FAA Approved
Manual No. 156A
Revision 2
61-10-56
June 2005

HARTZELL

Inspection Repair Overhaul

Instruction Manual
for Series HC-E4P-5( )/E11990K

Four-Blade Lightweight Turbine Propeller and Composite Propeller Blades

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REVISION HIGHLIGHTS

- Revised the Cover, Revision Highlights, Record of Temporary Revisions, List of Effective Pages, and the Table of Contents to reflect the manual revision.
- Incorporated Temporary Revision TR-002 that added a Record of Temporary Revisions page to permit the reader to record information about temporary revisions.
- Revised the Disassembly chapter to refer the reader to the Composite Blade Overhaul Procedures section for counterweight clamp removal.
- Revised the Assembly chapter to refer the reader to the Composite Blade Overhaul Procedures section for counterweight clamp installation.
- Incorporated Temporary Revision TR-003 that replaced the previously unnumbered Temporary Revision with a document in the current format and updated the information.
- Revised the Overhaul Procedures (Composite Blade Section) to include gap requirements for the clamp.
- Incorporated Temporary Revision TR-005 that updated the illustrated parts list for Composite Blade model E11990K and added an overhaul column (O/H) to indicate parts to be replaced at overhaul.
- Incorporated Temporary Revision TR-006 that updated the illustrated parts list for Composite Blade model E11990K and added an overhaul column (O/H) to indicate parts to be replaced at overhaul.

REVISIONS HIGHLIGHTS

1. Introduction

A. General

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

B. Components

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

(2) Issue Date is the date of revision.

(3) Comments indicates the level of the revision.

(a) New Issue is a new manual distribution. The manual is distributed in its entirety. All the revision dates are the same and no change bars are used.

(b) Reissue is a revision to an existing manual that includes major content and/or major format changes. The manual is distributed in its entirety. All the revision dates are the same and no change bars are used.

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

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

Revision No.	Issue Date	Comments
Revision 1	Apr/03	Minor Revision
Revision 2	Jun/05	Minor Revision

HARTZELL PROPELLER INC.
Manual No. 156A

Record of Revisions to this Manual

Rev. No.	Issue Date	Date Inserted	Inