic cylinder.
- (3) When the engine is operating below the RPM set by the pilot using the cockpit control, the governor is operating **underspeed**. Refer to Figure 2-2. In an underspeed condition, the flyweights tilt inward because there is not enough centrifugal force on the flyweights to overcome the force of the speeder spring. The pilot valve, forced down by the speeder spring, meters oil flow to decrease propeller pitch and raise engine RPM.
- (4) When the engine is operating above the RPM set by the pilot using the cockpit control, the governor is operating **overspeed**. Refer to Figure 2-3. In an overspeed condition, the centrifugal force acting on the flyweights is greater than the speeder spring force. The flyweights tilt outward, and raise the pilot valve. The pilot valve then meters oil flow to increase propeller pitch and lower engine RPM.

- (5) Feathering governors allow oil to be pushed from the propeller to the engine drain to increase propeller pitch to feather.
- (a) Some governors will move the propeller to feather by electrically or mechanically actuating a valve that opens to drain the oil supply between the propeller and governor to increase propeller pitch and allow the propeller to feather.
- (b) Figure 2-4 illustrates another feathering propeller governor system. When it is desired to feather the propeller, the lift rod may be moved by the cockpit control to mechanically engage the valve. The lifted valve dumps oil to increase propeller pitch until the propeller feathers.

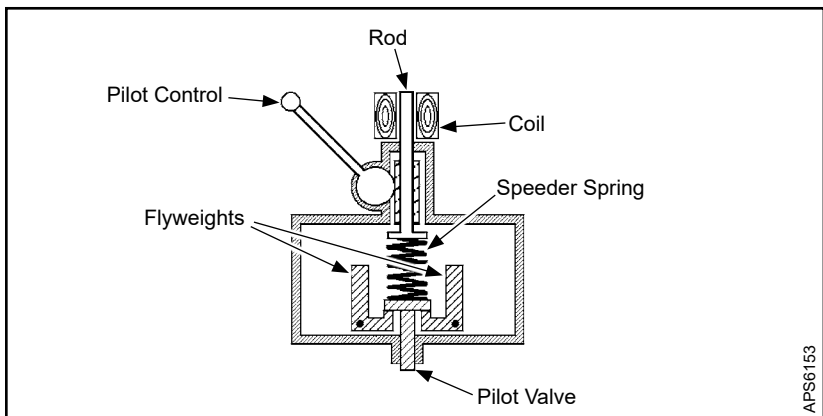


APS6152

Feathering Governor
Figure 2-4

(6) A synchronizing system can be employed in a multi-engine aircraft to keep the engines operating at the same RPM. A synchrophasing system not only keeps the RPM of the engines consistent, but also keeps the propeller blades in phase with each other. Both synchronizing and synchrophasing systems serve to reduce noise and vibration. Figure 2-5 illustrates a governor as a component of a synchronizing or synchrophasing system.

(a) Hartzell Propeller synchronizing or synchrophasing systems use one engine (the master engine) as an RPM and phase reference and adjust the RPM of the remaining engine(s) [slave engine(s)] to match it. The RPM of the master engine is monitored electronically, and this information is used to adjust the voltage applied to the electrical coil on the slave governor(s). The voltage to the coil either raises or lowers a rod which changes the force of the speeder spring. In this manner, engine RPM and phase of the propellers is synchronized or synchrophased.



Synchronizer/Synchrophaser Governor

Figure 2-5

APS6153

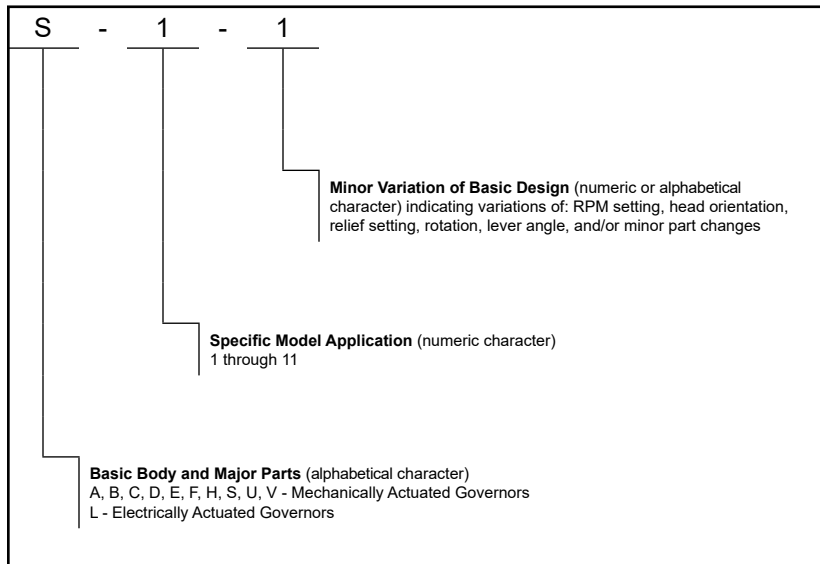
B. Governor Model Designation

- (1) Hartzell Propeller LLC uses a model number designation system to identify specific governor models.
- (2) The governor model number is stamped on the base and/or body of the governor assembly.
- (3) Refer to Table 2-3 for a description of the characters used in the governor model number.

4. Propeller Ice Protection Systems (Rev. 1)

A. System Description

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



**Governor Model Designation
Table 2-3**

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1. Tools, Consumables, and Expendables

A. General

(1) The following tools, consumables, and expendables are required for propeller removal or installation:

B. Tooling

A Flange

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench
- Torque wrench adapter TE5

F Flange

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench
- Torque wrench adapter TE152

N Flange

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench
- Torque wrench adapter TE5

P Flange

- Safety wire pliers (Alternate: Safety cable tool)
- Torque wrench
- Torque wrench adapter
TE5 that use bolt
TE155 that use nut

W Flange

- Torque wrench adapter TE432
- Torque check tool TE404-1
- Feeler gage
- Beta ring puller TE100
- 5/8 inch deep well socket
- 1-7/16 inch crowfoot wrench

C. Expendables

- 0.032 inch (0.81 mm) Stainless Steel Aircraft Safety wire (Alternate: 0.032 inch [0.81 mm] aircraft safety cable and associated washers and ferrules)
- O-ring, Propeller-to-Engine Seal (Refer to Table 3-1)

2. Pre-Installation (Rev. 5)**A. Inspection of Shipping Package**

- (1) Examine the exterior of the shipping container, especially the box ends around each blade, for signs of shipping damage.
 - (a) If the box is damaged, contact the freight company for a freight claim.
 - (b) A hole, or tear, or crushed appearance at the end of the box (blade tips) may indicate that the propeller was dropped during shipment, possibly damaging the blades.
 - 1 If the propeller is damaged, contact Hartzell Propeller LLC. Refer to the section, "Hartzell Propeller Contact Information" in the Introduction chapter of this manual.

B. Uncrating

- (1) Put the propeller on a firm support.
- (2) Remove the banding and any external wood bracing from the cardboard shipping container.
- (3) Remove the cardboard from the hub and blades.

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

- (4) Put the propeller on a padded surface that supports the entire length of the propeller.
- (5) Remove the plastic dust cover cup from the propeller mounting flange, if installed.

C. Inspection after Shipment

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

D. Reassembly of a "Knockdown" Propeller

- (1) Propellers that were disassembled for shipment must be reassembled by trained personnel in accordance with the applicable propeller maintenance manual.
- (2) For installation of ice protection systems manufactured by Hartzell, refer to Hartzell Propeller Ice Protection System Manual 180 (30-61-80).
- (3) For installation of ice protection systems not manufactured by Hartzell, refer to the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).

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Flange	O-ring	Bolt/Stud	Washer	Nut	Misc
A	C-3317-239-2	B-3347	A-2048-2	---	
F	C-3317-228	A-1328	A-1381	---	
N	C-3317-230	B-3339-1	A-2048-2	---	
N (HC-E4N-3K) (HC-E4N-5KE) (HC-E4N-5K[C,F]L)	C-3317-230	103560	A-2048-2	C-6006	
P except for Pratt engine	C-3317-230	B-3347	A-2048-2	---	
P Pratt engine, ex- cept for HC-E4P-3K	C-3317-230	B-3339-1	A-2048-2	---	
HC-E4P-3K	C-3317-230	103560	A-2048-2	C-6006	
W (HC-E4W-3[A])	C-3317-230 (Spacer-to- engine) C-3317-233 (Hub-to- spacer)	A-3254	109514	B-7458	C-7620 Spacer B-3868-S52 Screw
W (HC-E4W-3[KD,T])	C-3317-230	103560	109514	B-7458	
W (HC-E4W-5L)	C-3317-230	A-3254	B-7624	B-7458	101058 Propeller Mounting Shim

Propeller/Engine Flange O-rings and Mounting Hardware
Table 3-1

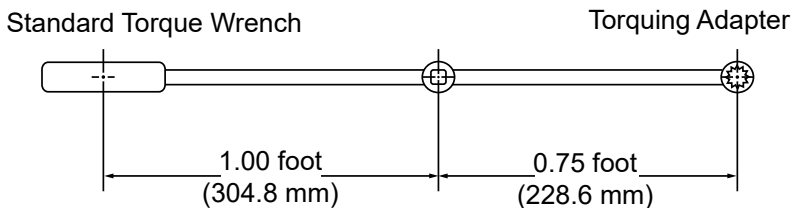
CAUTION 1: FOR A PROPELLER THAT DOES NOT USE A LUBRICATED (WET) TORQUE, THE MOUNTING HARDWARE MUST BE CLEAN AND DRY TO PREVENT EXCESSIVE PRELOAD OF THE MOUNTING FLANGE.

CAUTION 2: TORQUE VALUES WITH "WET" NOTED AFTER THEM ARE BASED ON LUBRICATED THREADS WITH APPROVED ANTI-SEIZE COMPOUND CM118.

CAUTION 3: REFER TO FIGURE 3-1 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.

Accessory mounting bolts	36-44 In-Lbs (4.1-4.9 N•m) Wet
A flange propeller mounting bolts	100-105 Ft-Lbs (136-142 N•m) Wet
F flange propeller mounting bolts	80-90 Ft-Lbs (108-122 N•m)
N flange propeller mounting bolts except HC-E(4,5)N-(3,5)K()	100-105 Ft-Lbs (136-142 N•m) Wet
N flange propeller mounting nuts HC-E(4,5)N-(3,5)K()	120-130 Ft-Lbs (163-176 N•m) Wet
P flange propeller mounting bolts except HC-E4P-(3,5)K	100-105 Ft-Lbs (136-142 N•m) Wet
P flange propeller mounting nuts HC-E4P-(3,5)K	120-130 Ft-Lbs (163-176 N•m) Wet
W flange propeller mounting nuts	120-125 Ft-Lbs (163-170 N•m)
For HC-D3F-7H ONLY Hub clamping bolts/spinner mounting nuts	24-26 Ft-Lbs (33-35 N•m)
107528(P) spinner to slip ring mounting screw	70-85 In-Lbs (94-115 N•m)

Torque Table
Table 3-2



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

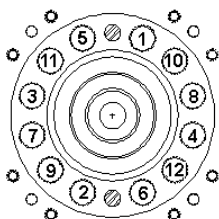
EXAMPLE:

$$\frac{100 \text{ Ft-Lb (136 N}\cdot\text{m)} \times 1 \text{ ft (305mm)}}{1 \text{ ft (304.8 mm)} + 0.75 \text{ ft (228.6 mm)}} = \frac{57.1 \text{ Ft-Lb (77.4 N}\cdot\text{m)}}{77.4 \text{ N}\cdot\text{m}} < \begin{array}{l} \text{reading on torque} \\ \text{wrench with 9-inch} \\ \text{(228.6 mm) adapter for} \\ \text{actual torque of} \\ \text{100 Ft-Lb (136 N}\cdot\text{m)} \end{array}$$

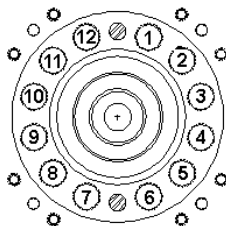
The correction shown is for an adapter that is aligned with the centerline of the torque wrench. If the adapter is angled 90 degrees relative to the torque wrench centerline, the torque wrench reading and actual torque applied will be equal.

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

A or B Flange

SEQUENCE A



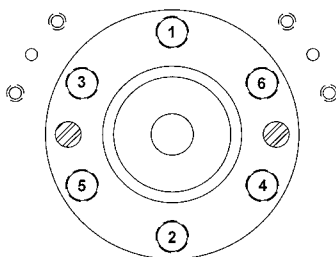
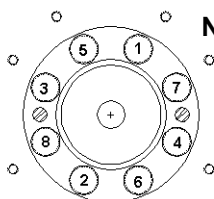
SEQUENCE B

Use Sequence A for steps one and two.

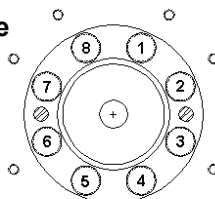
Use Sequence B for step three.

Step 1 - Torque all bolts/nuts to 40 Ft-Lbs (54 N•m).**Step 3** - Torque all bolts/nuts**Step 2** - Torque all bolts/nuts to 80 Ft-Lbs (108 N•m).

to Table 3-2.

F Flange**Step 1** - Torque all bolts/nuts to 40 Ft-Lbs (54 N•m).**Step 2** - Torque all bolts/nuts to Table 3-2.**N, P or W Flange**

SEQUENCE A



SEQUENCE B

Use Sequence A for steps one and two.

Use Sequence B for step three.

Step 1 - Torque all bolts/nuts to 40 Ft-Lbs (54 N•m).**Step 3** - Torque all bolts/nuts**Step 2** - Torque all bolts/nuts to 80 Ft-Lbs (108 N•m).

to Table 3-2.

Torquing Sequence for Propeller Mounting Bolts/Nuts
Figure 3-2

3. Propeller Mounting Hardware and Torque Information (Rev. 1)
 - A. Propeller Mounting Hardware
 - (1) Refer to Table 3-1 for part numbers of the propeller mounting hardware and O-rings.
 - B. Torque Information
 - (1) The structural integrity of joints in the propeller that are held together with threaded fasteners is dependent upon proper torque application.
 - (a) Vibration can cause an incorrectly tightened fastener to fail in a matter of minutes.
 - (b) Correct tension in a fastener depends on a variety of known load factors and can influence fastener service life.
 - (c) Correct tension is achieved by application of measured torque.
 - (2) Use accurate wrenches and professional procedures to make sure of correct tensioning.
 - (3) Refer to Table 3-2 for the torque values to use when installing a Hartzell propeller.
 - (4) When an adapter is used with a torque wrench, use the equation in Figure 3-1 to determine the correct torque value.
 - (5) Refer to Figure 3-2 for the proper torquing sequence of the propeller mounting bolts/nuts.

4. Propeller Assembly Installation

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. Precautions

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

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

CAUTION: AVOID THE USE OF BLADE PADDLES. DO NOT PUT THE BLADE PADDLE IN THE AREA OF THE DE-ICE BOOT WHEN APPLYING TORQUE TO A BLADE ASSEMBLY. PUT THE BLADE PADDLE IN THE THICKEST AREA OF THE BLADE, JUST OUTSIDE OF THE DE-ICE BOOT. USE ONE BLADE PADDLE PER BLADE.

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

- (2) Follow the airframe manufacturer's instructions for installing the propeller.
 - (a) If such instructions are not in the airframe manufacturer's manual, then follow the instructions in this manual; however, mechanics must consider that this owner's manual does not describe important procedures that are outside the scope of this manual.
 - (b) In addition to propeller installation procedures, items such as rigging and preflight testing of flight idle blade angle, and propeller synchronization devices are normally found in the airframe manufacturer's manuals.

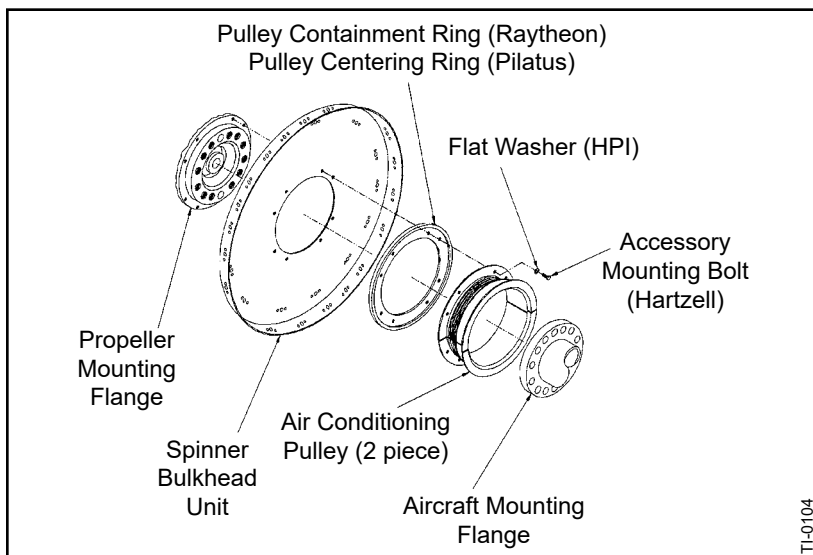
- B. Installing the HC-(D,E)4()-2() Propeller on the Aircraft Engine

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

- (1) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.
 - (a) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (2) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
- (3) Remove the pitch change rod cap, if applicable.
- (4) Install the specified O-ring on the engine flange. Refer to Table 3-1.



Part	Raytheon T6A HC-E4A-2()	Pilatus PC-9 HC-D4N-2(E,F,G)	Pilatus PC-7MKII HC-D4N-2E
Air Conditioning Pulley	133-910029-7	PC9-1401-1	PC9-1401-1
Pulley Containment Ring	133-910029-11	NA	NA
Pulley Centering Ring w/De-ice	NA	NA	NA
Pulley Centering Ring w/o De-ice	NA	PC9-1402-1	PC9-1402-1
Accessory Mounting Bolt	(Hartzell Part) B-3384-8H ***	(Hartzell Part) B-3384-9H *	(Hartzell Part) B-3384-9H **
Accessory Mounting Washer	(Hartzell Part) B-3851-0463	(Hartzell Part) B-3851-0432	(Hartzell Part) B-3851-0432

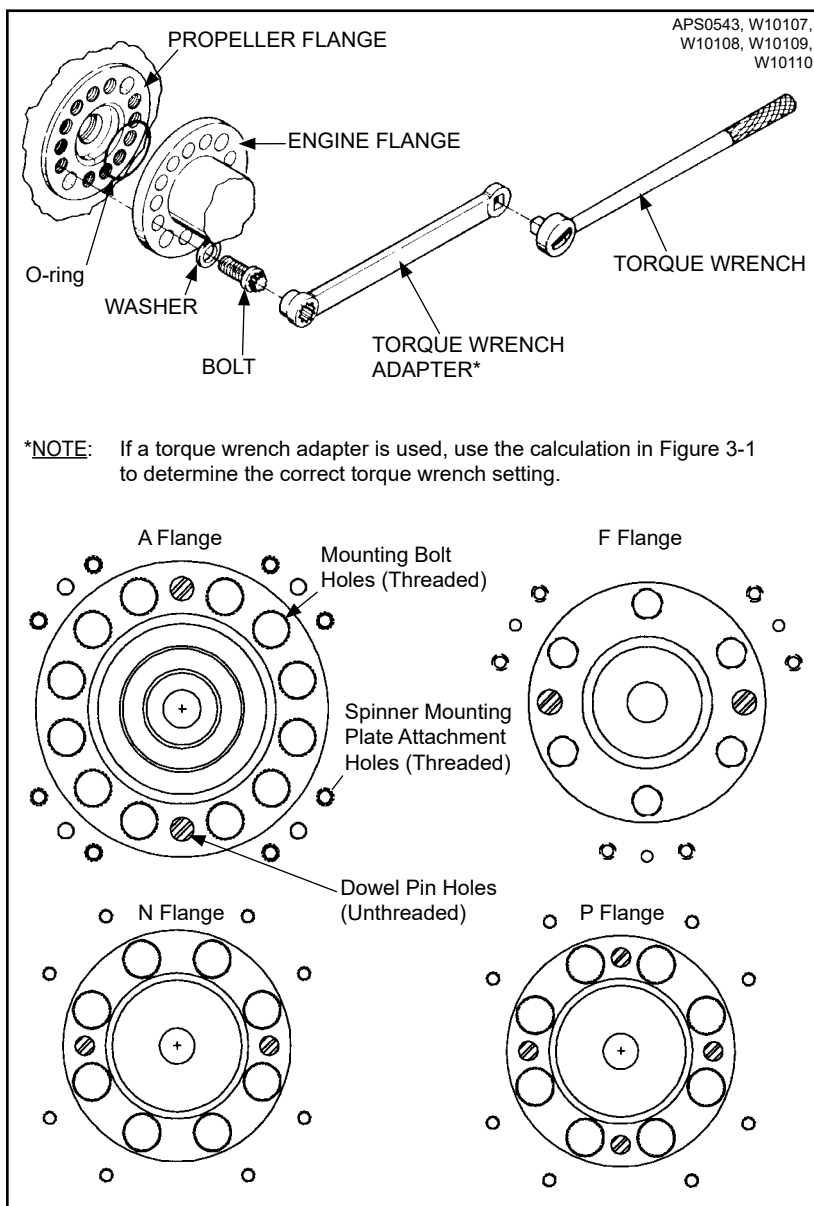
* Propeller is built using bolt (Hartzell Part) B-3384-6H to hold the bulkhead on the propeller. When the propeller is installed on the aircraft, use mounting bolt (Hartzell Part) B-3384-9H (pulley only).

** Propeller is built using bolt (Hartzell Part) B-3384-2H to hold the bulkhead on the propeller. When the propeller is installed on the aircraft, use mounting bolt (Hartzell Part) B-3384-9H (pulley only).

*** Propeller is built using bolt (Hartzell Part) B-3384-1H to hold the bulkhead on the propeller. When the propeller is installed on the aircraft, use mounting bolt (Hartzell Part) B-3384-8H (pulley only).

Air Conditioning Drive Accessories

Figure 3-3



Installing Propeller on Engine Flange

Figure 3-4

- (5) For propeller models with air conditioning accessories, refer to Figure 3-3.
 - (a) Temporarily attach the spinner bulkhead and pulley containment ring to the propeller hub with two of the separately packaged accessory mounting bolts.
- (6) Align mounting and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins in the engine flange.
- (7) Slide the propeller flange onto the engine flange.

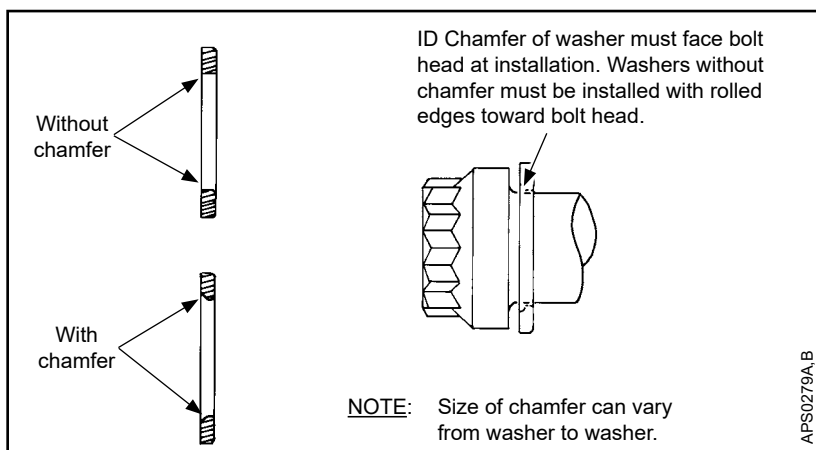
CAUTION 1: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

CAUTION 2: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

- (8) Apply anti-seize compound CM118 to the threaded surfaces of the mounting bolts. Refer to Table 3-1 for the applicable mounting hardware.
 - (a) If the propeller is removed between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

CAUTION: ID CHAMFER OF WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH ROLLED EDGES TOWARD THE BOLT HEAD. (REFER TO FIGURE 3-5).

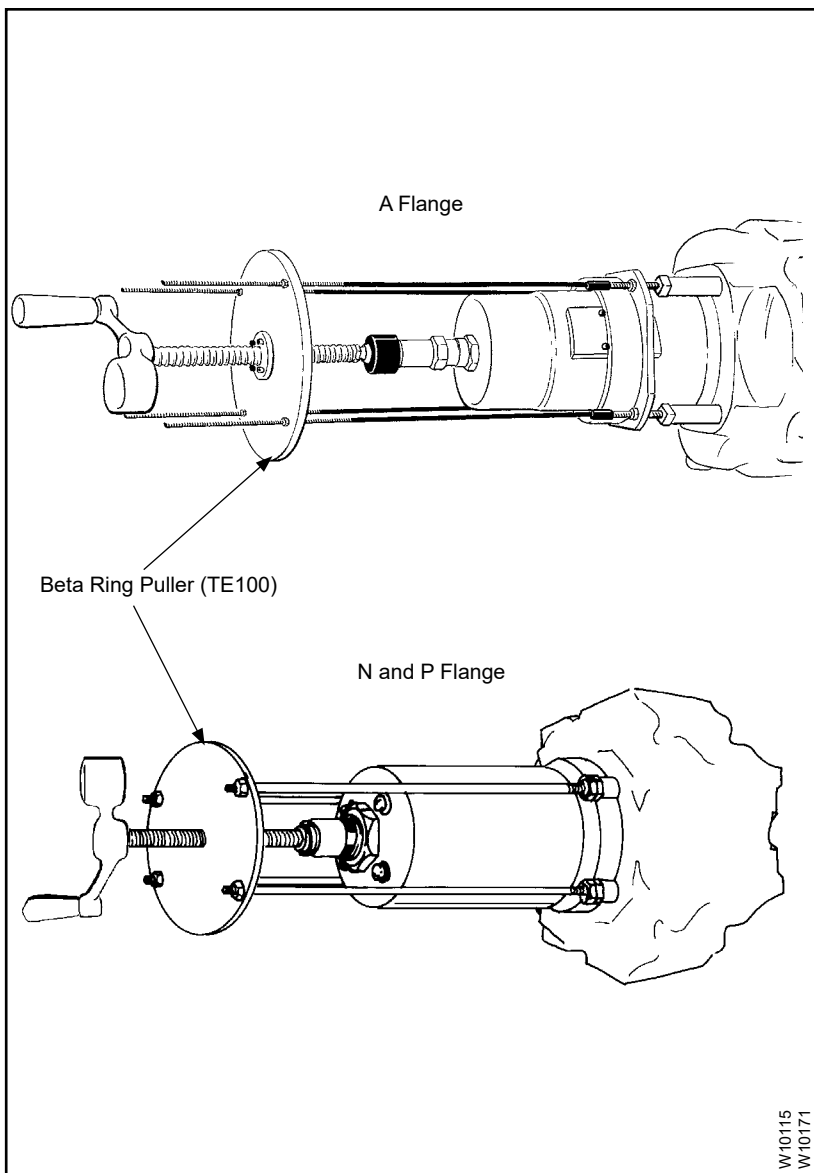
- (9) Install the mounting bolts with washers through the engine flange and into the propeller hub flange. Refer to Figure 3-4.
- (10) Using a torque wrench and torque wrench adapter TE5, torque all mounting bolts in sequences and steps shown in Figure 3-2.
- (a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.
- (11) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire, two bolts per safety.
- (12) For propeller models with air conditioning accessories:
 - (a) Remove the two accessory mounting bolts temporarily attaching the spinner bulkhead and pulley containment ring to the propeller hub.



Mounting Bolt and Washer
Figure 3-5

- (b) With the eight separately packaged accessory mounting bolts and washers, attach the spinner bulkhead, pulley containment ring, and air conditioning pulley onto the propeller hub. Refer to Figure 3-3.
 - (c) Torque bolts in accordance with Table 3-2.
 - (d) Safety wire the accessory mounting bolts.
- (13) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.
- (14) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (15) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (16) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

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**Tool for Decompressing HC-(D,E)(4,5)()-3() Series
External Beta System
Figure 3-6**

C. Installing the HC-(D,E)(4,5)(A,N)-3() Propeller on the Aircraft Engine, Except HC-E4N-3K()

- (1) Using a beta ring puller TE100 (Figure 3-6), compress the beta system and pull the beta ring forward to permit installation of the double hex head propeller mounting bolts.

NOTE: Some propeller models have cylinder-mounted start locks. If the cylinder-mounted start lock housings interfere with the beta ring puller TE100, plate kit TE615 is available from Hartzell Propeller LLC. The plate kit TE615 fits over the start lock housings and has multiple mounting holes for the beta ring puller rods.

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: DO NOT CONTACT THE ANTI-ICE TRAVEL TUBES WITH THE SLING WHEN LIFTING THE PROPELLER.

CAUTION 3: 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.

- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.

- (a) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (3) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
- (4) Remove the pitch change rod cap, if applicable.
- (5) Install the specified O-ring on the engine flange. Refer to Table 3-1.
- (6) Align the mounting and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins in the engine flange.
- (7) Slide the propeller onto the engine flange.

CAUTION 1: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

CAUTION 2: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

- (8) Apply anti-seize compound CM118 to the threaded surfaces of the mounting bolts. Refer to Table 3-1 for the applicable mounting hardware.
 - (a) If the propeller is removed between overhaul intervals, mounting bolts and washers may be reused if they are not damaged or corroded.

CAUTION: ID CHAMFER OF WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH ROLLED EDGES TOWARD THE BOLT HEAD. (REFER TO FIGURE 3-5).

- (9) Install the mounting bolts with washers through the engine flange and into the propeller hub flange. Refer to Figure 3-4.

(10) Using a torque wrench and torque wrench adapter TE5, torque all mounting bolts in sequences and steps shown in Figure 3-2.

(a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.

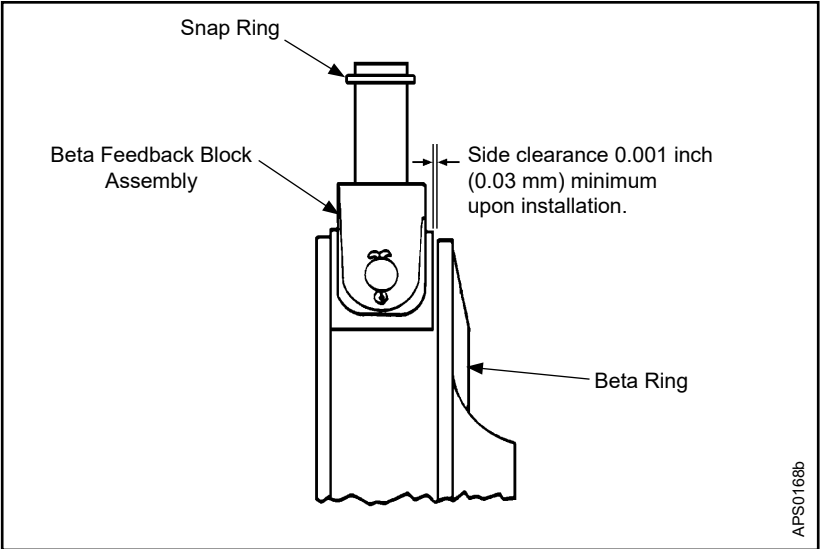
(11) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable. (Two bolts per safety.)

(12) Decompress the external beta system and remove the beta ring puller TE100.

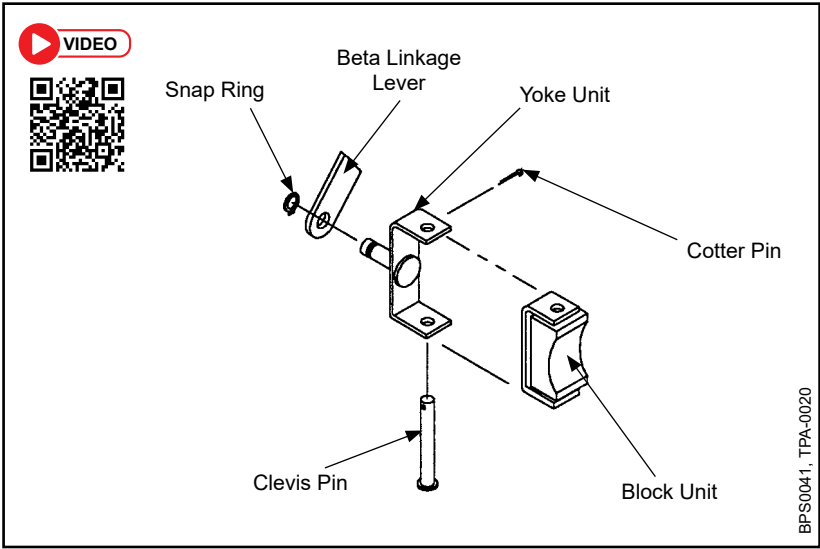
CAUTION: THE BETA FEEDBACK COLLAR MUST NOT CONTACT ANY ENGINE COMPONENT OR MOUNTING BOLT SAFETY WIRE. THE BETA FEEDBACK MECHANISM COULD BE DAMAGED IF IT CONTACTED ANY STATIC ENGINE COMPONENT WHILE ROTATING.

(13) Examine the beta feedback collar to make sure that it is not in contact with any engine components or mounting bolt safety wire.

(a) If there is contact between the beta feedback collar and any engine components or mounting bolt safety wire, consult a certified propeller repair station with an appropriate rating.



Beta Feedback Block Assembly and Beta Ring Clearance
Figure 3-7



Beta Feedback Block Assembly
Figure 3-8

- (14) Install the beta feedback block assembly into the beta linkage lever, in accordance with the airframe manufacturer's instructions.

CAUTION: FIT THE BETA FEEDBACK BLOCK ASSEMBLY IN THE BETA RING WITH A MINIMUM SIDE CLEARANCE OF 0.001 INCH (0.03 mm). REFER TO FIGURE 3-7.

- (15) Install the beta feedback assembly into the beta ring. Refer to Figure 3-8.
- (16) Install, adjust and safety the beta linkage per the airframe manufacturer's instructions.
- (17) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.
- (18) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (19) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (20) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

D. Installing the HC-E4P-3K and HC-E4N-3K Propeller on the Aircraft Engine

- (1) Using a beta ring puller TE100 (Figure 3-6), compress the beta system and pull the beta ring forward to permit access to the propeller mounting flange.

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: 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.

- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.

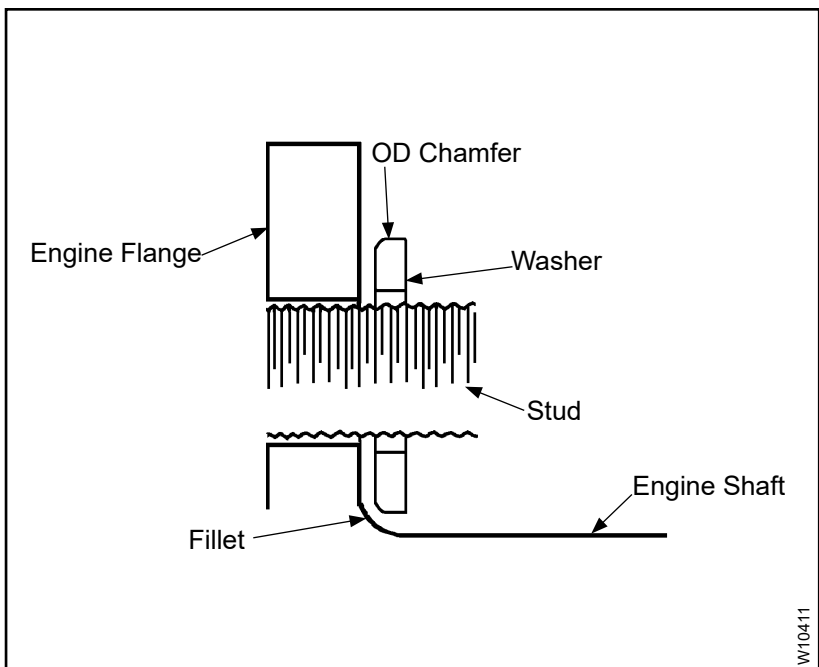
CAUTION: IF THE PROPELLER IS REMOVED BETWEEN OVERHAUL INTERVALS, A TORQUE CHECK OF THE MOUNTING STUDS MUST BE PERFORMED.

- (3) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
- (4) Install the specified O-ring on the engine flange. Refer to Table 3-1.
- (5) Put the propeller onto the engine flange.

CAUTION 1: NEW PROPELLER MOUNTING NUTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

CAUTION 2: THE SIDE OF THE WASHER WITH THE OD CHAMFER MUST BE AGAINST THE ENGINE FLANGE. REFER TO FIGURE 3-9.

- (6) Install self locking mounting nuts with washers onto the propeller mounting bolts with the chamfer on the washer against the engine flange. Refer to Table 3-1 for applicable mounting hardware. Refer to Figure 3-11.
- (a) If the propeller is removed between overhaul intervals, mounting nuts and washers may be reused if they are not damaged or corroded.



Installing the Washer on the Mounting Stud
Figure 3-9

- (7) Using a torque wrench and the specified torque wrench adapter (refer to the Tooling section in this chapter), torque all mounting bolts in sequences and steps shown in Figure 3-2.
 - (a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.
- (8) Safety all propeller mounting nuts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable. (Two nuts per safety.)
- (9) Decompress the external beta system and remove the beta ring puller TE100.

CAUTION: THE BETA FEEDBACK COLLAR MUST NOT CONTACT ANY ENGINE COMPONENT OR MOUNTING BOLT SAFETY WIRE. THE BETA FEEDBACK MECHANISM COULD BE DAMAGED IF IT CONTACTED ANY STATIC ENGINE COMPONENT WHILE ROTATING.

- (10) Examine the beta feedback collar to make sure that it is not in contact with any engine components or mounting bolt safety wire.
 - (a) If there is contact between the beta feedback collar and any engine components or mounting bolt safety wire, consult qualified personnel at an certified propeller repair station with the appropriate rating.
- (11) Install the carbon block into the beta linkage lever, in accordance with the airframe manufacturer's instructions.

CAUTION: FIT THE BLOCK IN THE BETA RING WITH A SIDE CLEARANCE OF 0.001 TO 0.002 INCH (0.03 TO 0.05 mm). REFER TO FIGURE 3-7.

- (12) Install the carbon block assembly into the beta ring. Refer to Figure 3-8.

- (13) Install, adjust, and safety the beta linkage in accordance with the airframe manufacturer's instructions.
- (14) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.
- (15) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (16) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (17) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

E. Installing the HC-E4W-3() Propeller on the Aircraft Engine

- (1) Using a beta ring puller TE100 (Figure 3-6), compress the beta system and pull the beta ring forward to permit access to the propeller mounting flange.

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: 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.

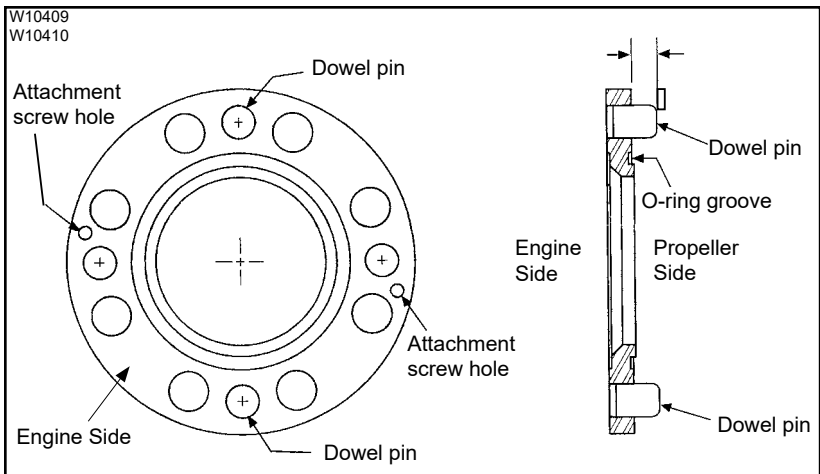
- (2) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.

CAUTION: IF THE PROPELLER IS REMOVED BETWEEN OVERHAUL INTERVALS, A TORQUE CHECK OF THE MOUNTING STUDS MUST BE PERFORMED.

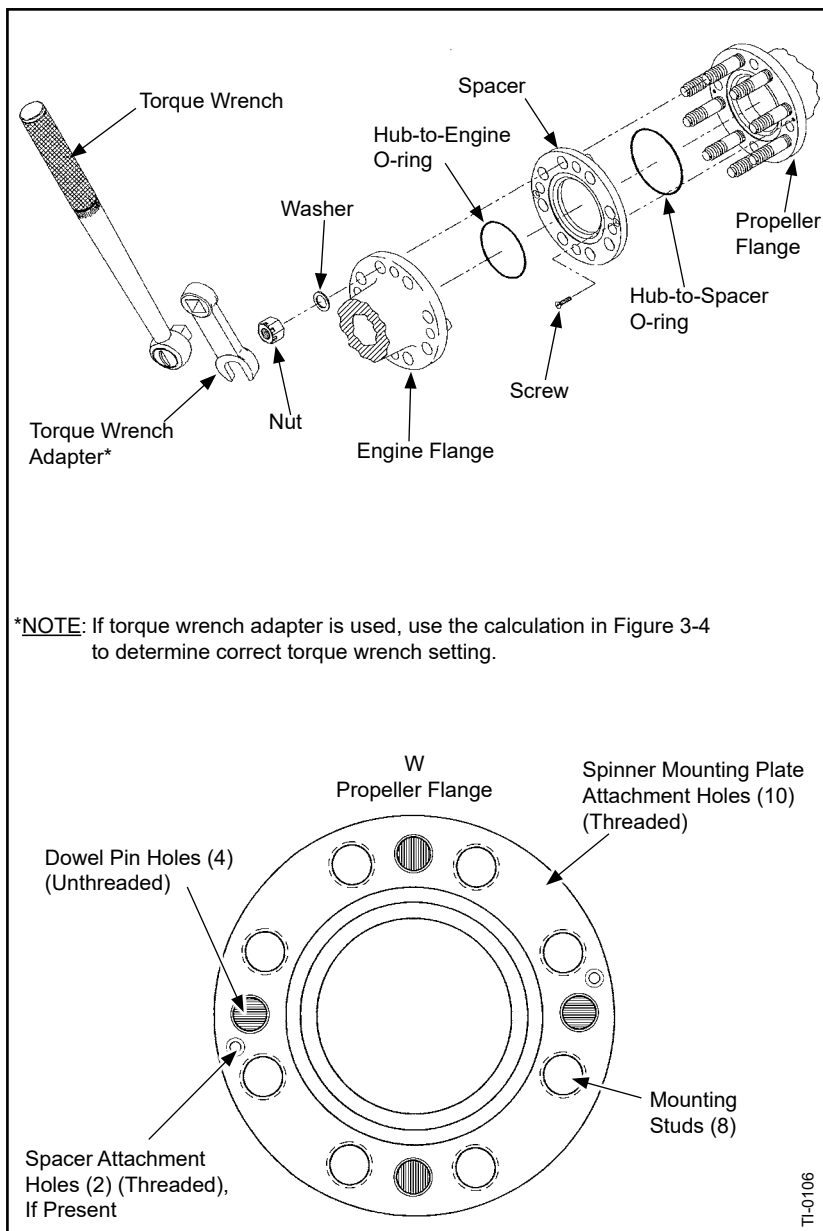
- (3) Unless this is the first installation of a new, or newly overhauled propeller, perform a torque check of the propeller mounting studs as follows:

- (a) Thread the torque check tool TE404-1 onto each propeller mounting stud and torque to 35 Ft-Lbs (47.6 N•m).

- (b) Visually inspect each stud for evidence of movement.
 - (c) Remove the torque check tool TE404-1 while visually inspecting each stud for evidence of movement.
 - (d) If any stud rotates due to either the tightening or removal of the torque check tool, all studs that fail the torque requirement must be replaced. Refer to an appropriately licensed repair facility for stud replacement.
- (4) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
 - (5) Install the specified O-ring on the engine flange. Refer to Table 3-1.
 - (6) If the C-7620 spacer is attached to the propeller hub with screws, proceed to step 3.E.(8).



Hub-to-Spacer O-ring Location in the Spacer
Figure 3-10



Installing the HC-E4W-3() Propeller on Engine Flange

Figure 3-11

- (7) If the C-7620 spacer is not already installed on the propeller hub, perform the following installation procedures:
- (a) If the hub flange does not have two 8-32 threaded holes to attach the spacer, or if two attachment screws were not provided, perform the following steps:
- 1 Coat the hub-to-spacer O-ring with grease. Refer to Table 3-1.
 - 2 Install the hub-to-spacer O-ring in the groove in the spacer that interfaces with the face of the hub flange. Refer to Figure 3-10.
 - 3 Align the mounting studs and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins in the spacer.
- CAUTION:** MAKE SURE THAT THE HUB-TO-SPACER O-RING STAYS IN THE GROOVE IN THE SPACER. IF THE O-RING IS TWISTED OR PINCHED, OIL LEAKAGE WILL RESULT WHEN THE PROPELLER IS OPERATED ON THE AIRCRAFT.
- 4 Slide the spacer onto the mounting studs and against the hub flange.
 - 5 If the hub flange has two 8-32 threaded holes and two MS24693-S2 flat-head screws (HPI P/N B-3868-S52) are provided to attach the C-7620 spacer, install the flat-head screws.
 - 6 Insert a supplied flat-head screw through each screw hole in the spacer and into the 8-32 threaded holes in the hub flange. Refer to Figure 3-11.

CAUTION: MAKE SURE THAT THE FLAT-HEAD ATTACHMENT SCREWS DO NOT PROTRUDE ABOVE THE ENGINE-SIDE SURFACE OF THE SPACER.

7 Tighten the flat-head screw until snug, but do not over-torque.

8 If after the flat-head screws are tightened, one or both protrude above the engine side surface of the spacer, check to make sure that the spacer is properly seated against the surface of the hub flange.

CAUTION 1: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE SPACER AND THE ENGINE FLANGE.

CAUTION 2: IF THE C-7620 SPACER IS NOT ATTACHED TO THE HUB, MAKE SURE THE HUB-TO-SPACER O-RING STAYS IN THE GROOVE IN THE SPACER. IF THE O-RING IS TWISTED OR PINCHED, OIL LEAKAGE WILL RESULT WHEN THE PROPELLER IS OPERATED ON THE AIRCRAFT.

(8) Slide the propeller onto the engine flange.

CAUTION 1: NEW PROPELLER MOUNTING NUTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

CAUTION 2: THE SIDE OF THE WASHER WITH THE OD CHAMFER MUST BE AGAINST THE ENGINE FLANGE. REFER TO FIGURE 3-9.

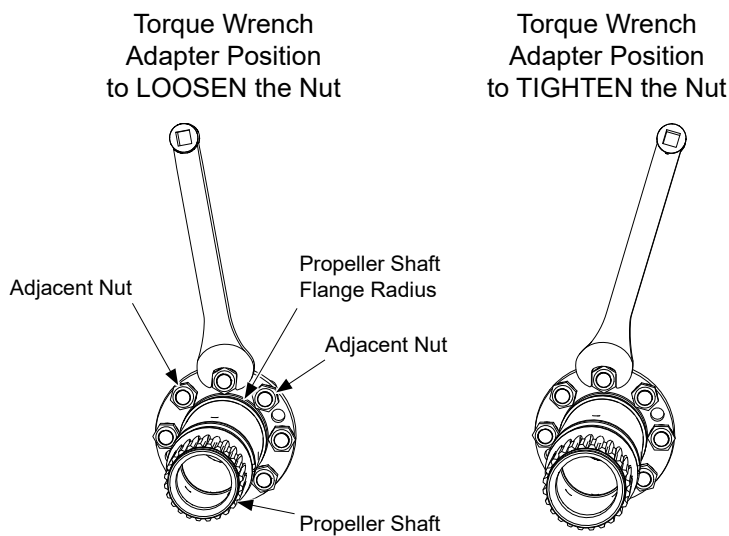
- (9) Install self locking mounting nuts with washers onto the propeller mounting studs. Refer to Table 3-1 for applicable mounting hardware. Refer to Figure 3-11.

NOTE: The OD chamfer on the washer is for clearance of the engine flange fillet. Refer to Figure 3-9.

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



CAUTION: DO NOT LET THE TORQUE WRENCH ADAPTER CONTACT THE ADJACENT NUTS OR THE PROPELLER SHAFT FLANGE RADIUS WHEN LOOSENING OR TIGHTENING THE MOUNTING NUTS.



TPI-MB-0635
TPI-MB-0636,
TPA-0008

Torque Wrench Adapter Position for W-flange Propellers
Figure 3-12

- (10) Using a torque wrench and the specified torque wrench adapter, torque all mounting bolts in sequences and steps shown in Figure 3-2 and Figure 3-12.
- (a) Refer to the section, "Tooling" in this chapter for the applicable torque wrench adapter.
 - (b) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.
- (11) For all HC-E4W-3() propellers, **except** HC-E4W-3K(): Safety all propeller mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable, if applicable. (Two studs per safety.)
- (12) Decompress the external beta system and remove the beta ring puller TE100.

CAUTION: THE BETA FEEDBACK COLLAR MUST NOT CONTACT ANY ENGINE COMPONENT OR MOUNTING BOLT SAFETY WIRE. THE BETA FEEDBACK MECHANISM COULD BE DAMAGED IF IT CONTACTED ANY STATIC ENGINE COMPONENT WHILE ROTATING.

- (13) Examine the beta feedback collar to make sure that it is not in contact with any engine components or mounting bolt safety wire.
- (a) If there is contact between the beta feedback collar and any engine components or mounting bolt safety wire, consult qualified personnel at a certified propeller repair station with an appropriate rating.
- (14) Install the carbon block into the beta linkage lever, in accordance with the airframe manufacturer's instructions.

CAUTION: FIT THE BLOCK IN THE BETA RING WITH A SIDE CLEARANCE OF 0.001 TO 0.002 INCH (0.03 TO 0.05 mm). REFER TO FIGURE 3-7.

- (15) Install the carbon block assembly into the beta ring. Refer to Figure 3-8.

- (16) Install, adjust, and safety the beta linkage per the airframe manufacturer's instructions.
- (17) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.
- (18) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (19) Propeller ice protection system components not supplied by Hartzell Propeller are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (20) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

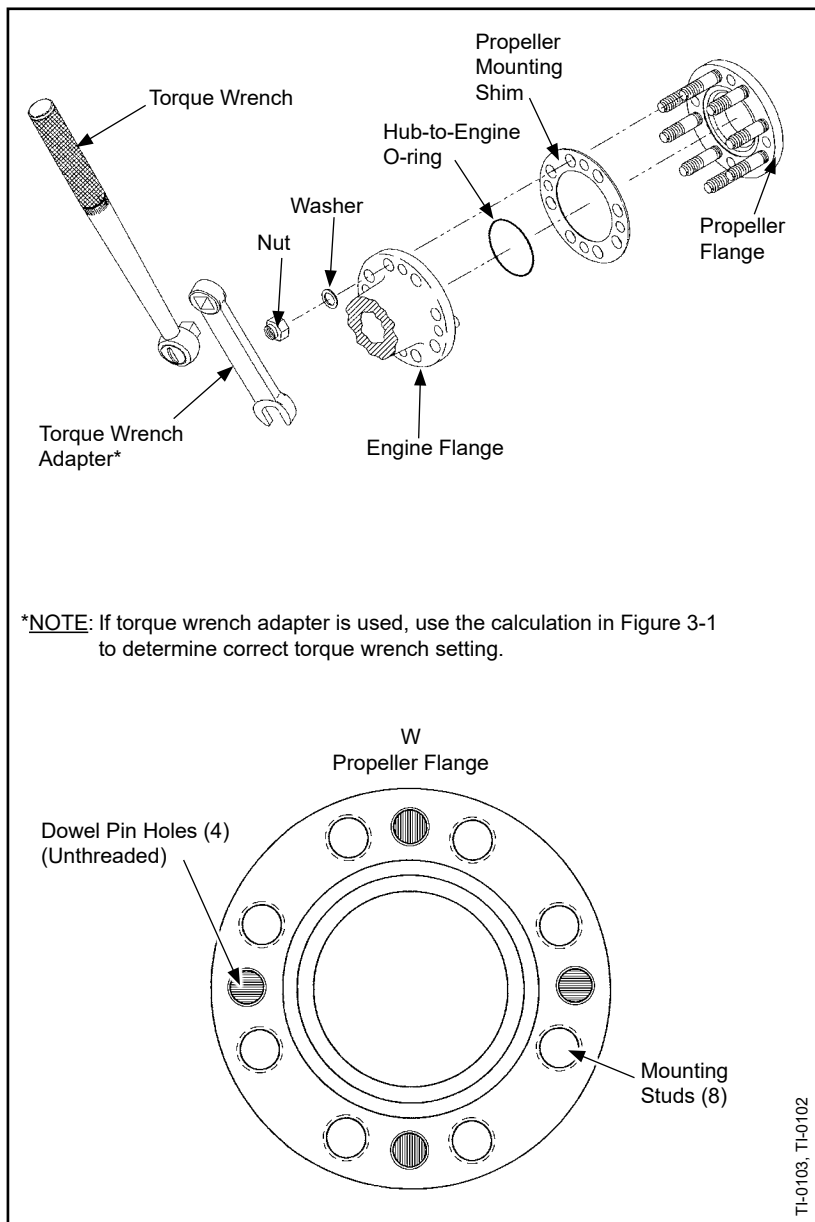
F. Installing the HC-E4W-5L Propeller on the Aircraft Engine

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

- (1) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.
- (2) Unless this is the first installation of a new, or newly overhauled propeller, perform a torque check of the propeller mounting studs as follows:
 - (a) Thread the torque check tool TE404-1 on each propeller mounting stud and torque to 35 Ft-Lbs (47.6 N•m).
 - (b) Visually inspect each stud for evidence of movement.
 - (c) Remove the torque check tool TE404-1 while visually inspecting each stud for evidence of movement.



Installing the HC-E4W-5L Propeller on Engine Flange

Figure 3-13

- (d) If any stud rotates due to either the tightening or removal of the torque check tool, all studs that fail the torque requirement must be replaced. Refer to an appropriately licensed repair facility for stud replacement.
- (3) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
- (4) Remove the pitch change rod cap, if applicable.
- (5) Install the specified O-ring on the engine flange. Refer to Table 3-1.
- (6) Slide the propeller mounting shim on the mounting studs and against the hub flange. Refer to Figure 3-13.
- (7) Align the mounting and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins in the engine flange.

CAUTION: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER MOUNTING SHIM, THE PROPELLER HUB FLANGE, AND THE ENGINE FLANGE.

- (8) Slide the propeller flange onto the engine flange.

CAUTION 1: NEW PROPELLER MOUNTING NUTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

CAUTION 2: THE SIDE OF THE WASHER WITH THE OD CHAMFER MUST BE AGAINST THE ENGINE FLANGE. REFER TO FIGURE 3-9.

- (9) Install self locking mounting nuts with washers onto the propeller mounting studs. Refer to Table 3-2 for applicable mounting hardware. Refer to Figure 3-13.

NOTE: The OD chamfer on the washer is for clearance of the engine flange fillet. Refer to Figure 3-9.

- (a) If the propeller is removed between overhaul intervals, mounting nuts and washers may be reused if they are not damaged or corroded.
- (10) Using a torque wrench and the specified torque wrench adapter, torque all mounting nuts in the sequences and steps shown in Figure 3-2 and Figure 3-12.
 - (a) Refer to the section, "Tooling" in this chapter for the applicable torque wrench adapter.
 - (b) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.
- (11) Safety all propeller mounting studs with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable. (Two studs per safety.)
- (12) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (13) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (14) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

- G. Installing the HC-(D,E)4()-5() Propeller on the Aircraft Engine, Except HC-E4W-5L and HC-E4N-5K()

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

- (1) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.
 - (a) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (2) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
- (3) Remove the pitch change rod cap, if applicable.
- (4) Install the specified O-ring on the engine flange. Refer to Table 3-1.
- (5) Align the mounting and dowel pin holes in the propeller hub flange with the mounting holes and dowel pins in the engine flange.

- (6) Slide the propeller onto the engine flange.

CAUTION 1: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

CAUTION 2: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

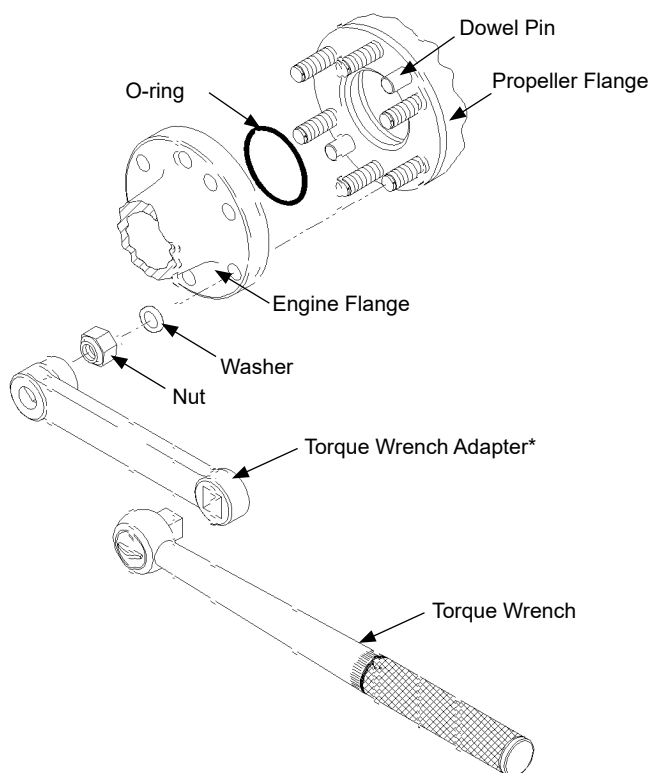
- (7) Apply anti-seize compound CM118 to the threaded surfaces of the mounting bolts. Refer to Table 3-1 for the applicable mounting hardware.

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

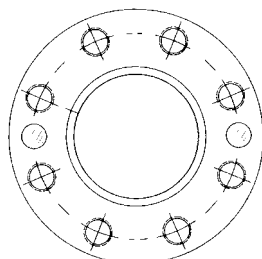
CAUTION: ID CHAMFER OF WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH ROLLED EDGES TOWARD THE BOLT HEAD. (REFER TO FIGURE 3-5).

- (8) Install the mounting bolts with washers through the engine flange and into the propeller hub flange. Refer to Figure 3-4.
- (9) Using a torque wrench and a torque wrench adapter TE5, torque all mounting bolts in sequences and steps shown in Figure 3-2.
- (a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.
- (10) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable. (Two bolts per safety.)

- (11) Install the beta tube in accordance with the airframe and/or engine manufacturer's instructions.
 - (a) Follow the airframe manufacturer's instructions for adjusting the beta tube to obtain the correct low pitch (flight idle blade angle).
 - (b) Refer to the Aircraft Type Certificate Data Sheet for the low pitch blade angle setting.
- (12) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.
- (13) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (14) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (15) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.



***NOTE:** If torque wrench adapter is used, use the calculation in Figure 3-4 to determine correct torque wrench setting



N-flange

APS6159C

APS6169

Installing the HC-E4N-5K() Propeller on Engine Flange Figure 3-13.1

H. Installing the HC-E4N-5K() Propeller on the Aircraft Engine

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

CAUTION 1: WHEN INSTALLING THE PROPELLER ON THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

- (1) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.

CAUTION: IF THE PROPELLER IS REMOVED BETWEEN OVERHAUL INTERVALS, A TORQUE CHECK OF THE MOUNTING STUDS MUST BE PERFORMED.

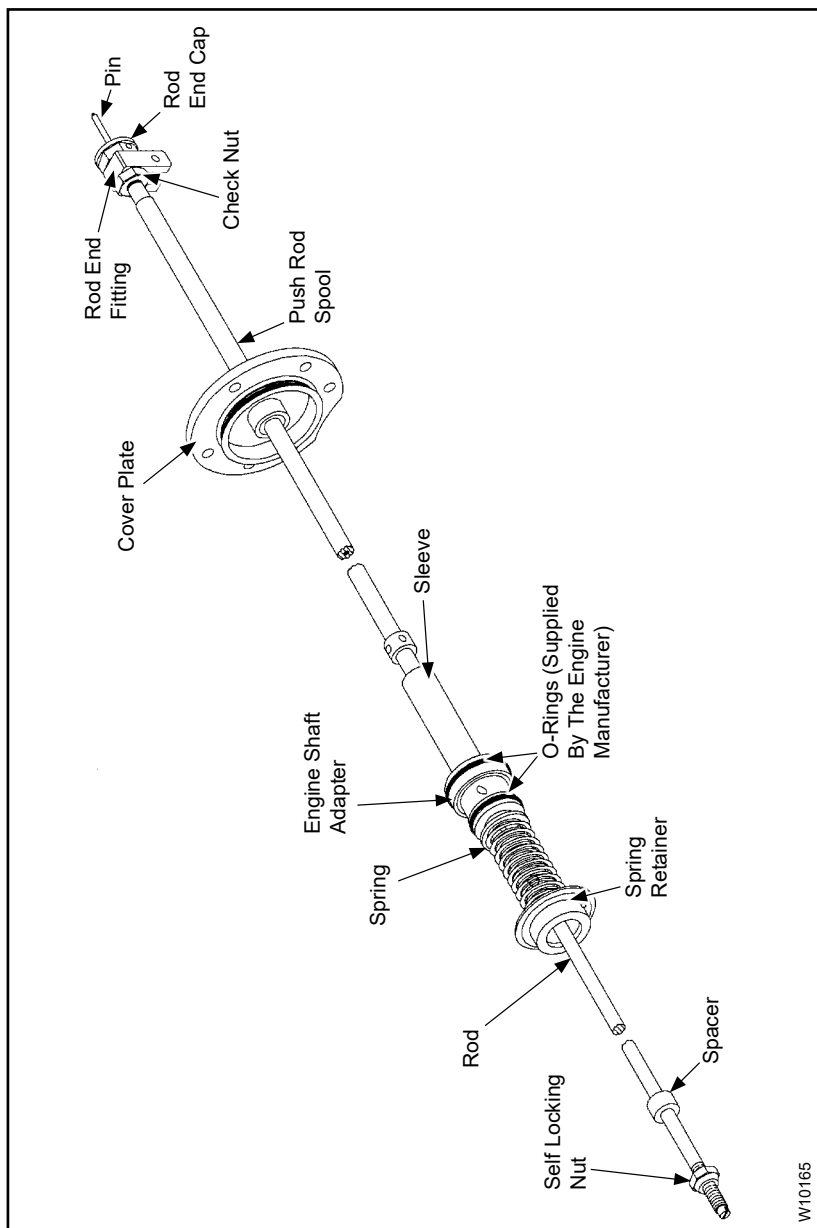
- (2) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.
- (3) Remove the pitch change rod cap, if applicable.
- (4) Install the specified O-ring on the engine flange. Refer to Table 3-1.
- (5) Put the propeller onto the engine flange.

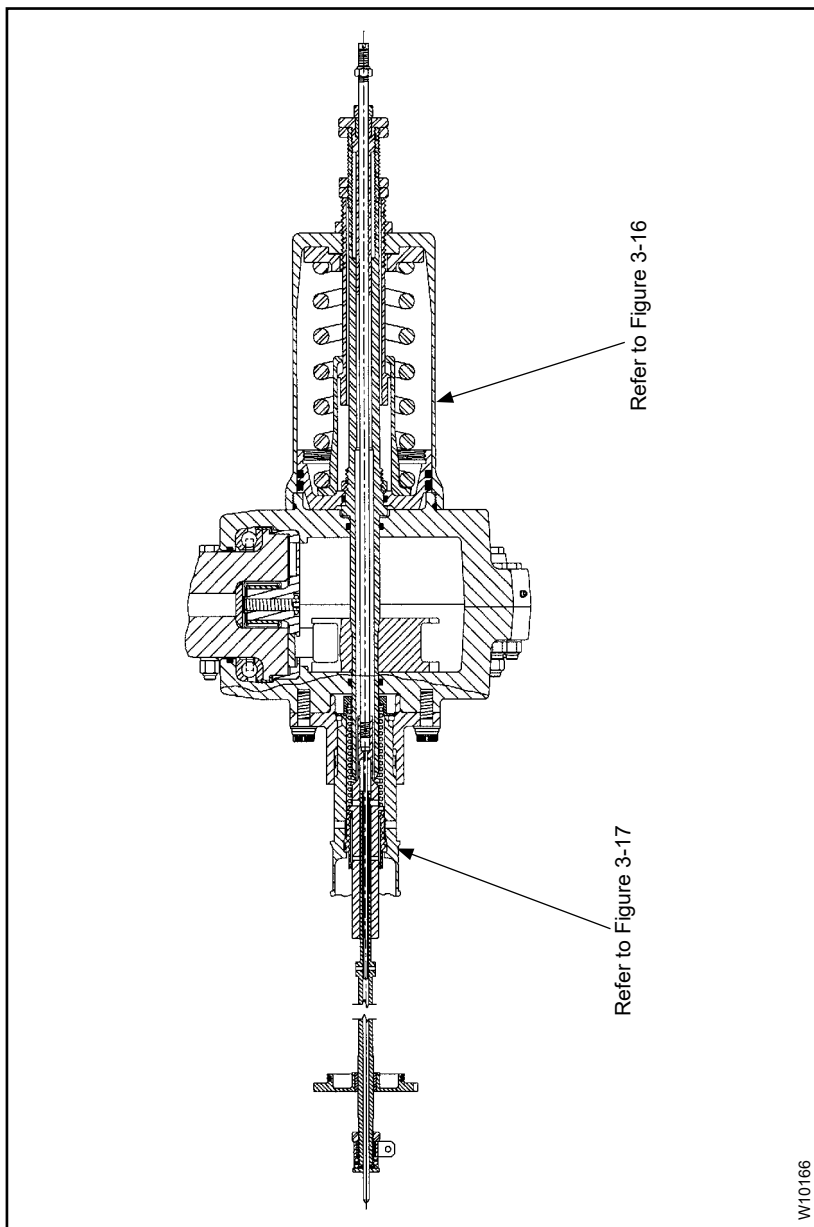
CAUTION 1: NEW PROPELLER MOUNTING NUTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

CAUTION 2: THE SIDE OF THE WASHER WITH THE OD CHAMFER MUST BE AGAINST THE ENGINE FLANGE. REFER TO FIGURE 3-9.

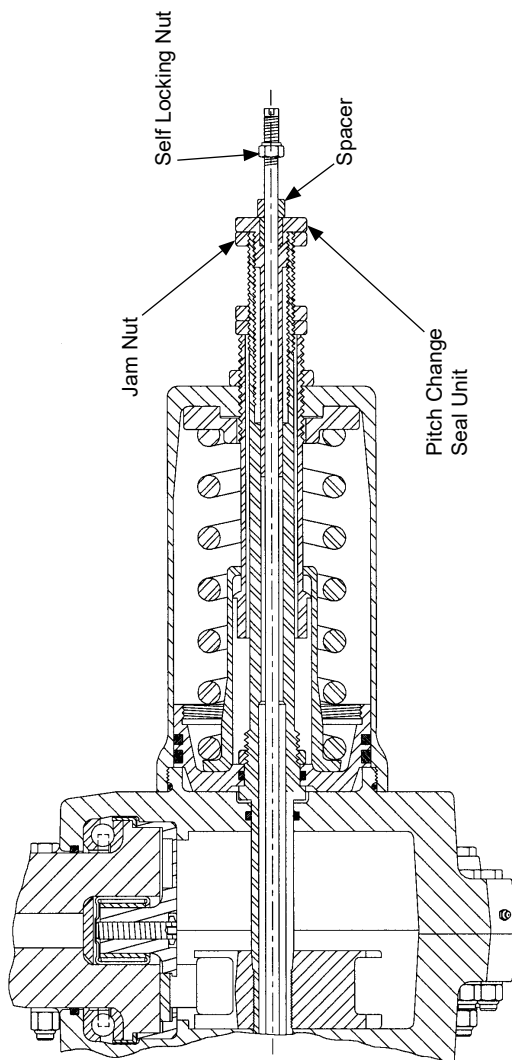
- (6) Apply anti-seize compound CM118 to the threaded surfaces of the mounting nuts. Refer to Table 3-1 for the applicable mounting hardware.
 - (a) If the propeller is removed between overhaul intervals, mounting nuts and washers may be reused if they are not damaged or corroded.
- (7) Install self locking mounting nuts with washers onto the propeller mounting studs with the chamfer of the washer against the engine flange. Refer to Table 3-1 for applicable mounting hardware. Refer to Figure 3-13.1.
- (8) Using a torque wrench and the specified torque wrench adapter (refer to the section, "Tooling" in this chapter), torque all mounting nuts in sequences and steps shown in Figure 3-2.
 - (a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.
- (9) Safety all propeller mounting nuts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire or equivalent aircraft safety cable. (Two nuts per safety.)
- (10) Install the beta tube in accordance with the airframe and/or engine manufacturer's instructions.
 - (a) Follow the airframe manufacturer's instructions for adjusting the beta tube to obtain the correct low pitch (flight idle blade angle).
 - (b) Refer to the Aircraft Type Certificate Data Sheet for the low pitch blade angle setting.
- (11) If the propeller is equipped with an accessory drive pulley, follow the applicable manufacturer's instructions for installation of the accessory drive pulley hardware.

- (12) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (13) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (14) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

**Beta Valve System****Figure 3-14**

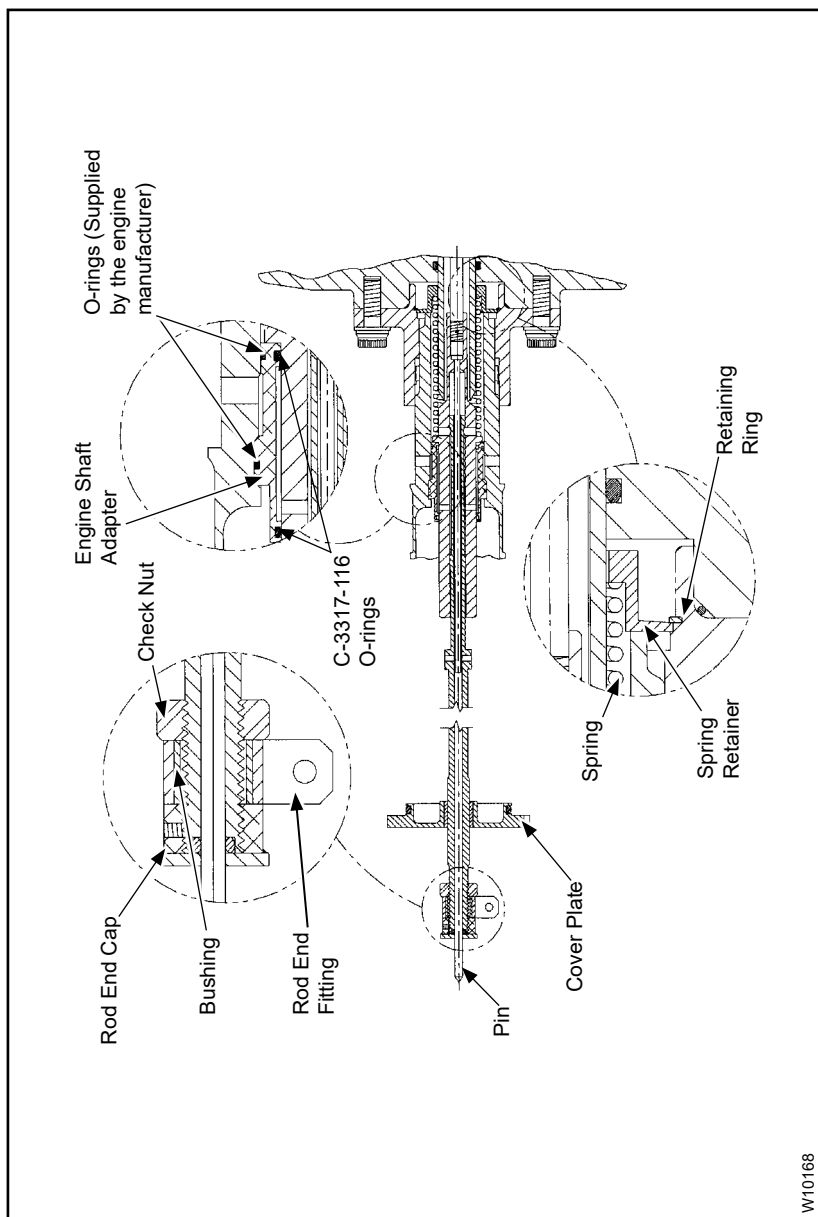


Beta Valve System in the Propeller
Figure 3-15



W10167

Front View of the Beta Valve System in the Propeller
Figure 3-16



W10168

Rear View of the Beta Valve System in the Propeller
Figure 3-17

I. Installing the HC-D3F-7() Propeller on the Allison Engine

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

(1) General

- (a) This propeller incorporates a beta valve assembly that is installed inside of the propeller shaft and extends from the rear of the engine to the front of the propeller pitch change rod.
- (b) The beta valve assembly is installed in the engine shaft before the propeller is installed. Refer to Figures 3-14 through 3-17.
- (2) Make sure that the shaft adapter is installed in the engine shaft.
- (3) Install the C-3317-116 O-rings in the two grooves of the shaft adapter. Coat with a light oil (engine oil).
- (4) Remove the cover plate from the rear of the engine case.
- (5) Prepare the beta valve.

NOTE: The beta valve should be preassembled as shown in Figure 3-14 less the pitch change rod, engine shaft adapter, engine supplied O-rings and cover plate when new or from overhaul.

Refer to Figures 3-14 and 3-17.

- (a) If the beta valve is supplied preassembled, remove the self locking nut, spacer, rod end cap, rod end fitting, bushing and check nut.

(b) If the beta valve is supplied unassembled, assemble as follows:

- 1 Slide the push rod spool onto the pin and into the sleeve with the threaded end facing away from the sleeve.
- 2 Slide the spring onto the rod up to and against the shoulder of the sleeve.
- 3 Install the spring retainer onto the rod with the recessed center section facing toward the two springs.

- (6) Slide the partially assembled beta valve into the engine shaft from the engine shaft end permitting the push rod spool to extend out the rear of the engine. The shoulder of the sleeve should be against the shaft adapter.
- (7) Compress the spring with spring retainer and install the retaining ring that is furnished with the engine to secure the spring retainer.

NOTE: A locator button on the spring retainer will fit into a recess in the engine shaft/flange.

- (8) Install the ID and OD O-rings on the engine cover, per the airframe or engine manufacturer's instructions.
- (9) Install the engine cover on the rear of the engine gear box encircling the beta valve push rod spool, per airframe or engine manufacturer's instructions.

NOTE: Cover plate fasteners are supplied by the engine manufacturer.

- (10) Prepare the propeller for installation.

- (a) Remove the safety wire from the pitch change seal unit and the jam nut. Refer to Figure 3-16.
- (b) Remove the pitch change seal unit from the front of the propeller.

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

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

(11) With a suitable crane hoist and sling, carefully move the propeller assembly to the aircraft engine mounting flange.

(12) Using Quick Dry Stoddard Solvent or MEK, clean the engine flange and the propeller flange.

(a) Follow the manufacturer's instructions manual for installation of the spinner bulkhead.

(13) Remove the pitch change rod cap, if applicable.

(14) Install the specified O-ring into the groove of the hub flange bore. Refer to Table 3-1.

CAUTION: DO NOT PERMIT THE PROPELLER ASSEMBLY TO HIT OR REST ON THE BETA FEEDBACK ROD. THIS COULD BEND OR OTHERWISE DAMAGE THE FEEDBACK ROD.

(15) Slide the propeller over the beta valve assembly.

(16) Align the mounting holes in the propeller hub flange with the mounting holes in the engine flange.

CAUTION: MAKE SURE THAT COMPLETE AND TRUE SURFACE CONTACT IS ESTABLISHED BETWEEN THE PROPELLER HUB FLANGE AND THE ENGINE FLANGE.

(17) Slide the propeller hub flange onto the engine flange.

CAUTION 1: ID CHAMFER OF THE WASHER MUST BE FACING TOWARD THE BOLT HEAD. WASHERS WITHOUT CHAMFER MUST BE INSTALLED WITH ROLLED EDGES TOWARD THE BOLT HEAD (FIGURE 3-3).

CAUTION 2: NEW PROPELLER MOUNTING BOLTS MUST BE USED WHEN INITIALLY INSTALLING A NEW OR OVERHAULED PROPELLER.

(18) Install the propeller mounting bolts and washers through the engine flange and into the propeller hub flange. Refer to Table 3-1 for the applicable mounting hardware.

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

(19) Using a torque wrench and a torque wrench adapter TE152, torque all the mounting bolts in the sequences and steps shown in Figure 3-2.

(a) Refer to Table 3-2 and Figure 3-1 to find the correct torque value.

(20) Safety all mounting bolts with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. (Two bolts per safety.)

(21) Reinstall the pitch change seal unit to the front of the propeller tight against the jam nut.

(22) Safety the pitch change seal unit and jam nut with 0.032 inch (0.81 mm) minimum diameter stainless steel wire.

CAUTION: THE ROD END CAP MUST BOTTOM ON THE PUSH ROD SPOOL WHEN INSTALLED.

(23) Install the rod end cap onto the threaded end of the push rod spool.

NOTE: Do not tighten the set screw in the rod end cap.

(a) Mark the location of the set screw on the rod and then remove the end cap unit.

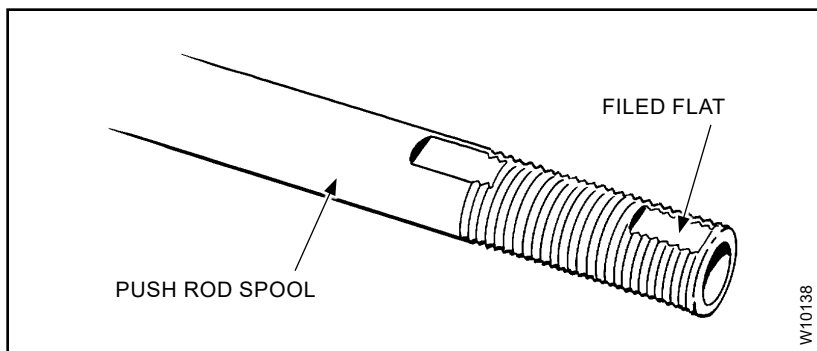
(b) File a flat, tangent to the rod, no deeper than the depth of the threads at the marked location of the set screw. Refer to Figure 3-18.

(24) Install the check nut onto the threaded end of the push rod spool.

(25) Install the bushing onto the threaded end of the push rod spool.

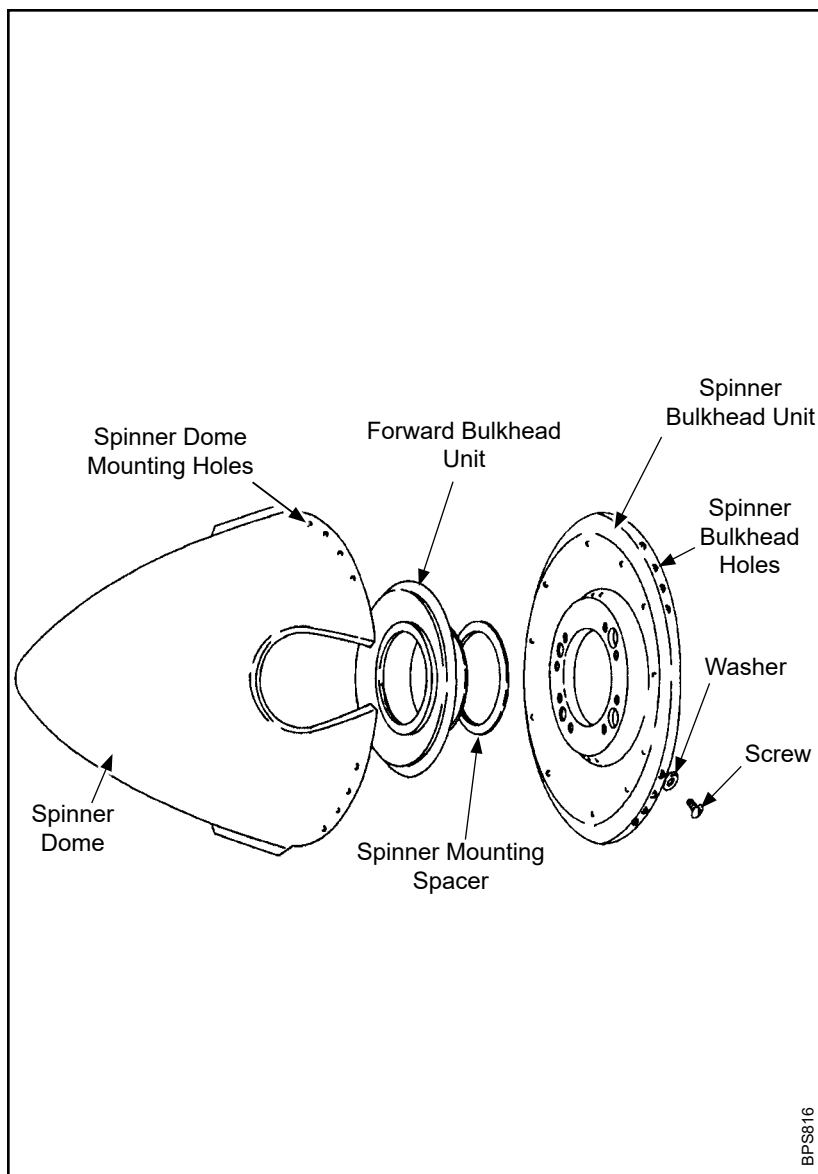
(26) Install the rod end fitting onto the threaded end of the push rod spool.

(27) Install the C-3317-006 O-ring in the cavity at the rear end of the push rod spool.



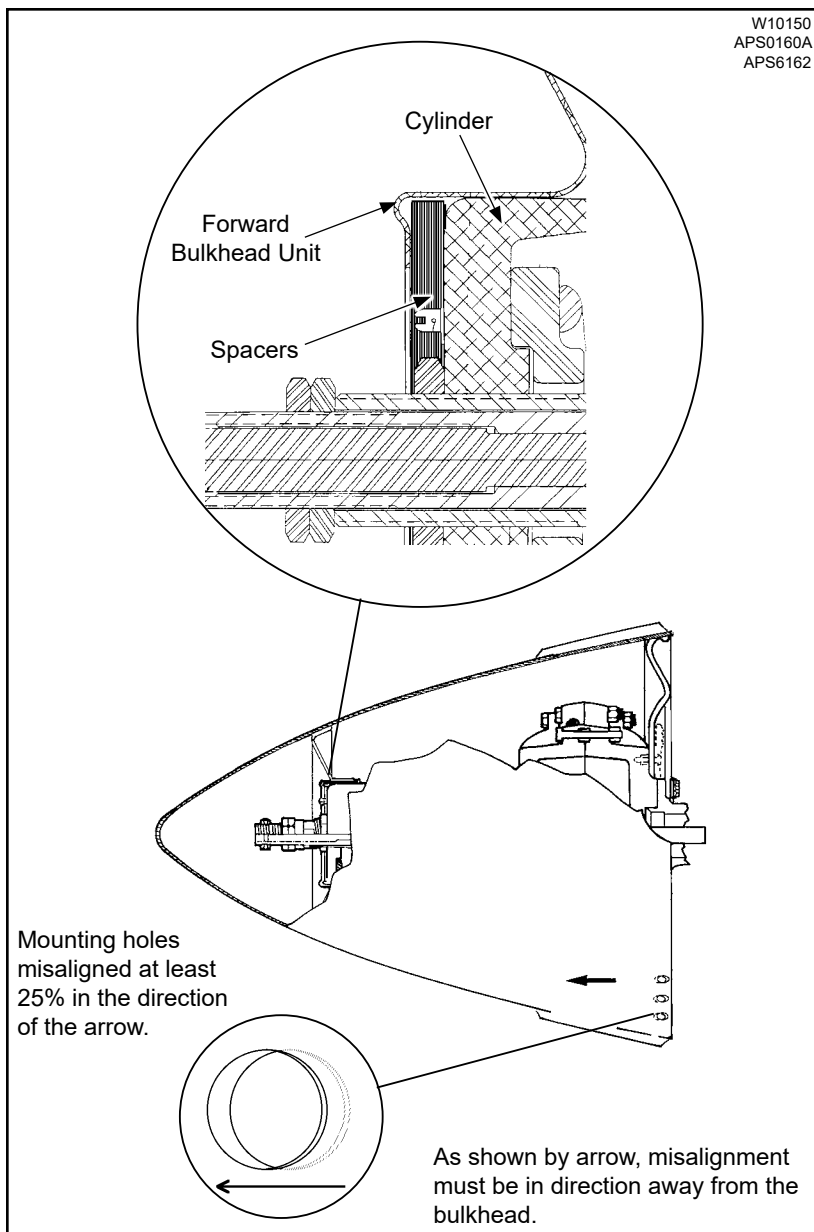
Filed Rod for Set Screw
Figure 3-18

- (28) Install the rod end cap onto the threaded end of the push rod spool.
 - (a) Make sure the rod end cap is bottomed on the end of the push rod spool.
 - (b) Apply Loctite 272 to the set screw threads.
 - (c) Tighten the set screw.
- (29) Apply Loctite 272 to the push rod threads where the check nut will be located on the push rod spool next to the bushing.
- (30) Tighten the check nut against the bushing to torque indicated in Table 3-2.
- (31) Attach engine mounted beta system control hardware to the rod end fitting and adjust per airframe or engine manufacturer's instructions.
- (32) Install the beta light switch against the pin per airframe manufacturer's instructions.
- (33) Install the spacer and self-locking nut onto the front of the rod that protrudes through the front of the pitch change rod and cylinder.
 - (a) Follow the airframe manufacturer's instructions for making pitch control adjustments.
- (34) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (35) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA). Hartzell Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (36) Install the propeller spinner dome in accordance with the section, "Spinner Dome Installation" in this chapter.

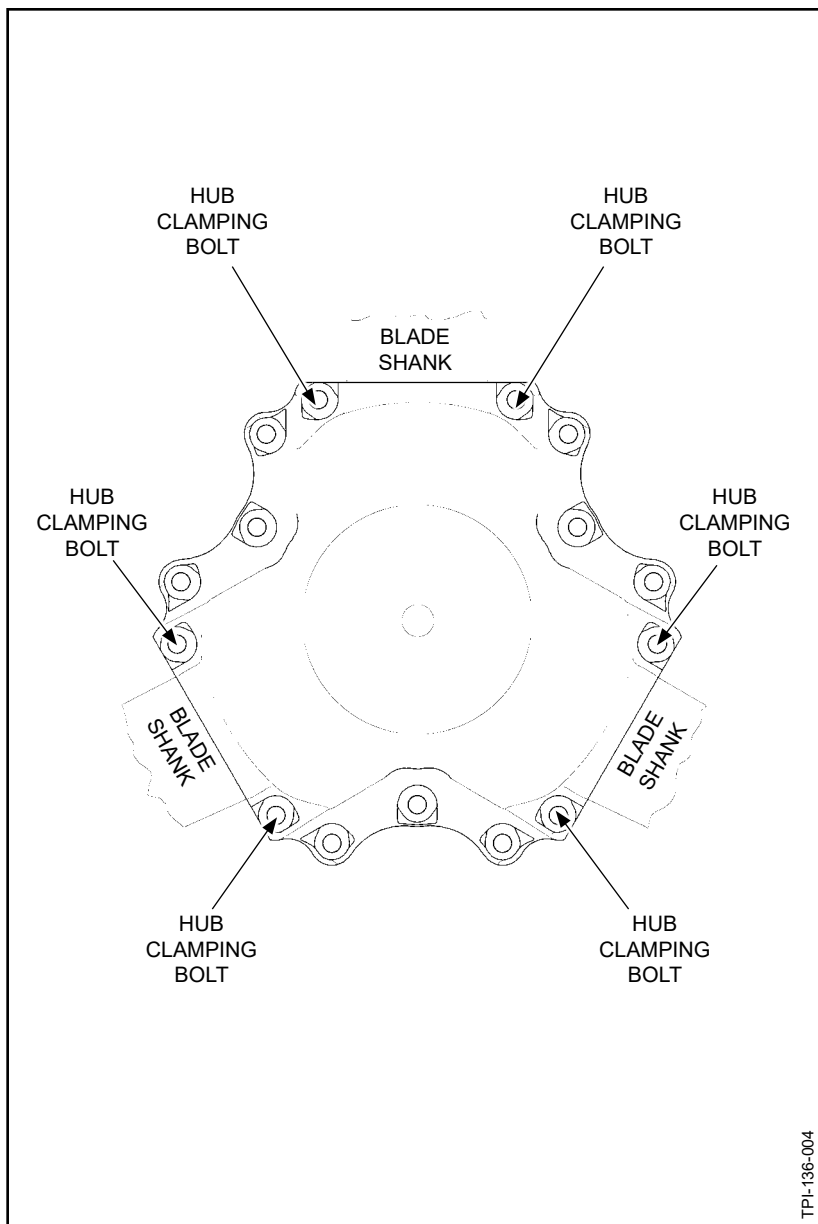


**Spinner Assembly for HC-(D,E)4(-)(2,3,5)() and
HC-E5N-3() with D-5505-1() Spinner Assembly**
Figure 3-19

W10150
APS0160A
APS6162



Spinner Reassembly Procedures
Figure 3-20



Hub Clamping Bolt Location for Spinner Mounting

Figure 3-21

5. Spinner Dome Installation

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

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

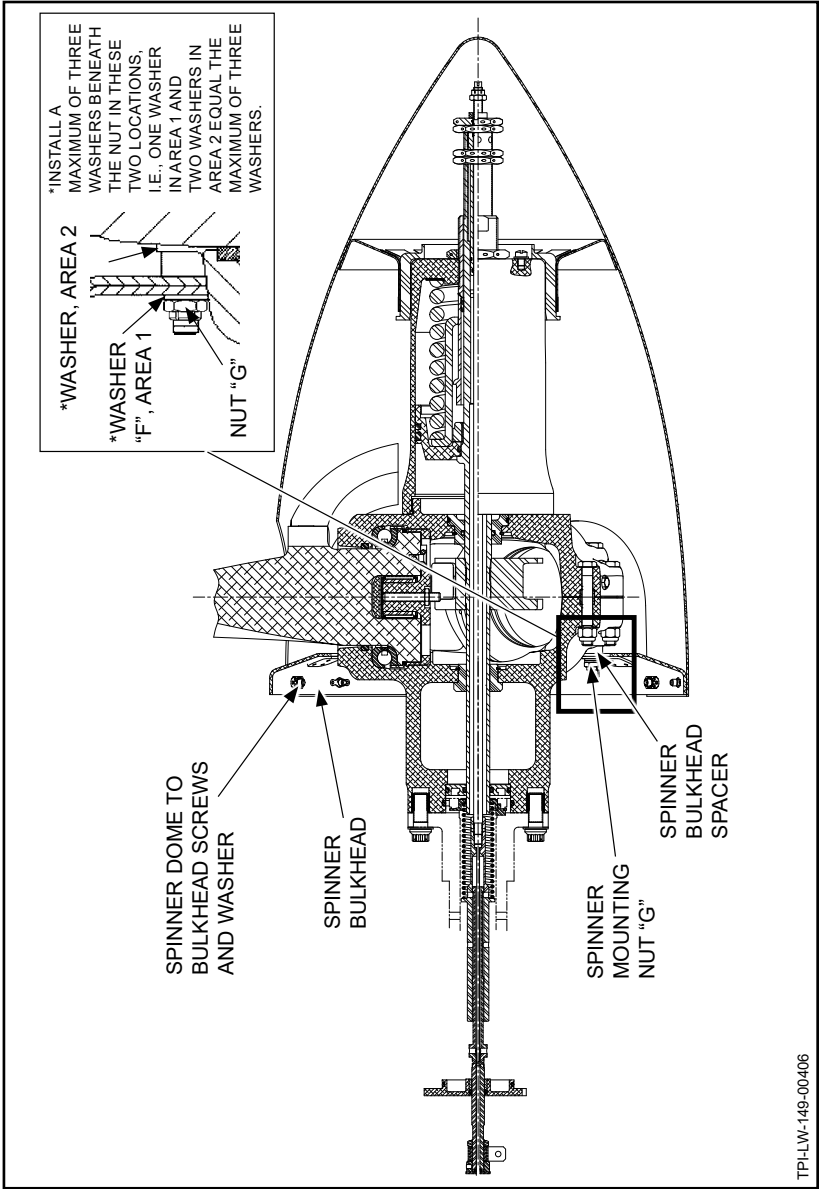
A. General

- (1) The following instructions relate to Hartzell Propeller spinners only. In some cases, the airframe manufacturer produced the spinner assembly. Refer to the airframe manufacturer's manual for spinner installation instructions.

B. Installation of a Metal Spinner Bulkhead on HC-D3F-7H Propeller Hub

- (1) Refer to Figure 3-21. Remove the nuts from the hub clamping bolts that are located on either side of the blade shank.
- (a) Do not remove the remaining nuts and bolts.
- (2) Refer to Figure 3-21. The spinner may be supplied with long hub clamping bolts. If the bolts were supplied with the spinner, remove the bolts on either side of the blade shank and replace them with the bolts supplied with the spinner. The supplied hub clamping bolts will be longer than those removed from the hub.

NOTE: Depending upon the installation, the propeller hub may have been shipped from the factory with the longer hub clamping bolts installed. In this case, the hub clamping bolts will not be supplied with the spinner.



**Metal Bulkhead and Spinner Mounting for
HC-D3F-7H Series Propeller
Figure 3-22**

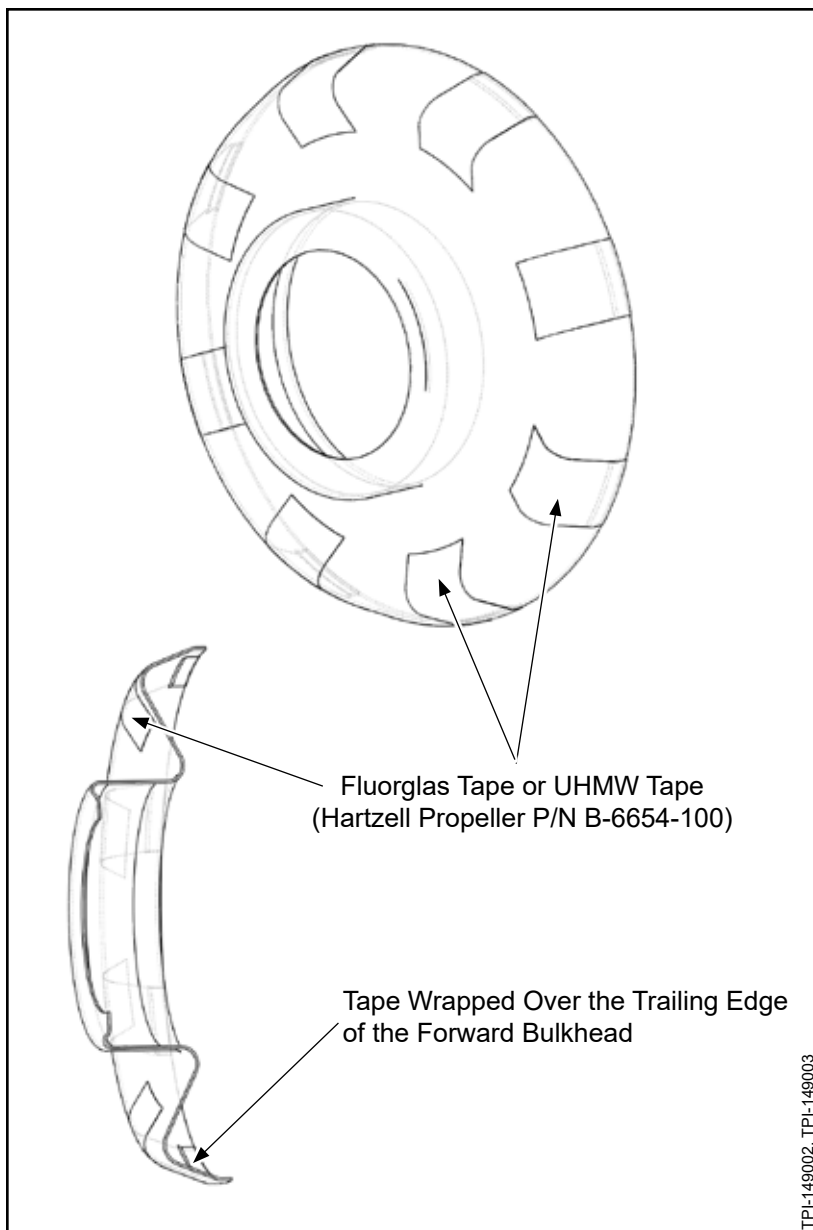
- (3) Refer to Figure 3-22. Put the spinner bulkhead spacers on the hub clamping bolts. Install the spinner bulkhead over the installed spacers on the hub clamping bolts.

CAUTION: A MINIMUM OF ONE THREAD OF THE HUB CLAMPING BOLT MUST BE VISIBLE AFTER THE SPINNER MOUNTING NUT IS INSTALLED.

- (4) When the spinner bulkhead is installed, there must be no less than one thread of the hub clamping bolt exposed beyond the spinner mounting nut. A total of three washers in two areas may be installed beneath the spinner mounting nut to achieve this result. On some installations, it may be necessary to install spacers and one or more washers beneath the head of the bolt to avoid interference with aircraft cowling.
- (a) Additional washers (as many as four) may have been used for hub clamping purposes during assembly of the propeller.
- 1 Use the quantity of washers required when installing the bulkhead for the correct spinner position. Refer to Figure 3-22.
 - 2 After the correct installation of the spinner, any remaining washers may be discarded.
- (5) Install at least one flat washer "F" and a new self-locking spinner mounting nut "G" on each hub clamping bolt used to mount the spinner bulkhead. Refer to Table 3-3.
- (6) Torque each spinner mounting nut in accordance with Table 3-2, Figure 3-1, and Figure 3-2.

Description	Part Number
Flat Washer "F"	B-3824-0663
Spinner Mounting Nut "G"	B-3599

Metal Spinner Bulkhead Mounting Hardware
Table 3-3



Optional Tape on the Spinner Forward Bulkhead
Figure 3-23

C. Propeller Models HC-(D,E)4()-(2,3,5)(), HC-E5N-3(), and HC-D3F-7H That Use a One-piece Spinner Dome and Forward Bulkhead

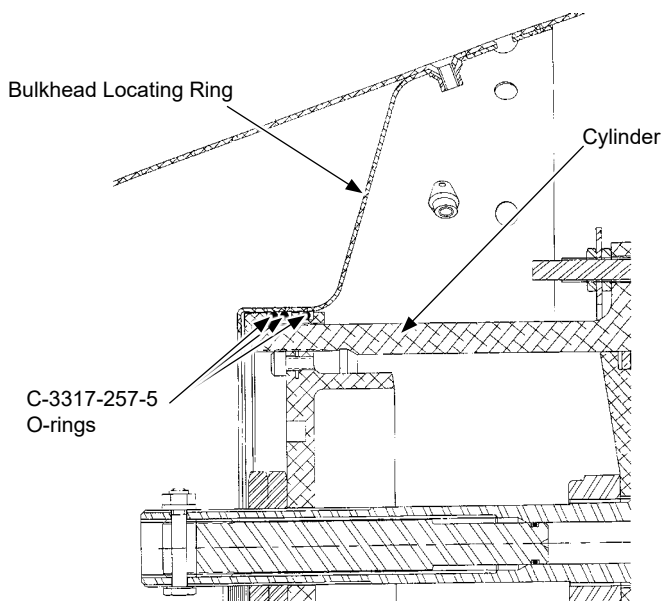
- (1) The spinner dome is supported by a forward bulkhead unit that encircles the propeller cylinder. Refer to Figure 3-20.
 - (a) If the forward bulkhead unit does not fit snugly on the cylinder, the cylinder may need to be wrapped with one or more layers of fluoroglas or UHMW tape (Hartzell Propeller P/N B-6654-100).
 - 1 Apply a layer of tape, check, and repeat until the forward bulkhead unit fits snugly on the cylinder.
 - (b) The forward bulkhead unit is positioned away from the cylinder with spacers to cause the spinner dome mounting holes to stop short of full alignment with the bulkhead holes by 25% of the spinner dome mounting hole diameter.
 - (c) Positioning of the spinner dome mounting holes and forward bulkhead unit is accomplished by installing or removing spacers that are between the cylinder and forward bulkhead.
- (2) Optionally for a spinner dome that has a removable forward bulkhead, apply a layer of fluoroglas tape or UHMW tape (Hartzell Propeller P/N B-6654-100) on the outboard flange of the forward bulkhead to prevent contact between the forward bulkhead and the spinner dome.
 - (a) Using acetone, denatured alcohol, or MEK, clean the area where the tape will be applied.
 - (b) Cut eight pieces of tape that are approximately 3 inches (76 mm) long.
 - (c) Apply the pieces of tape in equally spaced locations on the forward bulkhead as shown in Figure 3-23.
 - (d) Tape may be wrapped over the trailing edge of the forward bulkhead as necessary.

- (3) Carefully slide the spinner dome over the propeller and forward bulkhead to check for proper positioning of the spinner dome mounting holes. Add or remove spacers to obtain the spinner dome mounting hole and spinner bulkhead hole misalignment. Refer to Figure 3-19.
- (4) Push the spinner dome with firm pressure toward the spinner bulkhead unit to make sure that the spinner dome mounting holes will fully align with the spinner bulkhead holes. Remove a minimum quantity of spacers to obtain hole alignment while maintaining preload.

NOTE: Tension induced by hole misalignment improves spinner longevity and reduces vibration induced wear.

- (5) Using the supplied screws and washers, attach the spinner dome to the spinner bulkhead.
 - (a) Install one or two screws in the hole(s) centered between two blade cutouts.
 - (b) Tighten the screw(s) until snug.
 - (c) Install one or two screws in the hole(s) centered between two blade cutouts on the opposite side of the spinner dome.
 - (d) Tighten the screw(s) until snug.
 - (e) Repeat installation of screws in the holes centered between two blade cutouts for the remaining areas.
 - (f) Tighten screw(s) until snug.
 - (g) Install the remaining screws in the remaining holes.
 - (h) Tighten until snug.

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NOTE: This figure shows a cylinder bulkhead locating ring that has one narrow O-ring groove and one wide O-ring groove.

W10151

D-5527-1() Spinner Assembly
Figure 3-24

D. Propeller Models HC-E5N-3() with D-5527-1() Spinner Assembly

- (1) Install the C-3317-257-5 O-rings into the OD grooves of the bulkhead locating ring that encircles the propeller cylinder. Refer to Figure 3-24.

NOTE: The bulkhead locating ring is bonded to the outboard end of the cylinder OD.

- (a) For a cylinder bulkhead locating ring that has one narrow O-ring groove and one wide O-ring groove:

1 Install two O-rings in the wide OD groove.

2 Install one O-ring in the narrow OD groove.

- (b) For a cylinder bulkhead locating ring that has two narrow O-ring grooves:

1 Install an O-ring in each of the narrow OD grooves.

- (2) Carefully slide the spinner dome over the propeller and cylinder. Align the spinner dome mounting holes with the spinner bulkhead holes.

- (a) Slide the forward bulkhead unit, that is attached to the ID of the spinner dome, over the O-rings installed on the cylinder mounted metal ring.

- (3) Using the supplied screws and washers, attach the spinner dome to the spinner bulkhead.

- (a) Install one or two screws in the hole(s) centered between two blade cutouts.

- (b) Tighten the screw(s) until snug.

- (c) Install one or two screws in the hole(s) centered between two blade cutouts on the opposite side of the spinner dome.

- (d) Tighten the screw(s) until snug.

- (e) Repeat installation of screws in the holes centered between two blade cutouts for the remaining areas.

- (f) Tighten screw(s) until snug.

- (g) Install the remaining screws in the remaining holes.

- (h) Tighten until snug.

- E. Propeller Model HC-D3F-7 Installed on Goodyear Airship GZ-22
- (1) Carefully slide the spinner bulkhead over the propeller and cylinder. Align the spinner dome mounting holes with the spinner bulkhead holes.
 - (2) Using the supplied screws and washers, attach the spinner dome to the spinner bulkhead.
 - (a) Install one or two screws in the hole(s) centered between two blade cutouts.
 - (b) Tighten the screw(s) until snug.
 - (c) Install one or two screws in the hole(s) centered between two blade cutouts on the opposite side of the spinner dome.
 - (d) Tighten the screw(s) until snug.
 - (e) Repeat installation of screws in the holes centered between two blade cutouts for the remaining areas.
 - (f) Tighten screw(s) until snug.
 - (g) Install the remaining screws in the remaining holes.
 - (h) Tighten until snug.
6. Post-Installation Checks
- A. Refer to the airframe manufacturer's instructions for post-installation checks.
 - B. Perform a Maximum RPM (Static) Hydraulic Low Pitch Stop Check as outlined in the Testing and Troubleshooting chapter of this manual.

7. Spinner Dome Removal

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

A. Removal Procedure

- (1) Remove the screws and washers that secure the spinner dome to the spinner bulkhead.
- (2) Remove the spinner dome.
 - (a) When the spinner dome is removed from the HC-E5N-3() propeller model with the D-5527-1() spinner assembly check the three C-3317-257-5 O-rings in the metal ring encircling the propeller cylinder.
- (2) Replace the O-rings if they are damaged or worn.

8. Propeller Assembly Removal

A. Removal of HC-(D,E)4()-2() Propellers

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

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

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.

- (5) Cut and remove the safety wire (if installed) on the propeller mounting bolts.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

- (6) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit rotating the propeller for ease of bolt removal.

- (7) If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of correct orientation during reinstallation to prevent dynamic imbalance.

- (8) For propeller models with air conditioning accessories:
removal of air conditioning drive accessories, if installed.
- (a) Remove the accessory mounting bolts and washers.
 - (b) Remove the two-piece air conditioning pulley.
 - (c) Temporarily reattach the spinner bulkhead and pulley containment ring to the hub with two of the accessory mounting bolts.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS IF THEY ARE DAMAGED OR CORRODED, OR WHEN THE PROPELLER IS REMOVED FOR OVERHAUL.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

- (10) Using the support sling, lift the propeller from the mounting flange.
- (11) Remove and discard the propeller mounting O-ring.
- (12) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.
- (13) For propeller models with air conditioning accessories:
- (a) Remove the temporary fasteners attaching the spinner bulkhead and pulley containment ring.
 - (b) Remove the spinner bulkhead and pulley containment ring.
- (14) Put the propeller on a suitable cart for transportation.

- B. Removal of HC-(D,E)(4,5)(A,N)-3() Propellers,
Except HC-E4N-3K()

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

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

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (5) Disconnect the engine beta linkage and the carbon block assembly from the beta ring per airframe manufacturer's instructions. Refer to Figure 3-8.
- (6) Remove the snap ring that retains the carbon block assembly to the beta linkage.

- (7) Remove the carbon block assembly. Refer to Figure 3-7.
- (8) Using the beta ring puller TE100, compress the beta system and pull the beta ring forward to expose the propeller mounting bolts and washers. Refer to Figure 3-6.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

- (9) Support the propeller assembly with a sling.
- (10) Cut and remove the safety wire (if installed) on the propeller mounting bolts.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS IF THEY ARE DAMAGED OR CORRODED, OR WHEN THE PROPELLER IS REMOVED FOR OVERHAUL.

(11) Remove the propeller mounting bolts and washers.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

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

(13) Remove and discard the propeller mounting O-ring.

(14) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.

(15) Decompress and remove the beta ring puller TE100.

(16) Put the propeller on a suitable cart for transportation.

C. Removal of HC-E4P-3K and HC-E4N-3K() Propellers

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN THE FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

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

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (5) Disconnect the engine beta linkage and the carbon block assembly from the beta ring in accordance with the airframe manufacturer's instructions. Refer to Figure 3-8.
- (6) Remove the snap ring that retains the carbon block assembly to the beta linkage.
- (7) Remove the carbon block assembly. Refer to Figure 3-7.

- (8) Using the beta ring puller TE100, compress the beta system and pull the beta ring forward to expose the propeller mounting nuts and washers. Refer to Figure 3-6.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

- (9) Support the propeller assembly with a sling.

- (10) Cut and remove the safety wire (if installed) on the propeller mounting nuts.

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

- (11) Remove the propeller mounting nuts and washers.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

- (12) Using the support sling, lift the propeller from the mounting flange.
- (13) Remove and discard the propeller mounting O-ring.
- (14) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.
- (15) Decompress and remove the beta ring puller TE100.
- (16) Put the propeller on a suitable cart for transportation.

D. Removal of HC-E4W-3() Propellers

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

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Disconnect the engine beta linkage and carbon block assembly from the beta ring per the airframe manufacturer's instructions. Refer to Figure 3-7.
 - (a) If the carbon block must be removed, perform the following procedures:
 - 1 Remove the snap ring that retains the carbon block assembly to the beta linkage.
 - 2 Remove the carbon block assembly.

CAUTION: MAKE SURE THAT THE BETA LINKAGE IS DISCONNECTED BEFORE COMPRESSING THE BETA SYSTEM.

- (5) Using the beta ring puller TE100, compress the beta system and pull the beta ring forward to expose the propeller mounting nuts and washers. Refer to Figure 3-6.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

- (6) Cut and remove the safety wire on the propeller mounting studs.
- (7) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting nuts and washers have been removed to permit rotating the propeller for ease of nut removal.

- (8) If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to ensure proper orientation during reinstallation to prevent dynamic imbalance.

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

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

- (10) Using the support sling, lift the propeller from the mounting flange.
- (11) Remove and discard the engine flange-to-spacer O-ring.
- (12) If the C-7620 spacer is not attached with flat-head screws, perform the following procedures:
- (a) Remove the spacer from the hub.
- (b) Remove and discard the hub-to-spacer O-ring.
- (13) If the C-7620 spacer is attached to the hub with flat-head screws, perform the following procedures if the O-ring must be replaced due to oil leakage.
- (a) Remove the spacer attachment screws, if applicable.
- (b) Remove the C-7620 spacer.
- (c) Remove and discard the propeller hub-to-spacer O-ring.
- (14) Decompress and remove the beta ring puller TE100.
- (15) Put the propeller on a suitable cart for transportation.

E. Removal of HC-E4W-5L Propellers

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

CAUTION 1: WHEN REMOVING THE PROPELLER FROM THE AIRCRAFT, DO NOT DAMAGE THE ICE PROTECTION SYSTEM COMPONENTS, IF APPLICABLE.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (5) Remove the beta adjust anti-rotation hardware.
- (6) Remove the beta adjust screw.

CAUTION: THE BETA TUBE MUST BE REMOVED BEFORE THE PROPELLER ASSEMBLY IS REMOVED FROM THE AIRCRAFT. REFER TO THE AIRCRAFT MAINTENANCE INSTRUCTION MANUAL.

(7) Remove the beta tube.

(8) Cut and remove the safety wire (if installed) on the propeller mounting bolts.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(9) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit rotating the propeller for ease of bolt removal.

(a) If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during reinstallation to prevent dynamic imbalance.

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

(10) Remove the propeller mounting nuts and washers.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

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

(12) Remove and discard the propeller mounting O-ring.

(13) Remove the propeller mounting shim.

(14) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.

(15) Put the propeller on a suitable cart for transportation.

- F. Removal of HC-(D,E)4()-5() Propellers, except HC-E4W-5L and HC-E4N-5K()

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

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

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (5) Remove the beta adjust anti-rotation hardware.
- (6) Remove the beta adjust screw.

CAUTION: THE BETA TUBE MUST BE REMOVED BEFORE THE PROPELLER ASSEMBLY IS REMOVED FROM THE AIRCRAFT. REFER TO THE AIRCRAFT MAINTENANCE INSTRUCTION MANUAL.

(7) Remove the beta tube.

(8) Cut and remove the safety wire (if installed) on the propeller mounting bolts.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

(9) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit rotating the propeller for ease of bolt removal.

(a) If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during reinstallation to prevent dynamic imbalance.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS IF THEY ARE DAMAGED OR CORRODED, OR WHEN THE PROPELLER IS REMOVED FOR OVERHAUL.

(10) Remove the propeller mounting bolts and washers.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

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

(12) Remove and discard the propeller mounting O-ring.

(13) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.

(14) Put the propeller on a suitable cart for transportation.

G. Removal of HC-E4N-5K() Propellers

WARNING: FOR SAFETY REASONS, PUT THE PROPELLER IN FEATHER POSITION BEFORE IT IS REMOVED FROM THE AIRCRAFT.

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

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).
- (4) Some propellers may require installation of an accessory drive pulley. If installation procedures are not in this manual, refer to the aircraft manufacturer's instructions.
- (5) Remove the beta adjust anti-rotation hardware.
- (6) Remove the beta adjust screw.

CAUTION: THE BETA TUBE MUST BE REMOVED BEFORE THE PROPELLER ASSEMBLY IS REMOVED FROM THE AIRCRAFT. REFER TO THE AIRCRAFT MAINTENANCE INSTRUCTION MANUAL.

- (7) Remove the beta tube.
- (8) Cut and remove the safety wire (if installed) on the propeller mounting bolts.

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

- (9) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit rotating the propeller for ease of bolt removal.

- (a) If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to make sure of proper orientation during reinstallation to prevent dynamic imbalance.

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

(10) Remove the propeller mounting nuts and washers.

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

CAUTION: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

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

(12) Remove and discard the propeller mounting O-ring.

(13) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.

(14) Put the propeller on a suitable cart for transportation.

H. Removal of HC-D3F-7() Propellers

NOTE: Refer to Figures 3-14 through 3-17 for the Beta Valve System.

- (1) Remove the spinner dome in accordance with the section, "Spinner Dome Removal" in this chapter.
- (2) If the propeller is equipped with an ice protection system that uses components supplied by Hartzell Propeller LLC, applicable instructions and technical information can be found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) available on the Hartzell website at www.hartzellprop.com.
- (3) Propeller ice protection system components not supplied by Hartzell Propeller LLC are controlled by the applicable TC or STC holder's Instructions for Continued Airworthiness (ICA).

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

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

WARNING 3: MAKE SURE THE SLING IS RATED UP TO 800 LBS (363 KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING REMOVAL.

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.

- (4) Remove the self-locking nut and spacer from the beta system rod that protrudes from the pitch change seal unit.
- (5) Cut and remove the safety wire (if installed) on the propeller mounting bolts.
- (6) Support the propeller assembly with a sling.

NOTE: Supporting the propeller with the sling may be delayed until all but two mounting bolts and washers have been removed to permit rotating the propeller for ease of bolt removal.

- (7) If the propeller will be reinstalled, and it has been dynamically balanced, make an identifying mark on the propeller hub and a matching mark on the engine flange to ensure proper orientation during reinstallation to prevent dynamic imbalance.

CAUTION: DISCARD THE PROPELLER MOUNTING BOLTS IF THEY ARE DAMAGED OR CORRODED, OR WHEN THE PROPELLER IS REMOVED FOR OVERHAUL.

- (8) Remove the propeller mounting bolts and washers.
 - (a) If the mounting bolts and washers are not damaged or corroded, they may be reused when the propeller assembly is reinstalled if removed between overhauls.

CAUTION 1: DO NOT PERMIT THE PROPELLER ASSEMBLY TO HIT OR REST ON THE BETA FEEDBACK ROD. THIS COULD BEND OR OTHERWISE DAMAGE THE ROD.

CAUTION 2: USE ADEQUATE PRECAUTIONS TO PROTECT THE PROPELLER ASSEMBLY FROM DAMAGE WHEN IT IS REMOVED FROM THE AIRCRAFT ENGINE AND WHEN IT IS STORED.

- (9) Using the support sling, lift the propeller from the mounting flange.
- (10) Remove and discard the propeller mounting O-ring.
- (11) Install suitable covers on the pitch change rod opening, propeller mounting flange, and engine flange to prevent the introduction of contamination.
- (12) Put propeller on a suitable cart for transportation.

I. Removal of the D-751-() Beta Valve Assembly

- (1) Remove the beta light switch away from the beta valve pin per airframe manufacturer's instructions.
- (2) Remove the engine mounted beta system control hardware from the beta valve rod end fitting, per the airframe/engine manufacturer's instructions.
- (3) Loosen the check nut on the push rod spool away from the bushing to break the Loctite® bond.
- (4) Loosen the set screw to clear the threads of the push rod spool and to permit removal of the rod end cap.
- (5) Loosen the rod end cap to break the Loctite bond. Remove the rod end cap from the push rod spool.
- (6) Remove the rod end fitting from the push rod spool.
- (7) Remove the bushing from the push rod spool.
- (8) Remove the check nut from the push rod spool.
- (9) Remove the O-ring from the cavity at the rear of the threaded end of the push rod spool.

- (10) Remove the engine cover from the rear of the engine gear box encircling the beta valve push rod spool in accordance with the airframe or engine manufacturer's instructions.
- (11) Remove and discard the ID and OD O-rings from the engine cover.

WARNING: SPRINGS IN THE ENGINE SHAFT ARE PRELOADED AND MUST BE PROPERLY CONTROLLED WHEN RELEASING THE SPRING RETAINER TO AVOID INJURY.

- (12) Secure the spring retainer and remove the retaining ring that holds the spring retainer in place.
- (13) Remove the spring retainer from the engine shaft and beta valve.
- (14) Remove the spring from the engine shaft and beta valve.
- (15) Slide the beta valve's remaining assembly and push rod spool out of the engine shaft toward where the propeller had been mounted.
- (16) Put all beta valve parts together, including the self locking nut and spacer that were removed to permit the removal of the propeller assembly.

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1. Operational Checks (Rev. 1)

A. Operational Checks

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

2. Propeller Ice Protection Systems (Rev. 2)

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

A. Operational Checks and Troubleshooting

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

3. Troubleshooting

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

A. Hunting and Surging (Rev. 2)

(1) General

- (a) Hunting is characterized by a cyclic variation in engine speed above and below desired speed. Surging is characterized by a large increase/decrease in engine speed, followed by a return to set speed after one or two occurrences.

- (b) If the propeller is hunting, a certified airframe and powerplant mechanic with the appropriate rating or a certified propeller repair station with the appropriate rating should check:
 - 1 Governor
 - 2 Fuel control
 - 3 Synchrophaser, or synchronizer (if applicable)
- (2) If the propeller is surging:
 - (a) Perform the “Initial Run-Up” in accordance with the Inspection and Check chapter of this manual to release trapped air from the propeller.
 - 1 If surging reoccurs it is most likely due to a faulty governor.
 - a Have the governor tested by a certified propeller repair station with the appropriate rating.
 - (b) Hunting and/or surging may also be caused by friction or binding within the governor control, or internal propeller corrosion, which causes the propeller to react slower to governor commands.
 - 1 To isolate these faults, the propeller must be tested on a test bench at a certified propeller repair station with the appropriate rating.
- B. Engine Speed Varies with Flight Altitude (or Airspeed)
 - (1) Small variances in engine speed are normal and are no cause for concern.
 - (2) Increase in engine speed while descending or increasing airspeed:
 - (a) Governor is not reducing oil volume.
 - (b) Friction in propeller.
 - (3) Decrease in engine speed while increasing airspeed:
 - (a) Governor pilot valve is stuck and is excessively decreasing oil volume.
 - (b) Feathering command engaged on propeller pitch control.

- (4) Increase in engine speed while decreasing airspeed:
 - (a) Governor pilot valve is stuck and is excessively increasing oil volume.
- (5) Decrease in engine speed while decreasing airspeed:
 - (a) Governor is not increasing oil volume in the propeller.
 - (b) Engine oil transfer system leaking excessively.
 - (c) Friction in propeller.
- C. Loss of Propeller Control
 - (1) Propeller goes to uncommanded high pitch (or feather).
 - (a) Loss of propeller oil pressure - check:
 - 1 Governor pressure relief valve.
 - 2 Governor drive.
 - 3 Engine oil supply.
 - (b) Start locks not engaging.
 - (2) Propeller goes to uncommanded low pitch (high RPM).
 - (a) Governor pilot valve sticking.
 - (3) RPM increases with power and airspeed, propeller RPM control has little or no effect.
 - (a) Excessive friction in blade bearings or pitch changing mechanism.
 - (b) Broken feathering spring.
 - (4) RPM control sluggish (especially on reducing RPM).
 - (a) Broken feathering spring.
- D. Failure to Feather (or feathers slowly) (Rev. 1)
 - (1) Broken feathering spring (if applicable).
 - (2) Check for proper function and rigging of propeller/governor control linkage.
 - (3) Check the governor function.
 - (4) The propeller must be inspected for misadjustment or internal corrosion (usually in blade bearings or pitch changing mechanism) that results in excessive friction.
 - (a) This inspection must be performed by a certified propeller repair station with the appropriate rating.

- E. Failure to Unfeather (Rev. 1)
- (1) Check for proper function and rigging of propeller control linkage.
 - (2) Check the governor function.
 - (3) The propeller must be inspected for misadjustment or internal corrosion (usually in blade bearings or pitch change mechanism) that results in excessive friction.
 - (a) This inspection must be accomplished by a certified propeller repair station with the appropriate rating.
- F. Start Locks (Anti-feather Latches) Fail to Latch on Shutdown
- (1) Propeller was feathered before shutdown.
 - (2) Shutdown occurred at high RPM with the propeller control off the low pitch stop.
 - (a) The problem may be solved by restarting the engine, placing the propeller control in the proper shutdown position, and then shutting down the engine.
 - (3) Excessive governor pump leakage.
 - (a) The problem should be referred to an authorized engine repair facility.
 - (4) Broken start lock.
 - (a) The problem should be referred to an authorized propeller repair facility.

G. Vibration (Rev. 1)

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

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

(1) Check:

- (a) Control surfaces, cowl flaps, exhaust system, landing gear doors, etc. for excessive play that may be causing vibration that is unrelated to the propeller
- (b) Isolation of engine controls and lines
- (c) Engine mount wear
- (d) Uneven or over lubrication of propeller
- (e) Proper engine/propeller flange mating
- (f) Blade track:
 - 1 Refer to the section, "Blade Track" in the Inspection and Check chapter of this manual.
- (g) Blade angles:
 - 1 Blade angles must be within specified tolerance between blades.
 - a Refer to a certified propeller repair station with the appropriate rating to check/adjust blade angles.

- (h) Spinner for cracks, improper installation, or “wobble” during operation
 - (i) Static balance
 - (j) Hub damage or cracking
 - (k) Grease or oil leakage
 - (l) Blade deformation
- (2) Dynamic Balance
- (a) Dynamic balancing is recommended after installing or performing maintenance on a propeller. While this is normally an optional task, it may be required by the engine or airframe manufacturer to make certain the propeller/engine combination is balanced properly before operation.
 - 1 Refer to the engine or airframe manuals, and the Maintenance Practices chapter of this manual.

H. Propeller Overspeed

- (1) Check:
- (a) Low pitch stop adjustment.
 - (b) Governor Maximum RPM set too high.
 - (c) Broken feathering spring.
 - (d) Governor pilot valve jammed, supplying high pressure only.
 - (e) Tachometer error.

I. Propeller Underspeed

- (1) Check:
- (a) Governor oil pressure low.
 - (b) Governor oil passage clogged.
 - (c) Tachometer error.

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1. Pre-Flight Checks (Rev. 5)

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

A. Important Information

- (1) Follow propeller pre-flight inspection procedures specified in the Pilot Operating Handbook (POH) in addition to the inspections specified in this section.
- (2) Defects or damage found during the pre-flight inspection must be evaluated in accordance with the applicable section in the Testing and Troubleshooting chapter and/or the Maintenance Practices chapter of this manual.

B. Propeller Blades

- (1) Visually examine the entire blade (leading edge, trailing edge, face, and camber sides) for nicks, gouges, erosion, cracks, and debonds (composite blades only).
 - (a) Normal paint erosion (sand-blasted appearance) on the leading edge of the blade is permitted and does not require removal before further flight.
- (2) Visually examine the blades for lightning strike indications in accordance with the section, "Lightning Strike" in this chapter.
- (3) Check the blades for radial play or movement of the blade tip (in-and-out, fore-and-aft, and end play).
 - (a) Refer to the section, "Blade Tolerances" in this chapter for blade play limits.

- (4) If an ice protection system is installed, visually examine the anti-icing or de-ice boot for damage.
 - (a) Refer to the Anti-ice and De-ice Systems chapter in this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.
 - C. Spinner Assembly and Blade Retention Components
 - (1) Inspect the spinner and the visible blade retention components for damage and/or cracks.
 - (a) Repair or replace components as required before further flight.
 - D. Hardware
 - (1) Check for loose or missing hardware.
 - (a) Retighten or reinstall as necessary.
- WARNING:** ABNORMAL GREASE/OIL LEAKAGE CAN BE AN INDICATION OF A FAILING PROPELLER BLADE OR BLADE RETENTION COMPONENT. AN IN-FLIGHT BLADE SEPARATION CAN RESULT IN A CATASTROPHIC AIRCRAFT ACCIDENT.
- E. Grease/Oil Leakage
 - (1) Examine the face and camber-sides of the blades for evidence of grease/oil leakage.
 - (2) Using an appropriate light source, examine the propeller through the blade cut-outs in the spinner for signs of grease/oil leakage.
 - (a) Spinner removal is not required for this inspection.
 - (b) If grease/oil leakage is found, refer to the section, "Inspection Procedures" in this chapter.
 - F. Initial Run-Up
 - (1) Perform the Initial Run-Up procedure in accordance with the section, "Operational Checks" in this chapter.
 - G. Additional Information
 - (1) Refer to the airframe manufacturer's manual for additional pre-flight checks.
 - (2) Refer to the section, "Inspection Procedures" in this chapter for additional inspection/repair information.

2. Post-Flight Checks

CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE 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. HC-E5N-3(A)/HE8218, HC-E5N-3(A)/LE8218, HC-E5N-3A/HE8492, and HC-E5N-3AL/LE8492 Propellers Installed on Piaggio P-180 Aircraft

(1) As a result of the "pusher" configuration, propeller blades on affected aircraft are exposed to hot exhaust gases, which makes them more susceptible to erosion and corrosion. Additional inspections and corrosion preventative measures are required.

- (a) Perform blade cleaning within three days after any flight.

NOTE: It is recommended to perform blade cleaning after the last flight of each day.

(b) Blade Cleaning

1 Use a cloth dampened with an approved solvent/cleaner to thoroughly clean each blade shank where exposed to engine exhaust and remove all foreign matter/exhaust residue.

2 Visually examine for corrosion indications and paint condition.

3 Paint must be in good condition in the area exposed to exhaust gases. Repair and repaint in accordance with the Maintenance Practices Chapter of this manual or by an appropriately licensed propeller repair facility if:

a Any of the underlying aluminum blade is exposed.

b There are any indications of corrosion, such as pitting or any other unusual conditions.

3. Operational Checks (Rev. 5)

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

A. Initial Run-Up

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

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

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

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

- (3) Cycle the propeller control through the operating blade range from low pitch to high pitch (or as specified in the POH).
- (a) Repeat this step at least three times.

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

- (4) Check the propeller speed control and operation from low pitch to high pitch using the procedure specified in the POH.
 - (a) Perform all ground functional, feathering, and cycling checks with the minimum propeller RPM drop required to demonstrate the function.

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

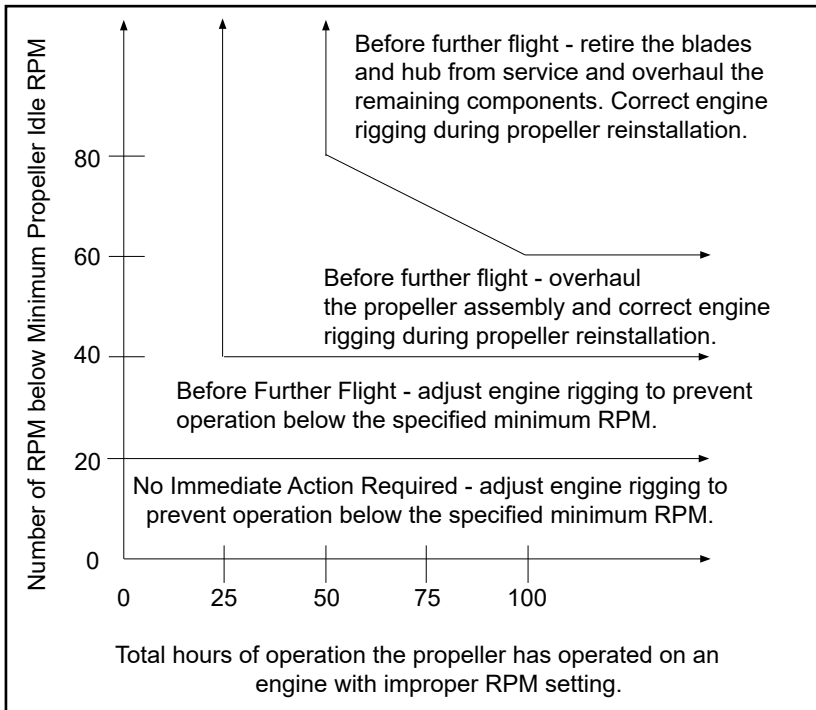
- (5) Check for any abnormal vibration during this run-up.
 - (a) If vibration occurs, shut the engine down, determine the cause, and correct it before further flight.
 - 1 Refer to the section, "Vibration" in the Testing and Troubleshooting chapter of this manual to determine the cause/correction for the vibration.
- (6) Shut down the engine in accordance with the POH.
- (7) For additional inspection information (including possible corrections), refer to the section, "Inspection Procedures" in this chapter, and/or the Testing and Troubleshooting chapter of this manual.
- (8) Refer to the POH and the airframe manufacturer's manual for additional operational checks.

B. Propeller Ground Idle RPM Check

WARNING: STABILIZED GROUND OPERATION WITHIN THE PROPELLER RESTRICTED RPM RANGE CAN GENERATE HIGH PROPELLER STRESSES AND RESULT IN FATIGUE DAMAGE TO THE PROPELLER. THIS DAMAGE CAN LEAD TO A REDUCED PROPELLER FATIGUE LIFE, PROPELLER FAILURE, AND LOSS OF CONTROL OF THE AIRCRAFT. THE PROPELLER RESTRICTED RPM RANGE IS DEFINED IN THE AIRPLANE FLIGHT MANUAL.

(1) General

- (a) The information in this section does not apply to the HC-D3F-7 propeller model that is addressed in this manual.
- (b) Propellers with four or more blades operating on turbine engines can be sensitive to operation within restricted RPM ranges. These restricted ranges are usually in the lower RPM ranges, requiring that ground idle RPM be set above a critical minimum value.
- (c) This minimum propeller idle RPM operating restriction is the result of a specific vibratory resonant condition known as “reactionless mode”. During operation in these conditions the flight crew cannot feel the resulting high propeller vibration. Ground operation at or near an RPM that can create a reactionless mode vibratory resonance can cause very high stresses in the propeller blades and the hub. These high stresses are more severe when operating in a quartering tail wind condition.
- (d) If the propeller is operated within a restricted RPM range or below a minimum idle RPM restriction for an extended period of time, the propeller blades and hub can become unairworthy because of fatigue. A failed blade or hub has the potential to cause a catastrophic blade separation.



Corrective Action Required

Figure 5-1

Example:

Minimum propeller idle RPM listed in the AMM is 1180 RPM

Propeller idle is set at 1120 RPM

Propeller has operated with a RPM deviation of **60 RPM**

Engine was rigged 2 months ago and has operated **75 hours** since it was rigged

Figure 5-1 shows that with an RPM deviation of 60 RPM for 75 hours - the propeller assembly must be overhauled and engine rigging corrected before further flight.

Example of a Ground Idle RPM Check Evaluation

Figure 5-2

- (e) Use the “Periodic Ground Idle RPM Check” steps in this section to determine if the propeller is operating within the specified RPM limits.
 - (f) Refer to the “Corrective Action” steps in this section for maintenance information about propellers operating outside of the specified RPM range.
- (2) Periodic Ground Idle RPM Check

NOTE: The accuracy of the tachometer is critical to the safe operation of the aircraft. Refer to the section, “Tachometer Calibration” in the Maintenance Practices chapter of this manual for important information.

- (a) Perform the RPM check in accordance with the Airplane Flight Manual or Airplane Flight Manual Supplement.
 - 1 Refer to the Airplane Flight Manual or Airplane Flight Manual Supplement to determine if there are any propeller RPM restrictions or limitations.
- (b) Perform an engine run up and determine if the engine and/or propeller rigging permits operation of the propeller below the minimum specified propeller idle RPM.
- (c) If the propeller cannot be operated below the minimum specified propeller idle RPM, no further action is required.
- (d) If the propeller can be operated below the minimum specified propeller idle RPM:
 - 1 Refer to Figure 5-1 for corrective action requirements, and Figure 5-2 for an example of a ground idle RPM check evaluation.

- 2 The corrective action is based on the amount the RPM is below the minimum propeller idle RPM and the total hours of operation the propeller has accumulated.
 - a Figure 5-1 applies to an aircraft that is operated in conventional service. "Hours of Operation" refers to the total number of hours the propeller is operated on an engine that has an improper RPM setting. It is not the number of hours the propeller is operated in a restricted range, which will be less than the total hours of operation.
- (3) Corrective Action
 - (a) The required corrective action is determined by both the amount and duration of RPM deviation.
 - 1 A turboprop propeller with four or more blades may have a variety of operating restrictions and these different restrictions may have different operating margins.
 - 2 The greater the amount of the RPM deviation and the longer it is permitted to exist, the more severe the required corrective action.
 - 3 The corrective action may vary from no action required, to retirement of the blades and the hub.
 - 4 The chart in Figure 5-1 specifies the required corrective action for operation below the minimum idle RPM.
 - a The chart in Figure 5-1 does not apply to other propeller restrictions that are above the minimum idle RPM.
 - 5 If the corrective action requires a propeller overhaul, overhaul the propeller in accordance with the applicable propeller overhaul manuals.

- 6 If the corrective action requires that the blades and the hub be retired from service, retire these components in accordance with the Part Retirement Procedures chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02) before further flight.
 - a A propeller hub or blade that has been retired from service because of a violation of the operating restrictions as specified in this section must not be reused on another aircraft application.
 - 7 If the corrective action requires the correction of the propeller RPM setting, refer to the applicable installation and rigging instructions for the adjustment of engine torque, engine idle speed, and propeller RPM setting.
 - (b) Contact the Hartzell Propeller Product Support Department to report the findings, or if a propeller restriction other than those described in Figure 5-1 has been violated.
 - 1 Refer to the section, "Hartzell Propeller Contact Information" in the Introduction chapter of this manual.
 - C. Post-Run Check
 - (1) After engine shutdown, check propeller for signs of grease/oil leakage.
 - D. Propeller Ice Protection System
 - (1) Refer to the Anti-ice and De-ice Systems chapter in this manual for operational checks and troubleshooting information for Hartzell Propeller ice protection systems.

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

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

A. Periodic Inspection

- (1) Perform the following inspection procedures at 400 hour intervals, not to exceed twelve (12) calendar months. Procedures involved in these inspections are detailed below.
 - (a) Inspection and maintenance specified by an airframe manufacturer's maintenance program and approved by the applicable airworthiness agency may not coincide with the inspection time intervals specified.
 - 1 In this situation, the airframe manufacturer's schedule may be applied as long as the calendar limit for the inspection interval does not exceed twelve (12) months.
 - (b) For additional inspection information (including possible corrections), refer to the section, "Inspection Procedures" in this chapter, and/or the Testing and Troubleshooting chapter of this manual.
- (2) Remove the spinner dome.
- (3) Visually examine the propeller blades (lead edge, trail edge, face, and camber sides) for nicks, gouges, erosion, cracks, etc.
 - (a) Refer to the section, "Aluminum Blades" in the Maintenance Practices chapter of this manual for damage evaluation and repair information.

- (b) For Piaggio P-180 aircraft with HC-E5N-3(A)/HE8218 and HC-E5N-3(A)/LE8218 propellers:

CAUTION: ESTABLISH MORE FREQUENT INTERVALS FOR INSPECTION IF SERVICE EXPERIENCE INDICATES THAT SEVERE CORROSION IS FOUND DURING INSPECTIONS.

- 1 Perform blade corrosion/paint inspections at intervals not to exceed 200 hours of operation, 12 calendar months, or at annual inspection, whichever occurs first.
 - a For scheduling purposes, the inspection interval has a maximum 10% additional non-cumulative flight hour tolerance.
 - b For example, the initial 200 hour inspection is overflown to 220 hours, and then inspected at this time. The next inspection must be accomplished 180 flight hours from previous inspection.
- 2 Using Stoddard-type solvent, thoroughly clean each blade shank in areas exposed to engine exhaust and remove all foreign matter/exhaust residue.
- 3 Visually examine the condition of the paint and any corrosion indications.
- 4 Paint must be in good condition in the area exposed to exhaust gasses. Repair and repainting is required if:
 - a Any of the underlying aluminum blade is exposed.
 - b There are any indications of corrosion, such as pitting or pinpoint "blisters" or "spiders".

- 5 All corrosion indications require repair and subsequent repainting.
- a Refer to FAA Advisory Circular AC 43-4A (or subsequent revision) for additional information concerning corrosion. This circular provides definitions, repair procedures, safety precautions, etc.

- 6 If repair and repainting are required, refer to the section, "Aluminum Blades" in the Maintenance Practices chapter of this manual for additional information.

NOTE: Hartzell Propeller recommends blades on the limit threshold be sent to an appropriately licensed propeller repair facility for determination and possible repair.

- 7 If there is severe corrosion, refer the propeller to an appropriately licensed service facility.

- (4) Inspect all visible propeller parts for cracks, wear, or unsafe conditions.
- (5) Check for oil and grease leaks. Refer to the section, "Inspection Procedures" in this chapter.
- (6) If a blade track problem is suspected, check the blade track. Refer to the section, "Inspection Procedures" in this chapter.
- (7) Check the preload plate set screw. Refer to the Preload Plate Set Screw information in the section, "Inspection Procedures" of this chapter.
- (8) Make an entry in the propeller logbook about completion of these inspections.

B. Periodic Maintenance

- (1) Lubricate the propeller assembly.
- (a) Refer to the section, "Lubrication" in the Maintenance Practices chapter of this manual for intervals and procedures.

C. Airworthiness Limitations

- (1) Certain components, as well as the entire propeller may have specific life limits established as part of the certification by the FAA. Such limits call for mandatory replacement of specified parts after a defined number of hours and/or cycles of use.
- (2) Life limited component times may exist for the propeller models covered in this manual. Refer to the Airworthiness Limitations chapter of this manual.
- (3) Operators are urged to keep informed of airworthiness information via Hartzell Propeller Service Bulletins and Service Letters, which are available from Hartzell distributors or from Hartzell by subscription. Selected information is also available on the Hartzell Propeller website at www.hartzellprop.com.

D. Overhaul Periods

- (1) In flight, the propeller is constantly subjected to vibration from the engine and the airstream, as well as high centrifugal forces.
- (2) The propeller is also subject to corrosion, wear, and general deterioration due to aging. Under these conditions, metal fatigue or mechanical failures can occur.
- (3) To protect your safety, your investment, and to maximize the safe operating lifetime of your propeller, it is essential that a propeller be properly maintained and overhauled according to the recommended service procedures.
 - (a) For propeller overhaul periods, refer to Hartzell Propeller Service Letter HC-SL-61-61Y.

5. Inspection Procedures

A. Blade Damage (Rev. 1)

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

B. Grease/Oil Leakage (Rev. 2)

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

(1) Important Information

- (a) A new or newly overhauled propeller may leak slightly during the first several hours of operation. This leakage may be caused by the seating of seals and O-rings, and the slinging of lubricants used during assembly. Leakage should cease within the first ten hours of operation.
- (b) Leakage that persists beyond the first ten hours of operation on a new or newly overhauled propeller, or occurs on a propeller that has been in service for some time will require repair.
 - 1 A determination should be made as to the source of the leak. If the source of the leak is the O-ring seal between the engine and the propeller flange or a lubrication fitting, field repair is permitted.
 - 2 All other leakage repairs should be referred to a certified propeller repair station with the appropriate rating.

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

(c) Grease Leakage - probable causes:

- 1 Loose/defective lubrication fitting
- 2 Faulty seal at the blade socket between the blade and the hub
 - a Refer to a certified propeller repair station with the appropriate rating for seal replacement.
- 3 Leakage from the hub and beta rod interface (if applicable)
 - a Over-greased hub
 - (1) Refer to a certified propeller repair station with the appropriate rating for grease removal.
 - b Faulty seal
 - (1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.
- 4 Cracked hub

(d) Oil Leakage - probable causes:

- 1 Leaks between the hub and cylinder
 - a Faulty or missing seal between the hub and the cylinder
 - (1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.
- 2 Leaks between the hub halves, beta rods and hub
 - a Faulty seal(s) between the hub and the pitch change rod
 - (1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.

- 3 Leaks from the front of the cylinder or through the start lock units
 - a Faulty seal(s) between the piston and cylinder, or piston and pitch change rod
 - (1) Refer to a certified propeller repair station with the appropriate rating for seal replacement.
- 4 Leaks between the hub and the engine
 - a Faulty or missing seal between the propeller hub and the engine flange

(2) Inspection Procedure

- (a) Remove the spinner dome.

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

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

- 1 If the source of the grease leak is a lubrication fitting, blade O-ring, or the hub parting line, repairs can be accomplished during scheduled maintenance as long as flight safety is not compromised.
 - a To repair a grease leak from a lubrication fitting, blade O-ring, or hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating.

- 2 If the source of the grease leak is a component or location other than a lubrication fitting, blade O-ring, or the hub parting line, the propeller must be disassembled and inspected at a certified propeller repair station with the appropriate rating before further flight.
- (c) Perform a visual inspection for cracks in the hub.
 - 1 Extra attention should be given to the blade retention area of the hub.
 - 2 A crack may be visible or may be indicated by grease leaking from a seemingly solid surface.
- (d) If cracks are suspected, additional inspections to verify the condition must be performed before further flight.
 - 1 Inspections typically include disassembly of the propeller followed by inspection of parts, using nondestructive methods in accordance with published procedures.
 - a These inspections must be performed by a certified propeller repair station with the appropriate rating.
- (e) If cracks or failing components are found, these parts must be replaced before further flight.
 - 1 Report such occurrences to the appropriate airworthiness authorities and to Hartzell Propeller Product Support.

C. Vibration (Rev. 3)

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

(1) Important Information

- (a) Instances of abnormal vibration should be investigated immediately. If the cause of the vibration is not readily apparent, examine the propeller in accordance with the instructions in this section.
- (b) Perform troubleshooting and evaluation of possible sources of vibration in accordance with engine or airframe manufacturer's instructions.
- (c) Refer to the section, "Vibration" in the Testing and Troubleshooting chapter of this manual.
 - 1 Perform the checks to determine possible cause of the vibration.
 - a If no cause is found, the propeller could be the source of the vibration. Examine the propeller in accordance with the Inspection steps in this section.

(2) Inspection

- (a) Remove the spinner dome.
- (b) Visually examine the hub, blades, and blade clamps (if applicable) for cracks.
 - 1 Pay particular attention to the blade retention areas of an aluminum hub, or the blade clamps on steel hub propellers.
 - 2 A crack may be readily visible, or may be indicated by grease leaking from a seemingly solid surface.

- (c) If cracks are suspected, additional inspections must be performed to evaluate the condition before further flight.
 - 1 These inspections typically include disassembly of the propeller, followed by inspection of parts, using nondestructive methods in accordance with published procedures.
 - 2 These inspections must be performed at a certified propeller repair station with the appropriate rating.
- (d) Inspect the play of the propeller blades in accordance with the section, "Blade Tolerances" in this chapter.
- (e) Inspect blade track in accordance with the section, "Blade Track" in this chapter.

CAUTION: DO NOT USE BLADE PADDLES TO TURN BLADES.

- 1 Manually (by hand) attempt to turn the blades (change pitch).
 - 2 Visually check for damaged blades.
- (f) If abnormal blade conditions or damage are found, additional inspections must be performed to evaluate the condition before further flight.
 - 1 These inspections must be performed at a certified propeller repair station with the appropriate rating.
- (g) If cracks or failing components are found, these parts must be replaced before further flight.
 - 1 Report such occurrences to airworthiness authorities and Hartzell Propeller Product Support.

D. Blade Track

- (1) If a blade track problem is suspected, examine the blade track as follows:
- (2) For -2 and -3 turbines only, move the propeller to low pitch.
 - (a) Remove the screws and washers that attach the spinner dome to the engine side bulkhead.
 - (b) Remove the spinner dome and set it aside.
 - (c) Remove forward bulkhead and spacers from the forward end of the cylinder.
 - (d) If applicable, remove the bolt, nut, and washer from the pitch change rod.

NOTE: Removal of the plug and O-ring is not required unless an early style propeller unfeathering tool that threads internally is used.

CAUTION 1: DO NOT ATTEMPT TO INSTALL AND USE THE PROPELLER UNFEATHERING TOOL WITHOUT REMOVING THE PITCH CHANGE ROD SAFETY BOLT. BOLT REMOVAL IS NECESSARY TO MAKE SURE OF ADEQUATE THREAD ENGAGEMENT OF THE TOOL.

CAUTION 2: DO NOT ATTEMPT TO MOVE THE PROPELLER BLADES BEYOND THE LOW PITCH MECHANICAL STOPS, IF APPLICABLE.

- (e) For all propellers except the HC-E5N-3()
 - 1 Install propeller unfeathering tool TE316 or equivalent.
 - a Turn the threaded rod of the unfeathering tool TE316 onto the end of the pitch change rod as far as possible.
 - (1) Hand tighten.

- b Put the cylindrical part of the unfeathering tool TE316 over the threaded rod and against the propeller cylinder.
- c Apply a small amount of lubricant or anti-seize compound to the threads of the 1-1/2 inch nut of the unfeathering tool TE316.
- d Install the 1-1/2 inch nut onto the threaded rod of the unfeathering tool TE316.
- e Turn the 1-1/2 inch nut down until it touches the thrust bearing.
- f Continue turning the nut until the blades move to low pitch.

CAUTION 1: DO NOT ATTEMPT TO INSTALL AND USE THE PROPELLER UNFEATHERING TOOL TE316 WITHOUT REMOVING THE PITCH CHANGE ROD SAFETY BOLT. BOLT REMOVAL IS NECESSARY TO MAKE SURE OF ADEQUATE THREAD ENGAGEMENT OF THE TOOL.

CAUTION 2: DO NOT ATTEMPT TO MOVE THE PROPELLER BLADES BEYOND THE LOW PITCH MECHANICAL STOPS, IF APPLICABLE.

(f) For the HC-E5N-3() propeller only

- 1 To move the propeller blades to reverse angle, install a modified propeller unfeathering tool TE316 or equivalent.
 - a Refer to Hartzell Propeller Service Letter HC-SL-61-361 for the unfeathering tool TE316 modification.
 - b Turn the threaded rod of the unfeathering tool TE316 onto the end of the pitch change rod as far as possible.

WARNING: TIGHTEN THE THREADED ROD UNTIL IT IS SNUG. THE FEATHERING SPRING IS PRELOADED WITH APPROXIMATELY 600 LBS. (271.8 KG) OF FORCE. FAILURE TO TIGHTEN THE THREADED ROD ONTO THE PITCH CHANGE ROD CAN CAUSE THE FEATHERING SPRING TO RELEASE WHEN MOVING THE BLADES BACK TO FEATHER. THIS CAN CAUSE PROPELLER DAMAGE, SERIOUS INJURY AND/OR DEATH.

- (1) Tighten the threaded rod until it is snug.
- c Put the cylindrical part of the unfeathering tool TE316 over the threaded rod and put it on top of the cylinder.
 - (1) Put the notch that is in the bottom of the unfeathering tool TE316 over the A-7428 stop plate on top of the cylinder.
- d Install the 1-1/2 inch nut onto the threaded rod of the unfeathering tool TE316.
 - (1) Turn the 1-1/2 inch nut until it touches the thrust bearing.
 - (2) Continue turning the nut until the blades move to low pitch.
- 2 To move the propeller blades back to feather using the modified unfeathering tool TE316:
 - a Refer to Hartzell Propeller Service Letter HC-SL-61-361 for the unfeathering tool TE316 modification.

WARNING: MAKE SURE THE THREADED ROD OF THE UNFEATHERING TOOL TE316 DOES NOT ROTATE WHEN LOOSENING THE 1-1/2 INCH NUT. THE FEATHERING SPRING IS PRELOADED WITH APPROXIMATELY 600 LBS. (271.8 KG) OF FORCE. IF THE THREADED ROD OF THE UNFEATHERING TOOL TE316 ROTATES WHEN TURNING THE 1-1/2 INCH NUT, THE FEATHERING SPRING CAN RELEASE CAUSING THE 1-1/2 INCH NUT TO BECOME A DANGEROUS PROJECTILE. THIS CAN CAUSE PROPELLER DAMAGE, SERIOUS INJURY AND/OR DEATH.

- b Loosen the 1-1/2 inch nut of the unfeathering tool TE316 until the blades move to feather position.
 - (1) Make sure the threaded rod of the unfeathering tool TE316 does not rotate when loosening the 1-1/2 inch nut.
 - (a) If the threaded rod rotates, immediately stop turning the 1-1/2 inch nut.
 - (b) Tighten the threaded rod of the unfeathering tool TE316. It may be necessary to tighten the 1-1/2 inch nut to access the top of the threaded rod.
 - (c) Repeat step 5.D.(2)(f)2b.
- c Remove the threaded rod and the cylindrical part of the unfeathering tool TE316 or equivalent.

- (3) Check blade track as follows:

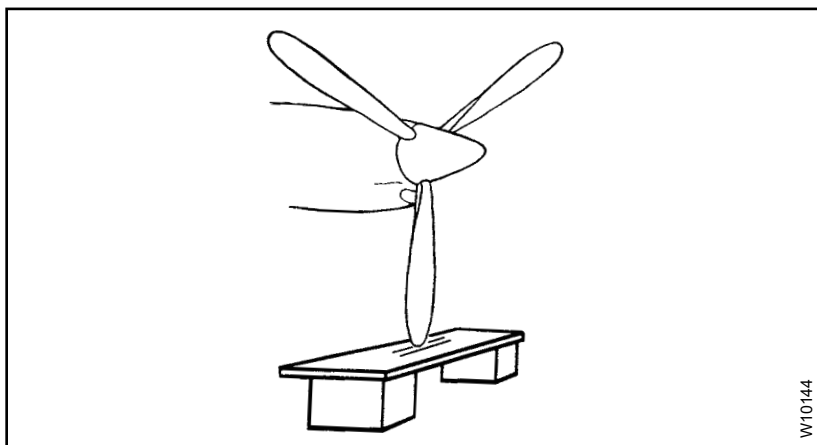
NOTE: An accurate blade track inspection cannot be accomplished with the propeller in feather position.

CAUTION: FOR -5 TURBINES ONLY, MAKE SURE THAT THE ENGINE WAS SHUT DOWN WITH THE PROPELLER ON THE LATCHES.

- (a) Chock the aircraft wheels securely.
- (b) Refer to Figure 5-3. Place a fixed reference point beneath the propeller, within 0.25 inch (6.3 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. The board may then be blocked up to within 0.25 inch (6.3 mm) of the propeller arc.

- (c) Rotate the propeller by hand in the direction of normal rotation until a blade points directly at the paper.
- (d) Mark the position of the blade tip in relation to the paper.
- (e) Repeat this procedure with the remaining blades.



Checking Blade Track
Figure 5-3

- (f) Tracking tolerance is ± 0.0625 inch (1.58 mm) or 0.125 inch (3.17 mm) total.

(4) Possible Correction

- (a) Remove foreign matter from the propeller mounting flange.
- (b) If no foreign matter is present, refer to an appropriately licensed propeller repair facility.

E. Blade Tolerances (Rev. 5)

- (1) Limits for blade play are specified below.
Refer to Figure 5-4.

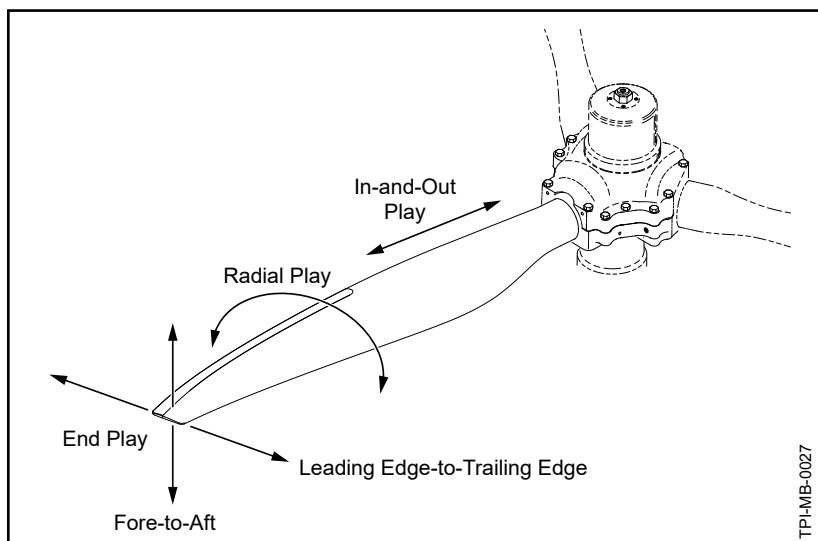
(a) End Play:

<u>1</u> Leading Edge-to-Trailing Edge	± 0.0625 inch (1.58 mm) Total: 0.125 inch (3.17 mm)
--	--

<u>2</u> Fore-to-Aft (face to camber)	± 0.0625 inch (1.58 mm) Total: 0.125 inch (3.17 mm)
---------------------------------------	--

- (b) In-and-Out Play None permitted

- (c) Radial Play ± 0.5 degree (Total: 1 degree) measured at reference station



TP-LMB-0027

Blade Play
Figure 5-4

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

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

F. Preload Plate Set Screw

- (1) The following inspection only applies to propellers that have not been overhauled since March of 1997.

NOTE: Propellers that have been overhauled after March of 1997 have had the new design preload plate set screw installed in accordance with Hartzell Propeller Service Bulletin HC-SB-61-225.

- (2) Manually rotate the propeller and listen for possible noise caused by a broken set or jam nut that may be loose in the propeller hub.
- (3) If there is noise indicating a loose part or the propeller blades do not go completely to feather, remove the propeller. Send the propeller to a repair station for disassembly and inspection for a possible broken preload plate set screw.
 - (a) If a broken set screw is found, the propeller must be inspected for damage that may have been caused by the broken set screw.
 - (b) Report any such incidents to the Hartzell Propeller Product Support Department.

G. Corrosion (Rev. 1)

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

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

H. Spinner Damage (Rev. 3)

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

- (a) Metal Spinners

- 1 For damage evaluation and repair information, refer to Hartzell Propeller Metal Spinner Maintenance Manual 127 (61-16-27) or a certified propeller repair station with the appropriate rating.
 - 2 Contact the local airworthiness authority for repair approval.

- (b) Composite Spinners

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

I. Propeller Ice Protection Systems (Rev. 1)

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

J. Unique Identification (UID) Plate Inspection

(1) General

- (a) Specific installations require selected aircraft components to have a unique identification that is compatible with Military Standard MIL-STD-130M.
- (b) The UID plate incorporates a laser etched scan code to identify the manufacturer's cage code, propeller IDS/item number, and propeller serial number.
- (c) The cage code, propeller IDS/item number, and serial number are also laser etched on the UID plate.
- (d) On a propeller, the UID plate is located on the cylinder.
- (e) When initially installing the UID plate, the one (1) washer B-3837-0463 and one (1) screw B-3841-5 are replaced with four (4) washers B-3837-0432 and four (4) screws B-3841-6.

(2) Inspection Procedure

- (a) If the UID plate is damaged, the scan code is visibly damaged, or the scan code is not scannable, replace the UID plate.

1 Order a new UID plate.

- a Contact Hartzell Propeller New Parts Sales to order the UID plate and the washers B-3837-0432 and screws B-3841-6 that are necessary for installation of the UID plate.

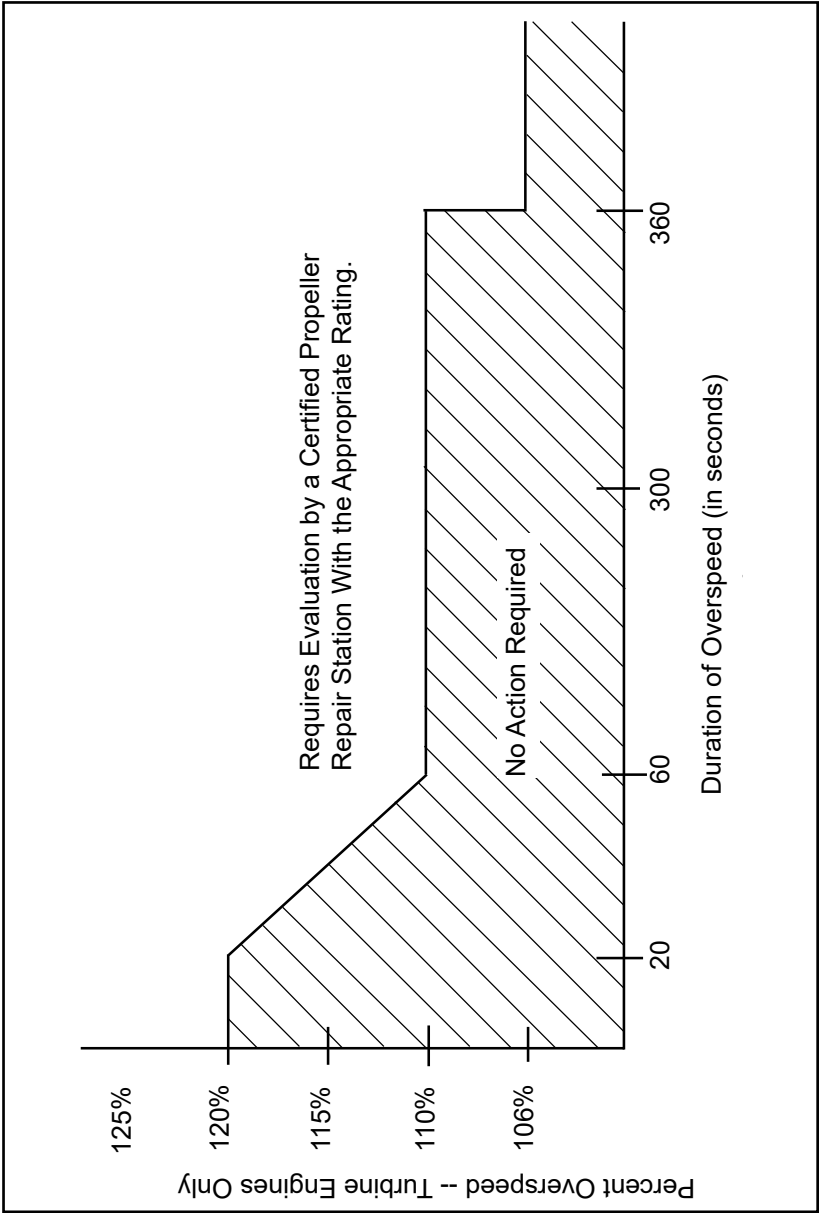
NOTE: A serial number specific UID plate cannot be manufactured until the order is received and the serial number requested is verified.

2 When the new UID plate and the washers B-3837-0432 and screws B-3841-6 that are necessary for installation of the UID plate are available, complete the UID plate removal and installation.

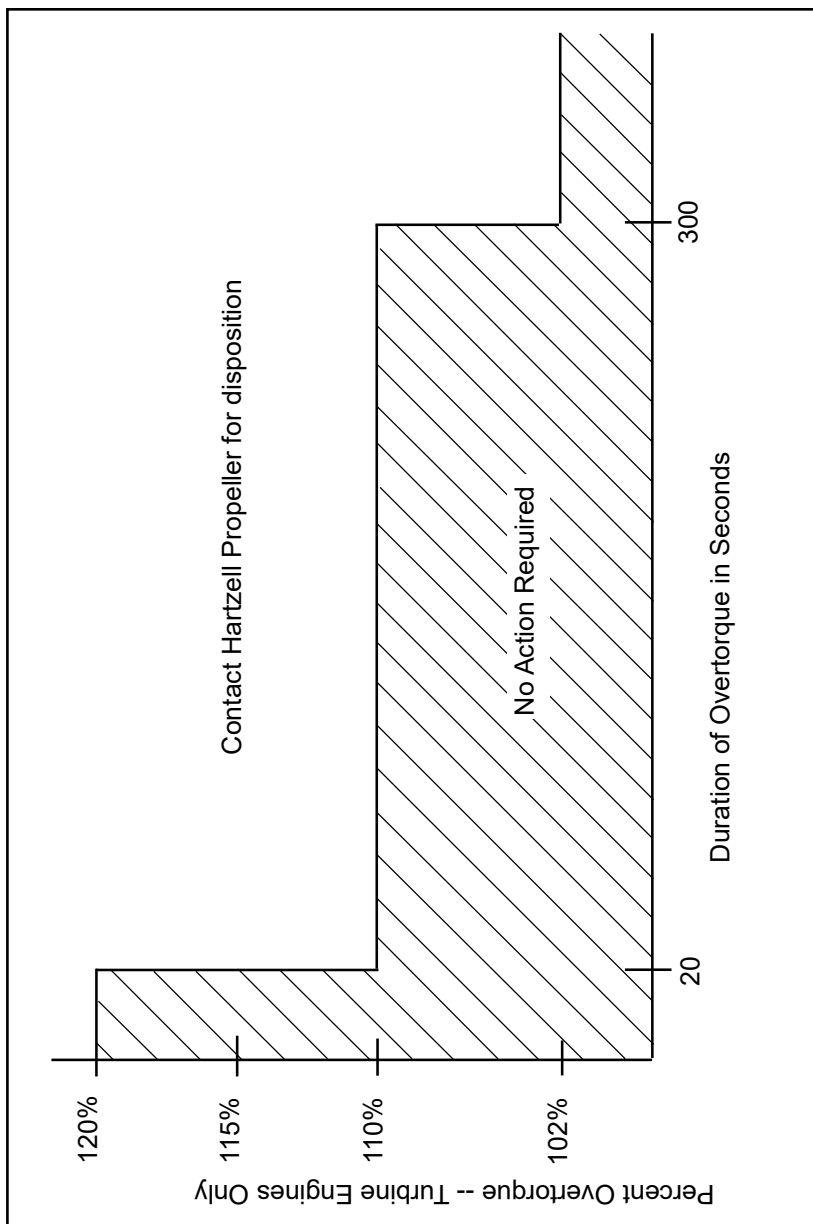
- a For removal of the UID plate, follow steps 5.J.(2)(c)1 through 5.J.(2)(c)4c in this section.

- b For installation of the UID plate, follow steps 5.J.(2)(d)2 through 5.J.(2)(d)8 in this section.
 - (b) If the UID plate is required, but has not yet been installed, install a new UID plate.
 - 1 Order a new UID plate.
 - a Contact Hartzell Propeller New Parts Sales to order the UID plate and the washers B-3837-0432 and screws B-3841-6 that are necessary for installation of the UID plate.
 - NOTE: A serial number specific UID plate cannot be manufactured until the order is received and the serial number requested is verified.
 - 2 When the new UID plate and the washers B-3837-0432 and screws B-3841-6 that are necessary for installation of the UID plate are available, complete the UID plate installation, in accordance with steps 5.J.(2)(d)1 through 5.J.(2)(d)8 in this section.
- (c) Removal of the UID plate.
 - 1 Remove and discard the safety wire between the screw B-3841-6 on the cylinder and the drilled thin hex nut on the reverse adjust sleeve unit.
 - 2 Remove and discard the screws B-3841-6 and the washers B-3837-0432 from the cylinder.
 - 3 Remove the UID plate from the cylinder.
 - 4 Make the UID plate unserviceable using one of these methods:
 - a Cut the plate in half through the scan code.
 - b Sand the plate to remove the scan code completely.
 - c Use any other method identified and/or required by the military/government authority that requires the use of the plate.
- (d) Installation of the UID plate.

- 1 If a UID plate was not removed, follow these additional steps:
 - a Remove and discard the safety wire between the B-3841-5 screw on the cylinder and the drilled thin hex nut on the reverse adjust sleeve unit.
 - b Remove and discard the B-3841-5 screw and the B-3837-0463 washers from the cylinder.
 - 2 Examine the UID plate and the propeller hub to make sure that the serial numbers match.
 - 3 With the laser etched side out, align the four (4) screw holes in the UID plate with the four (4) screw holes in the cylinder and hold in place.
 - 4 Apply one drop of Loctite 222 to one (1) of the B-3841-6 screws.
 - 5 Install one (1) B-3837-0432 washer onto the B-3841-6 screw.
 - 6 Install the washer and screw into one of the four (4) screw holes provided on the top of the cylinder.
 - 7 Torque the B-3841-6 screw to 41 in-lb (4.6 N-m).
 - 8 Repeat steps 5.J.(2)(d)3 through 5.J.(2)(d)6 for the remaining three B-3837-0432 washers and B-3841-6 screws.
- (e) If the aircraft will be flown without the UID plate installed, the thin hex nut must be safety wired:
- 1 Install one (1) B-3837-0463 washer onto one (1) B-3841-5 screw.
 - 2 Install the washer and screw into any one of the four (4) screw holes provided on the top of the cylinder.
 - 3 Torque the B-3841-5 screw to 41 in-lb (4.6 N-m).
 - 4 Using 0.032 inch (0.81 mm) diameter stainless steel wire, safety wire the drilled thin hex nut to the one (1) B-3841-5 screw.



Turbine Engine Overspeed Limits
Figure 5-5



Turbine Engine Overtorque Limits

Figure 5-6

6. Special Inspections (Rev. 2)

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

A. Overspeed/Overtorque

- (1) An overspeed has occurred when the propeller RPM has exceeded the maximum RPM stated in the applicable Aircraft Type Certificate Data Sheet. An overtorque condition occurs when the engine load exceeds the limits established by the engine, propeller, or airframe manufacturer. The duration of time at overspeed/overtorque for a single event determines the corrective action that must be taken to make sure no damage to the propeller has occurred.
- (2) The criteria for determining the required action after an overspeed are based on many factors. The additional centrifugal forces that occur during overspeed are not the only concern. Some applications have sharp increases in vibratory stresses at RPMs above the maximum rated for the airframe/engine/propeller combination.
 - (a) When a propeller installed on a turbine engine has an overspeed event, refer to the Turbine Engine Overspeed Limits (Refer to Figure 5-5) to determine the corrective action to be taken.
 - (b) When a propeller installed on a turbine engine has an overtorque event, refer to the Turbine Engine Overtorque Limits (Refer to Figure 5-6) to determine the corrective action to be taken.

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

NOTE: Some aircraft installations have torque indicator values indicating 100% torque that are less than the maximum certified torque for the specific propeller model as listed in the propeller type certificate data sheet. If an overtorque occurs that requires propeller repair station evaluation, contact Hartzell Propeller Product Support to confirm actual overtorque percentage.

B. Lightning Strike (Rev. 1)

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

(1) General

- (a) In the event of a propeller lightning strike, an inspection is required before further flight.
- (b) If the propeller meets the requirements of the "Temporary Operation Inspection" in this section, 10 hours of operation is permitted before propeller disassembly/inspection must be performed.

(2) Temporary Operation Inspection

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

CAUTION: IF THE PROPELLER EXPERIENCES A LIGHTNING STRIKE, REFER TO THE "ALUMINUM BLADES" SECTION IN THE MAINTENANCE PRACTICES CHAPTER OF THIS MANUAL TO EVALUATE THE DAMAGE BEFORE FURTHER FLIGHT.

- 1 If the only evident damage is minor arcing burns to the blades, temporary operation for up to 10 flight hours is permitted before propeller disassembly and inspection.
- 2 If there is evidence of additional damage, beyond minor arcing burns to the blades, temporary operation is not permitted. The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating before further flight.
 - (b) Perform an operational check of the propeller ice protection system (if installed) in accordance with the Anti-ice and De-ice Systems chapter of this manual.
 - (c) Make a record of the lightning strike in the propeller logbook, indicating any corrective action(s) taken.
- (3) For flight beyond the 10-hour temporary operation limit:
 - (a) The propeller must be removed from the aircraft, disassembled, evaluated, and/or repaired by a certified propeller repair station with the appropriate rating.

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

(1) General

- (a) A foreign object/ground strike can include a broad spectrum of damage, from a minor stone nick to severe ground impact damage.
 - 1 A conservative approach in evaluating the damage is required because there may be hidden damage that is not readily apparent during an on-wing, visual inspection.
- (b) A foreign object/ground strike is defined as:
 - 1 Any incident, whether or not the engine is operating, that requires repair to the propeller other than minor dressing of the blades.
 - a Examples of foreign object/ground strike include situations where an aircraft is stationary and the landing gear collapses causing one or more blades to be significantly damaged, or where a hangar door (or other object) strikes the propeller blade(s).
 - b These cases should be handled as foreign object/ground strikes because of potentially severe side loading on the propeller hub, blades, and retention bearings.
 - 2 Any incident during engine operation in which the propeller impacts a solid object that causes a drop in revolutions per minute (RPM) and also requires structural repair of the propeller (incidents requiring only paint touch-up are not included). This is not restricted to propeller strikes against the ground.
 - 3 A sudden RPM drop while impacting water, tall grass, or similar yielding medium, where propeller blade damage is not normally incurred.
- (c) In the event of a foreign object/ground strike, an inspection is required before further flight.

(2) Inspection Procedure

- (a) Examine the propeller assembly for damage related to the foreign object/ground strike.
- (b) If any of the following indications are found, the propeller must be removed from the aircraft, disassembled, and overhauled by a certified propeller repair station with the appropriate rating.
 - 1 Blade(s) damaged, bent, or out of track/angle
 - 2 Blade(s) loose in the hub (if applicable)
 - a Refer to the section, "Blade Tolerances" in this chapter for the permitted limits of blade play.
 - 3 Blade(s) rotated in the clamp (if applicable)
 - 4 Any noticeable or **suspected** damage to the pitch change mechanism
 - 5 Any blade diameter reduction
 - 6 Bent, cracked, or failed engine shaft
 - 7 Vibration during operation
(that was not present before the event)
- (c) Nicks, gouges, and scratches on blade surfaces or the leading and trailing edges must be removed before flight.
 - 1 Refer to the section, "Aluminum Blades" in the Maintenance Practices chapter of this manual (if applicable) for damage evaluation and repair information.
- (d) Engine mounted components - such as governors, pumps, etc. may be damaged by a foreign object strike, especially if the strike resulted in a sudden stoppage of the engine.
 - 1 These components should be inspected and repaired in accordance with the applicable component maintenance manual.
- (e) Make a record of the foreign object/ground strike event in the propeller logbook, indicating any corrective action(s) taken.

D. Fire/Heat Damage (Rev. 1)

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

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

E. Sudden Stoppage (Rev. 1)

- (1) When there is a propeller sudden stoppage because of catastrophic engine failure or seizure, the propeller and any engine driven/powered accessory must be inspected and repaired in accordance with the applicable component maintenance manual.
- (2) If the sudden stoppage was caused by a foreign object strike, refer to the section, "Foreign Object/Ground Strike" in this chapter.

F. Engine Oil Contamination (Rev. 1)

- (1) Following an incident of oil contamination, the components of the propeller that were exposed to oil contamination must be removed, cleaned, and inspected.
 - (a) A propeller that was exposed to oil contamination must be removed and sent to a certified propeller repair station with the appropriate rating for disassembly, cleaning, and inspection.
 - (b) A governor that was exposed to oil contamination must be inspected and repaired in accordance with the applicable component maintenance manual.

7. Long Term Storage (Rev. 1)**A. Important Information**

- (1) Parts shipped from Hartzell Propeller LLC are not shipped or packaged in a container that is designed for long term storage.
- (2) Long term storage procedures are detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).
- (3) Information regarding the return of a propeller assembly to service after long term storage is detailed in Hartzell Propeller Standard Practices Manual 202A (61-01-02).

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1. Cleaning (Rev. 2)

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

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

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

A. General Cleaning

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

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

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

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

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

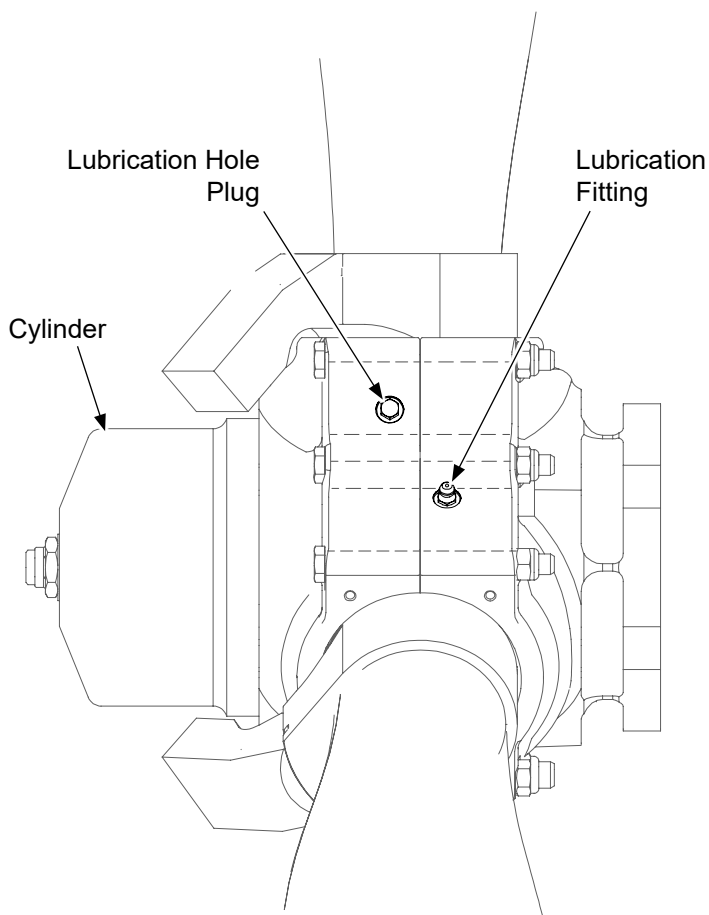
- (2) Using a clean cloth dampened with Stoddard solvent CM23 or equivalent, wipe the inside of the spinner dome to remove grease, oil, and other residue.
 - (a) Immediately dry the inside of the spinner dome using a clean dry cloth.
- (3) Using a clean cloth dampened with Stoddard solvent CM23 or equivalent, wipe the accessible surfaces of the hub, counterweight clamps, slip ring, and bulkhead to remove grease, oil, and other residue.
- (4) Fill a tank sprayer with a non-caustic/non-acidic soap solution.

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

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

- (5) Using the tank sprayer, apply a fine mist of the soap solution to the surfaces of the downward facing blades, and the hub, bulkhead, and slip ring around the downward facing blades.
 - (a) Use a cloth or soft nylon brush to loosen dirt and unwanted material on the surfaces where the soap solution was applied, particularly on the inboard surface of the counterweight clamp.

- (6) Using clean potable water at low pressure, rinse the surfaces where the soap solution was applied to remove dirt, unwanted material, and soap residue.
 - (7) Use a clean dry cloth to dry the surfaces cleaned in the previous steps.
 - (8) Rotate the propeller so that the next blade(s) to be cleaned are pointing downward, then repeat steps 5 thru 7.
 - (a) Repeat steps 5 thru 8 until all blades have been cleaned and dried.
 - (9) Let the propeller dry.
 - (10) Install the spinner dome in accordance with the Installation and Removal chapter in this manual.
- B. Spinner Cleaning and Polishing
- (1) Clean the spinner using the General Cleaning procedures in this section.
 - (2) If an aluminum spinner dome is installed, polish the dome (if required) with an automotive-type aluminum polish.



TPI-MB-0335

NOTE: A tractor/pusher propeller with clockwise (standard) rotation is shown in this illustration.

Lubrication Fittings/Hole Plugs
Figure 6-1

2. Lubrication (Rev. 7)

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. Lubrication Intervals

- (1) The propeller must be lubricated at intervals not to exceed 400 hours or 12 calendar months, whichever occurs first.
 - (a) Inspection and maintenance specified by an airframe manufacturer's maintenance program and approved by the applicable airworthiness agency may not coincide with the lubrication interval specified.
 - 1 In this situation, the airframe manufacturer's schedule may be applied as long as the calendar limit for the lubrication interval does not exceed twelve (12) months.
 - (b) If the aircraft is operated or stored under adverse atmospheric conditions, e.g., high humidity, salt air, calendar lubrication intervals should be reduced to six months.
 - (c) If the propeller is leaking grease, the lubrication interval should be reduced to 100 hours until the grease leak issue is resolved.
 - (d) The HC-E5()-3() propeller installed on Piaggio P-180 is to be lubricated at 150 hour intervals or at 12 calendar months, whichever occurs first, all other applications is to be lubricated at 400 hour intervals.

- (2) Owners of high use aircraft may wish to extend their lubrication interval. The lubrication interval may be gradually extended after evaluating bearing wear and internal corrosion when the propeller is overhauled.
- (3) Hartzell Propeller LLC 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 can 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 new aircraft should check the propeller logbook to verify whether the propeller was lubricated by the manufacturer during flight testing. If it was not lubricated, the propeller should be serviced at the earliest convenience.

B. Lubrication Procedure

WARNING 1: FOLLOW LUBRICATION PROCEDURES CORRECTLY TO MAINTAIN ACCURATE BALANCE OF THE PROPELLER ASSEMBLY.

WARNING 2: PITCH CONTROL DIFFICULTY COULD RESULT IF THE PROPELLER IS NOT CORRECTLY LUBRICATED.

- (1) Remove the propeller spinner.
- (2) Each blade socket has two lubrication fittings or one lubrication fitting and one lubrication hole plug. Refer to Figure 6-1.
- (3) Remove the caps from the lubrication fittings.
- (4) Remove the lubrication fittings or hole plugs as applicable.
 - (a) For all tractor or pusher propellers with clockwise (standard) rotation when viewed from BEHIND the aircraft, remove the lubrication fittings (p/n A-279 or C-6349) or lubrication hole plugs (p/n 106545) from the CYLINDER-SIDE hub half.

- (b) For all tractor or pusher propellers with counter-clockwise (backward) rotation when viewed from BEHIND the aircraft, remove the lubrication fittings (p/n A-279 or C-6349) or lubrication hole plugs (p/n 106545) from the ENGINE-SIDE hub half.

CAUTION: USE CARE NOT TO DAMAGE THE THREADED HOLE WHEN REMOVING A BLOCKAGE.

- (5) If there is a blockage in the threaded hole where the lubrication plug was removed (ex. hardened grease), bend a piece of safety wire and use the bent end to loosen the blockage.

CAUTION: USE ONLY HARTZELL PROPELLER APPROVED GREASE. DO NOT MIX DIFFERENT SPECIFICATIONS AND/OR BRANDS OF GREASE EXCEPT AS NOTED IN THIS SECTION.

- (6) A label is normally applied to the propeller to indicate the type of grease previously used. Refer to Figure 6-2.
- (a) The same grease type should be used during re-lubrication unless the propeller has been disassembled and the old grease removed.



Lubrication Label
Figure 6-2

- 1 It is not possible to purge old grease through lubrication fittings.
 - 2 To completely replace one grease with another, the propeller must be disassembled and cleaned in accordance with the applicable overhaul manual.
- (7) If different grease types are accidentally mixed, the propeller must be disassembled and cleaned in accordance with the applicable overhaul/maintenance manual within three months or 30 flights whichever occurs first.
- (a) EXCEPTION: Aeroshell 5 and Aeroshell 6 greases both have a mineral oil base and the same thickening agent; therefore, mixing of these two greases is permitted in Hartzell propellers.

WARNING: WHEN MIXING AEROSHELL 5 AND AEROSHELL 6 GREASES, THE AIRCRAFT MUST BE PLACARDED TO INDICATE THAT FLIGHT IS PROHIBITED IF THE OUTSIDE AIR TEMPERATURE IS LESS THAN -40° F (-40° C). AEROSHELL 5 GREASE MUST BE INDICATED ON THE LABEL.

CAUTION 1: IF A PNEUMATIC GREASE GUN IS USED, EXTRA CARE MUST BE TAKEN TO AVOID EXCESSIVE PRESSURE BUILDUP.

CAUTION 2: GREASE MUST BE APPLIED TO ALL BLADES OF A PROPELLER ASSEMBLY AT THE TIME OF LUBRICATION.

CAUTION 3: DO NOT ATTEMPT TO PUMP MORE THAN 1 FL. OZ. (30 ML) OF GREASE INTO THE LUBRICATION FITTING. USING MORE THAN 1 FL. OZ. (30 ML) OF GREASE COULD RESULT IN OVER SERVICING OF THE PROPELLER. VERIFY THE OUTPUT OF THE GREASE GUN BEFORE SERVICING THE PROPELLER.

CAUTION 4: 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.

- (8) Pump a maximum of 1 fl. oz. (30 ml) grease into the lubrication fitting, or until grease emerges from the hole where the lubrication fitting or hole plug was removed - whichever occurs first.

NOTE: It may be necessary to use a right angle coupler such as TE559 or equivalent, on the grease gun to access the lubrication fittings. Refer to Figure 6-3.

- (a) For all tractor or pusher propellers with clockwise (standard) rotation when viewed from BEHIND the aircraft, the lubrication fitting is in the ENGINE-SIDE hub half.
- (b) For all tractor or pusher propellers with counter-clockwise (backward) rotation when viewed from BEHIND the aircraft, the lubrication fitting is in the CYLINDER-SIDE hub half.



Right Angle Coupler for Grease Gun
Figure 6-3

(9) If a lubrication fitting (p/n A-279 or C-6349) was removed at the beginning of this procedure, it may be reinstalled or replaced with a lubrication hole plug (p/n 106545).

(a) Reinstall the lubrication fitting or hole plug that was removed at the beginning of this procedure.

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

(10) Make sure that the ball of each lubrication fitting is correctly seated.

(11) Reinstall a lubrication fitting cap on each lubrication fitting.

C. Approved Lubricants

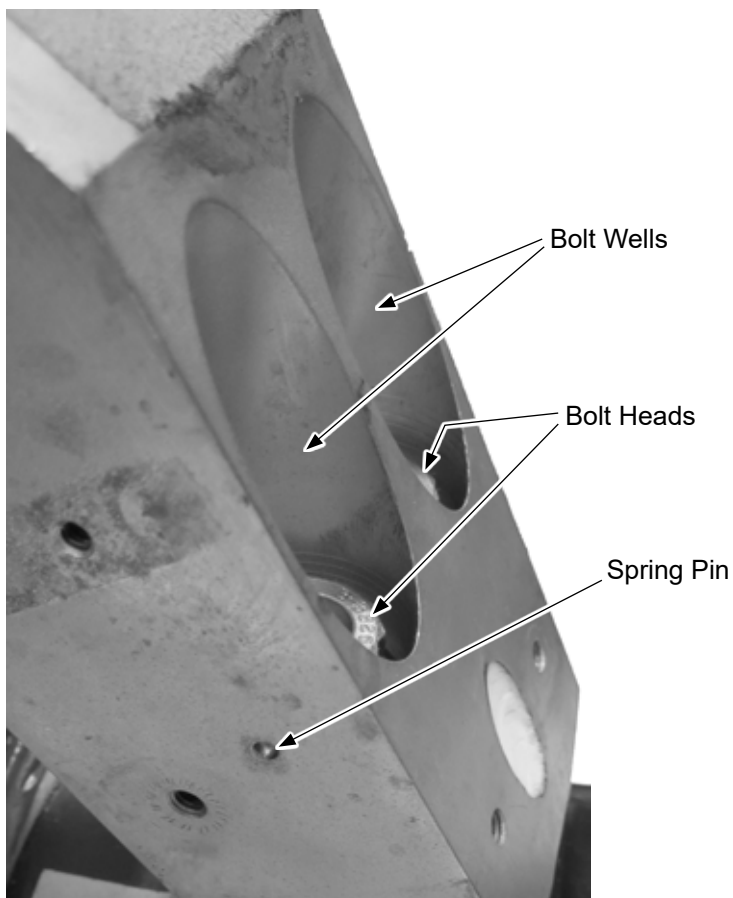
(1) For a list of lubricants approved for use in Hartzell propellers, refer to the Consumable Materials chapter of Hartzell Propeller Standard Practices Manual 202A (61-02-02).

3. Corrosion Inhibitor (Rev. 2)

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

A. Application Intervals

- (1) The bolt-on, steel counterweights on propellers manufactured after the release date of Service Letter HC-SL-61-364 dated April, 3, 2020 will be coated with corrosion inhibitor CM352 by Hartzell Propeller during the assembly process.
 - (a) Corrosion inhibitor CM352 is applied to prevent corrosion on the counterweight.
 - (b) Periodic re-application of the corrosion inhibitor CM352 will provide extended protection from corrosion.
- 1** Hartzell Propeller LLC recommends re-application of the corrosion inhibitor CM352 at regularly scheduled intervals, similar to the lubrication interval specified in this propeller owner's manual.



TPH-JM-000147

Applying Corrosion Inhibitor CM352
Figure 6-4

B. Application Procedure

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

CAUTION: DO NOT APPLY CORROSION INHIBITOR CM352 ONTO ICE PROTECTION SYSTEM COMPONENTS (TERMINAL STRIPS, BOOTS, HARNESES, ETC.).

- (2) Spray the corrosion inhibitor CM352 into a cup or container, then use a soft bristled brush to apply the corrosion inhibitor CM352 to the bolt heads, spring pins, and bolt wells of the counterweight. Refer to Figure 6-4.
 - (a) Use caution when applying the corrosion inhibitor CM352 around ice protection system components (terminal strips, boots, harnesses, etc.).
 - (b) Make sure the bolt heads, spring pins, and bolt wells are completely covered by the corrosion inhibitor CM352.
 - (c) Optionally, corrosion inhibitor CM352 can be applied to all exposed surfaces of the counterweight.
- (3) Let the corrosion inhibitor CM352 cure for a minimum of three hours before flight.

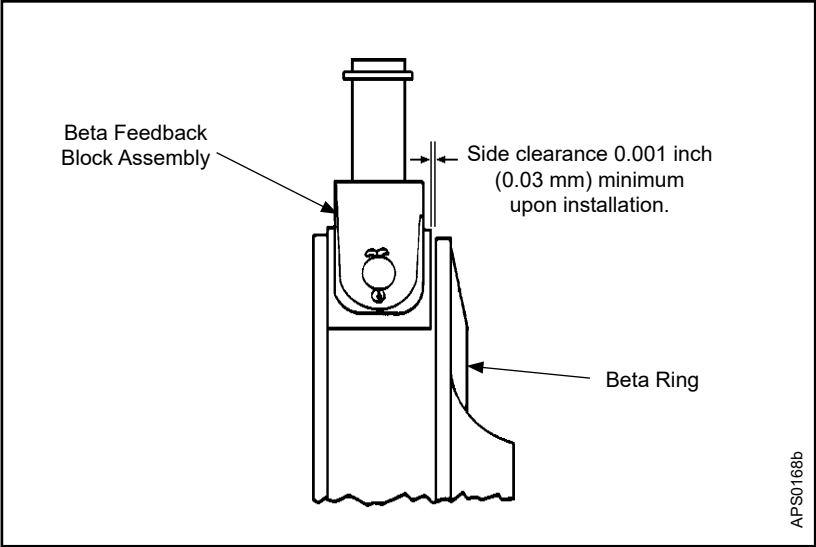
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4. Beta Feedback Block Assemblies (Rev. 1)

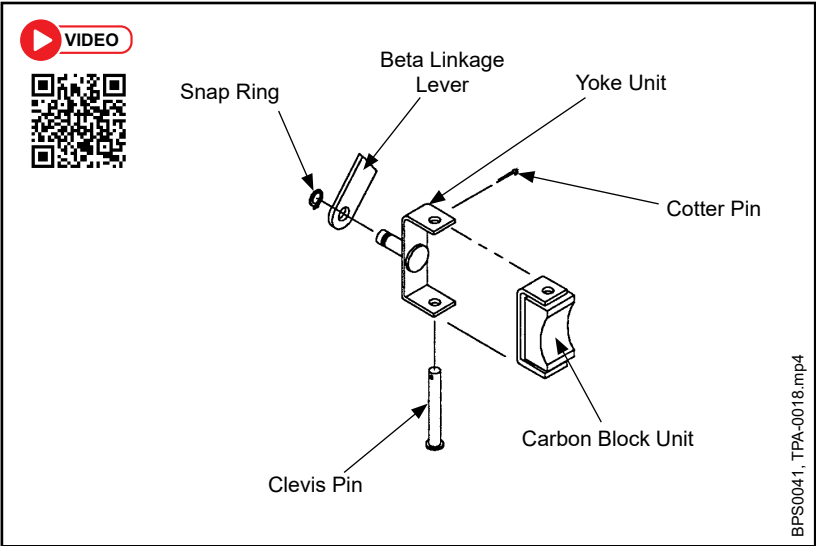
CAUTION: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC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

A. Inspection

- (1) The clearance between the yoke pin and the corresponding linkage (beta lever bushing) can become too close due to a buildup of plating and foreign particles between the two pieces. This can cause a binding action, resulting in excessive wear to the carbon block unit, low stop collar, beta ring, and/or beta linkage.
- (2) Inspect the beta lever and beta feedback block assembly interface for free movement. If there is binding, do the following:
 - (a) Disconnect the beta linkage and remove the beta feedback block assemblies from the beta ring.
 - (b) Using an abrasive pad, lightly polish the yoke pin to provide adequate clearance and eliminate binding.
 - (c) Reinstall the beta feedback block assembly into the beta ring.
 - (d) Install, adjust, and safety the beta linkage in accordance with the airframe manufacturer's instructions.



Beta Feedback Block Assembly and Beta Ring Clearance
Figure 6-5



Beta Feedback Block Assembly
Figure 6-6

- B. Replacement of the A-3026 Carbon Block Unit in the A-3044 Beta Feedback Block Assembly
- (1) If the side clearance between the beta ring and the beta feedback block unit exceeds 0.010 inch (0.25 mm) - refer to Figure 6-5, replace the A-3026 carbon block unit in accordance with Figure 6-6 and the following steps:
 - (a) Remove the cotter pin from the end of the clevis pin.
 - (b) Slide the pin from the assembly and remove and discard the carbon block unit.
 - (c) Inspect the yoke for wear or cracks.
 - 1 Replace the yoke, if necessary.
 - (d) Install a new carbon block unit and slide a new clevis pin into position.
 - (e) Secure the clevis pin with a T-head cotter pin.
 - (f) Refit the carbon block in accordance with Figure 6-5.
 - 1 Establish the required clearance by sanding the sides of the carbon block as needed.
- C. Installation of the A-3044 Beta Feedback Block Assembly
- (1) Refer to the Installation and Removal chapter of this manual for installation instructions.

5. Aluminum Blades (Rev. 6)

WARNING: NICKS, GOUGES, OR SCRATCHES OF ANY SIZE CAN CREATE A STRESS RISER THAT COULD POTENTIALLY LEAD TO BLADE CRACKING. ALL DAMAGE SHOULD BE VISUALLY EXAMINED CAREFULLY BEFORE FLIGHT FOR THE PRESENCE OF CRACKS OR OTHER ABNORMALITIES.

CAUTION 1: BLADES THAT HAVE BEEN PREVIOUSLY REPAIRED OR OVERHAULED MAY HAVE BEEN DIMENSIONALLY REDUCED. BEFORE REPAIRING SIGNIFICANT DAMAGE OR MAKING REPAIRS ON BLADES THAT ARE APPROACHING SERVICEABLE LIMITS, CONTACT A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING OR THE HARTZELL PRODUCT SUPPORT DEPARTMENT FOR BLADE DIMENSIONAL LIMITS.

CAUTION 2: INSTRUCTIONS AND PROCEDURES IN THIS SECTION MAY INVOLVE PROPELLER CRITICAL PARTS. REFER TO THE INTRODUCTION CHAPTER OF THIS MANUAL FOR INFORMATION ABOUT PROPELLER CRITICAL PARTS. REFER TO THE ILLUSTRATED PARTS LIST CHAPTER OF THE APPLICABLE OVERHAUL MANUAL(S) FOR THE IDENTIFICATION OF SPECIFIC PROPELLER CRITICAL PARTS.

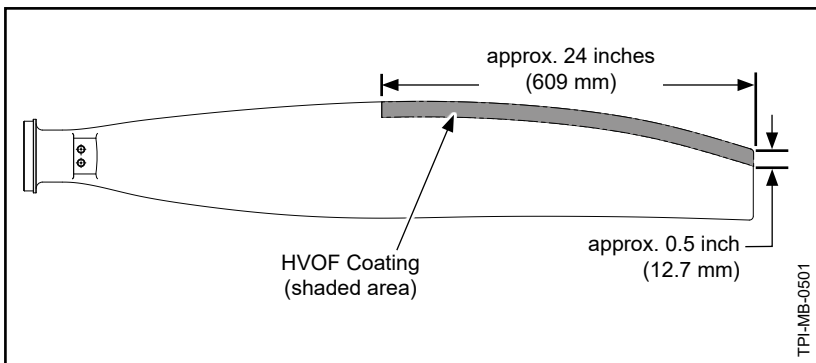
A. Important Information for LD9901H() Blades Only

- (1) LD9901H() blades have a thin durable (HVOF) coating of metal alloy applied to the leading edge of the blade to protect against erosion.

- (a) Refer to Figure 6-7 for the location of the HVOF coating area.

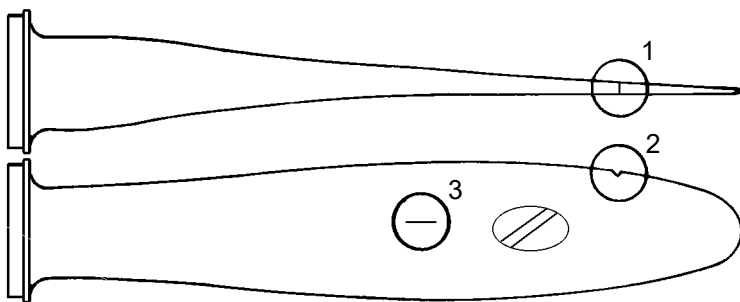
CAUTION: FIELD REPAIRS ARE **NOT** PERMITTED IN THE HVOF COATING AREA. CONTACT HARTZELL PROPELLER LLC IF THERE IS DAMAGE THAT PENETRATES THROUGH THE HVOF COATING.

- (2) Except in the HVOF coating area of the leading edge, field repair of small nicks and scratches may be performed by qualified personnel in accordance with FAA Advisory Circular 43.13-1B, and the procedures specified in this section.
 - (3) Nicks, gouges, and scratches on blade surfaces (except the HVOF coating area), that are greater than 0.031 inch (0.79 mm) wide or deep, must be repaired before flight.
 - (4) Normal paint erosion (sand-blasted appearance) on the leading edge of the blade is acceptable, and does not require removal before further flight.

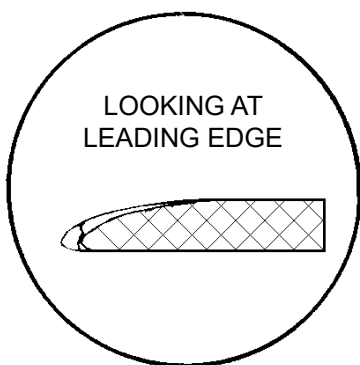


LD9901H() : HVOF Coating Area

Figure 6-7

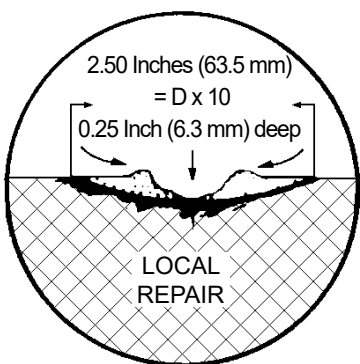


Example 1

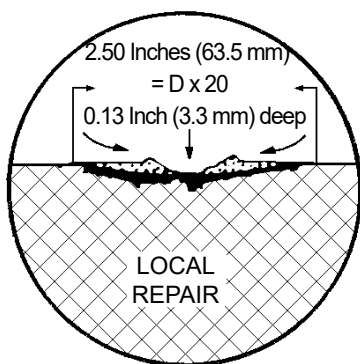


Finish repair must maintain original airfoil shape.

Example 2
LEADING EDGE



Example 3
FACE/CAMBER



APS6157

Repair Limitations
Figure 6-8

B. Repair of Nicks and Gouges

CAUTION: REFERENCES TO THE "LEADING EDGE" IN THIS SECTION DO NOT APPLY TO THE HVOF COATING AREA ON LD9901H() BLADES. REFER TO FIGURE 6-7. CONTACT HARTZELL PROPELLER LLC IF THERE IS DAMAGE IN THE HVOF COATING AREA.

- (1) Local repairs may be made using files, electrical or air powered equipment. Use emery cloth, scotch brite, and crocus cloth for final finishing.

CAUTION 1: ANY REPAIR THAT INVOLVES COLD WORKING THE METAL, RESULTING IN CONCEALMENT OF A DAMAGED AREA, IS NOT PERMITTED. A STRESS CONCENTRATION MAY EXIST THAT CAN RESULT IN A BLADE FAILURE.

CAUTION 2: SHOT PEENED BLADES ARE IDENTIFIED WITH AN "S" IMMEDIATELY FOLLOWING THE BLADE MODEL NUMBER, AS DESCRIBED IN THE DESCRIPTION AND OPERATION CHAPTER OF THIS MANUAL. BLADES THAT HAVE DAMAGE IN SHOT PEENED AREAS IN EXCESS OF 0.015 INCH (0.38 mm) DEEP ON THE FACE OR CAMBER OR 0.250 INCH (6.35 mm) ON THE LEADING OR TRAILING EDGES MUST BE REMOVED FROM SERVICE, AND THE REWORKED AREA SHOT PEENED BEFORE FURTHER FLIGHT. SHOT PEENING OF AN ALUMINUM BLADE MUST BE ACCOMPLISHED BY A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING IN ACCORDANCE WITH HARTZELL PROPELLER ALUMINUM BLADE OVERHAUL MANUAL 133C (61-13-33).

- (2) Calculate the area of repair using Figure 6-8 and the following formulas:
 - (a) For leading and trailing edge damage:
Depth of the damage x 10. Refer to Example 1 and 2.
NOTE: The leading edge includes the first 10% of chord from the leading edge. The trailing edge consists of the last 20% of chord adjacent to the trailing edge.
 - (b) For face and camber side damage:
Depth of damage x 20. Refer to Example 3.
- (3) Repair damage to the leading or trailing edge of the blade by removing material from the bottom of the damaged area.
 - (a) Remove material from this point out to both sides of the damage to form a smooth, blended depression that maintains the original shape of the blade airfoil.
- (4) Repair damage to the blade face or camber side by removing material from the bottom of the damaged area.
 - (a) Remove material from this point out to both sides of the damage to form a smooth, blended depression that maintains the original shape of the blade airfoil.
 - (b) Repairs that form a continuous line across the blade section (chordwise) are not permitted.
- (5) After filing or sanding the damaged area, use emery cloth to polish the area, then remove any file marks using crocus cloth.
- (6) Inspect the repaired area with a 10X magnifying glass.
 - (a) Be sure that no indication of the damage, file marks, or coarse surface finish remain.
- (7) If inspections show any remaining blade damage, repeat steps (5) and (6) of this procedure until no damage remains.

- (8) After repair, Hartzell Propeller recommends penetrant inspection of the blade in accordance with Hartzell Propeller Standard Practices Manual 202A (61-01-02).
- (9) Treat the repaired area to prevent corrosion. Properly apply chemical conversion coating and approved paint to the repaired area before returning the blade to service.
 - (a) Refer to the section, "Painting After Repair" in this chapter.

C. Repair of Bent Blades

CAUTION: DO NOT ATTEMPT TO "PRE-STRAIGHTEN" A BLADE BEFORE DELIVERY TO A CERTIFIED PROPELLER REPAIR STATION WITH THE APPROPRIATE RATING. THIS WILL CAUSE THE BLADE TO BE REPLACED BY THE REPAIR FACILITY.

- (1) Repair of a bent blade or blades is considered a major repair. This type of repair must be accomplished by a certified propeller repair station with the appropriate rating, and only within approved guidelines.

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

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

A. Important Information

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

(a) Aluminum Blades Only:

- 1** Blade paint touch-up is permitted for any size area on an aluminum blade.

B. Paint

- (1) The paints listed in Table 6-1 have been tested by Hartzell Propeller LLC and are recommended for blade touch-up.
- (a) Alternate paints may be used for blade touch-up, but Hartzell Propeller LLC accepts no responsibility for wear or adhesion-related issues.

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

Touch-up Paints
Table 6-1

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

(a) **Tempo Products Company**

A Plasti-kote Company

1000 Lake Road

Medina, OH 44256

Tel: 800.321.6300

Fax: 216.349.4241

Cage Code: 07708

(b) **Sherwin-Williams Company**

Refer to the Sherwin-Williams

Product Finishes Global Finishes Group website at:

<http://oem.sherwin-williams.com>

C. Procedure

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

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

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

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

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

- (3) Using 120 to 180 grit sandpaper, sand to feather the existing coatings away from the eroded or repaired area.
 - (a) Erosion damage is typically very similar on all blades in a propeller assembly. If one blade has more extensive damage, e.g. in the tip area, sand all the blades in the tip area to replicate the repair of the most severely damaged blade tip. This practice is essential in maintaining balance after refinishing.
- (4) Using acetone, #700 lacquer thinner, or MEK, wipe the surface of the blade.
- (5) Permit the solvent to evaporate.
- (6) Aluminum Blades Only:
 - (a) Apply an approved corrosion preventative coating to the bare aluminum surface of the blade in accordance with the manufacturer's instructions.
 - 1 Oakite 31, Chromicote L-25, or Alodine 1201 are approved chemical conversion coatings.
- (7) Apply masking material to the erosion shield, anti-icing or de-ice boot, and tip stripes, as needed.

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

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

- (8) Apply a sufficient amount of finish coating to achieve 2 to 4 mils thickness when dry.
 - (a) Re-coat before 30 minutes, or after 48 hours.
 - (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.
- (9) Remove masking material from the tip stripes and re-apply masking material for the tip stripe refinishing if required.
- (10) Apply sufficient tip stripe coating to achieve 2 to 4 mils thickness when dry.
 - (a) Re-coat before 30 minutes, or after 48 hours.
 - (b) If the paint is permitted to dry longer than four hours, it must be lightly sanded before another coat is applied.
- (11) Remove the masking material immediately from the anti-icing or de-ice boot and tip stripes, if applicable.
- (12) Optionally, perform dynamic balancing in accordance with the procedures and limitations specified in the Dynamic Balance section of this chapter.

7. Dynamic Balance

WARNING: WHEN USING REFLECTIVE TAPE FOR DYNAMIC BALANCING, DO NOT APPLY THE TAPE ON EXPOSED BARE METAL OF A BLADE. THIS WILL CAUSE MOISTURE TO COLLECT UNDER THE TAPE AND CAUSE CORROSION THAT CAN PERMANENTLY DAMAGE THE BLADE.

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

A. Overview

- (1) Dynamic balance is recommended to reduce vibrations that may be caused by a rotating system (propeller and engine) imbalance.
- (2) Dynamic balancing can help prolong the life of the propeller, engine, airframe, and avionics.
- (3) Static balancing is required when an overhaul or major repair is performed at a propeller overhaul facility.

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

- (4) Dynamic balance is accomplished by using an accurate means of measuring the amount and location of the dynamic imbalance.
- (5) The number of balance weights installed must not exceed the limits specified in this chapter.

- (6) Follow the dynamic balance equipment manufacturer's instructions for dynamic balance, in addition to the specifications of this section.

NOTE: The Static and Dynamic Balance chapter of Hartzell Propeller Standard Practices Manual 202A (61-01-02) also contains information about weight placement and balancing.

B. Inspection Procedures Before Balancing

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

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

- (a) Using a mild solvent, completely remove any grease on the blades or inner surface of the spinner dome.
 - (b) Visually examine each propeller blade assembly for evidence of grease leakage.
 - (c) Visually examine the inner surface of the spinner dome for evidence of grease leakage.
- (2) If there is no evidence of grease leakage, lubricate the propeller in accordance with the Maintenance Practices chapter in this manual. If grease leakage is evident, determine the location of the leak and correct before re-lubricating the propeller and before dynamic balancing.
- (3) Before dynamic balance make a record the number and location of all balance weights.

C. Modifying Spinner Bulkhead to Accommodate Dynamic Balance Weights

CAUTION 1: ALL HOLE/BALANCE WEIGHT LOCATIONS MUST TAKE INTO CONSIDERATION, AND MUST AVOID, ANY POSSIBILITY OF INTERFERING WITH THE ADJACENT AIRFRAME, DE-ICE AND ENGINE COMPONENTS.

CAUTION 2: DO NOT MODIFY A COMPOSITE SPINNER BULKHEAD TO ACCOMMODATE DYNAMIC BALANCE WEIGHTS.

- (1) It is recommended that the balance weights be placed in a radial location on aluminum spinner bulkheads that have not been previously drilled.
- (2) The radial location must be outboard of the de-ice slip ring or bulkhead doubler and inboard of the bend where the bulkhead creates the flange to attach the spinner dome.
- (3) Twelve equally spaced locations for weight attachment are recommended.
- (4) Install nut plates (10-32 thread) of the type used to attach the spinner dome. This will permit convenient balance weight attachment on the engine side of the bulkhead.
- (5) Alternatively, drilling holes for use with the AN3-() type bolts with self-locking nuts is acceptable.
- (6) Chadwick-Helmuth Manual AW-9511-2, "The Smooth Propeller", specifies several generic bulkhead rework procedures. These are acceptable providing they comply with the conditions specified herein.

D. Placement of Balance Weights for Dynamic Balance

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

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

- (2) If the location of static balance weights has not been altered, subsequent removal of the dynamic balance weights will return the propeller to its original static balance condition.
- (3) Use only stainless or plated steel washers as dynamic balance weights on the spinner bulkhead.
- (4) A maximum of six AN970 style washers weighing up to approximately 1.0 oz (28.0 g) may be installed at any one location.

NOTE: The dimensions of an AN970 washer are:
ID 0.203 inch (5.16 mm), OD 0.875 inch
(22.23 mm), and thickness 0.063 inch
(1.59 mm).

- (5) Install weights using aircraft quality #10-32 or AN-3() type screws or bolts.
- (6) Balance weight screws attached to the spinner bulkhead must protrude through the self-locking nuts or nut plates a minimum of one thread and a maximum of four threads.
 - (a) It may be necessary to alter the number and/or location of static balance weights to achieve dynamic balance.
- (7) Unless otherwise specified by the engine or airframe manufacturer, Hartzell recommends that the propeller be dynamically balanced to a reading of 0.2 IPS, or less.

CAUTION: IF REFLECTIVE TAPE IS USED FOR DYNAMIC BALANCING, REMOVE THE TAPE IMMEDIATELY UPON COMPLETION. TAPE THAT REMAINS ON THE BLADE WILL CAUSE MOISTURE TO COLLECT UNDER THE TAPE AND CAUSE CORROSION THAT CAN PERMANENTLY DAMAGE THE BLADE.

- (8) If reflective tape is used for dynamic balancing, remove the tape immediately after balancing is completed.
- (9) Make a record in the logbook of the number and location of dynamic balance weights and static balance weights, if they have been reconfigured.

8. Hydraulic Low Pitch Stop Setting (Rev. 2)**A. Hydraulic Low Pitch Stop Adjustment**

(1) The hydraulic low pitch stop is normally set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's requirements, and should not require any additional adjustment.

(a) Adjustments may be required after maintenance or because of aircraft variances.

1 Adjustments must be done in accordance with the specifications found in the airframe manufacturer's manual.

9. Propeller High Pitch Settings (Rev. 2)**A. High Pitch (Minimum RPM) Stop Adjustment**

(1) The high pitch stop is set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's recommendations.

(2) The high pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

10. Feathering Pitch Stop Settings (Rev. 2)**A. Feathering Pitch Stop Adjustment**

(1) The feathering pitch stop is set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's recommendations.

(2) The feathering pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

11. Reverse Pitch Stop Settings (Rev. 2)**A. Reverse Pitch Stop Adjustment**

(1) The reverse pitch stop is set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's recommendations.

(2) The reverse pitch stop can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

12. Start Lock Settings (Rev. 2)**A. Start Lock Adjustment**

- (1) The start locks are set by Hartzell Propeller LLC in accordance with the aircraft manufacturer's recommendations.
- (2) The start locks can only be adjusted by Hartzell or by a certified propeller repair station with the appropriate rating.

13. Propeller Ice Protection Systems (Rev. 1)**A. Maintenance Information**

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

14. Tachometer Calibration (Rev. 2)

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

A. Important Information

- (1) All engine/propeller combinations have operating conditions at which the propeller blade stresses begin to reach design limits.
 - (a) In most cases, these conditions occur above the maximum rated RPM of the engine.
 - (b) Some engine/propeller combinations have certain ranges of RPM that are less than maximum engine speed, where stresses are at a level considered too high for continuous operation. This results in a restricted operating range where continuous operation is not permitted. A placard on the instrument panel or yellow arc on the tachometer will inform the pilot to avoid operation in this range.

- (c) In other cases, the limiting condition occurs at an RPM only slightly above the maximum engine RPM.
 - (d) For these reasons, it is very important to accurately monitor engine speed.
- (2) The accuracy of the tachometer is critical to the safe operation of the aircraft.
- (a) Some tachometers have been found to be in error by as much as 200 RPM.
 - (b) Operating the aircraft with an inaccurate tachometer could cause continued operation at unacceptably high stresses, including repeatedly exceeding the maximum engine RPM.
 - (c) Continuous operation in a restricted RPM range subjects the propeller to stresses that are higher than the design limits.
 - (d) Stresses that are higher than the design limits will shorten the life of the propeller and could cause a catastrophic failure.

B. Tachometer Calibration

- (1) Hartzell Propeller LLC recommends that propeller owners/operators calibrate the engine tachometer in accordance with the National Institute of Standards and Technology (NIST) or similar national standard (traceable).
- (2) Contact Hartzell Propeller LLC if the propeller was operated in a restricted RPM range because of a tachometer error.

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ANTI-ICE AND DE-ICE SYSTEMS - CONTENTS

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

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

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

A. Overview of an Anti-ice System

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

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

B. Components of an Anti-ice System

- (1) A typical anti-ice system includes the following components:
 - (a) Fluid tank, pump, slinger ring, blade mounted anti-icing boots, and fluid dispensing tubes located at each blade mounted anti-icing boot

C. Anti-ice System Operation

- (1) The anti-ice system is typically controlled by the pilot using a cockpit mounted rheostat. The rheostat controls the pump and the flow of anti-ice fluid from the fluid tank.
- (2) The anti-ice fluid is pumped through airframe mounted distribution tubing and into a rotating slinger ring that is mounted on the rear of the propeller hub.

- (3) From the slinger ring, centrifugal force pushes the anti-icing fluid through the fluid dispensing tubes onto the blade mounted anti-icing boots.
- (4) The anti-icing boots evenly distribute the fluid along the leading edge of the propeller blade to prevent ice from forming.

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

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

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

A. Overview of a De-ice System

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

B. Components of a De-ice System

- (1) A typical de-ice system includes the following components:
 - (a) ON/OFF switch(es), ammeter, timer or cycling unit, slip ring, brush blocks, and blade mounted de-ice boots.

C. De-ice System Operation

- (1) The de-ice system is controlled by the pilot using a cockpit control switch. When this switch is ON, electrical power is supplied to the de-ice system.
 - (a) Some systems may have additional controls to adjust for different icing conditions.
 - 1 A mode selector switch lets the pilot set the cycling speed for heavy or light icing conditions.
 - 2 For twin engine aircraft, a full de-ice mode switch lets the pilot de-ice both propellers simultaneously. This switch is used when ice builds up on the propeller before the system is turned on and may only be used for short periods.
- (2) The ammeter indicates current draw by the system. It is typically located near the de-ice system switches. The ammeter may indicate total system load, or in twin engine aircraft, a separate ammeter may be supplied for each propeller.
- (3) The timer or cycling unit is controlled by the pilot using a cockpit control switch. When the timer/cycling unit is ON, power is applied to each de-ice boot (or boot segment) in a sequential order for a preset amount of time. This heating interval evenly de-ices the propeller.
- (4) The brush block supplies electrical current to the de-ice boot on each propeller blade via a slip ring. The brush block is typically mounted on the engine just aft of the propeller. The slip ring rotates with the propeller and is typically mounted on the spinner bulkhead.
- (5) The de-ice boots contain internal heating elements that melt the ice layer from the blades when electrical current is applied. De-ice boots are attached to the leading edge of each blade using adhesive.

3. Operational Checks (Rev. 2)**A. De-ice and Anti-ice Systems**

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

4. Troubleshooting (Rev. 2)**A. De-ice and Anti-ice Systems**

- (1) Refer to the applicable chapter(s) in Hartzell Propeller Ice Protection System Manual 180 (30-61-80) to troubleshoot malfunctions in Hartzell de-ice and anti-ice systems.
 - (a) Part numbers for components used in Hartzell de-ice and anti-ice systems are found in Hartzell Propeller Ice Protection System Manual 180 (30-61-80).

5. Periodic Inspections (Rev. 2)**A. De-ice and Anti-ice Systems**

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

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1. Record Keeping (Rev. 2)**A. General**

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

B. Information to be Recorded

- (1) Refer to Title 14 Code of Federal Regulations (CFR) Part 43 for a list of information that must be recorded.
- (2) The logbook may also be used to record:
 - (a) Propeller position (on aircraft)
 - (b) Propeller model
 - (c) Propeller serial number
 - (d) Blade design number
 - (e) Blade serial numbers
 - (f) Spinner assembly part number
 - (g) Propeller pitch range
 - (h) Aircraft information (aircraft type, model, serial number and registration number).

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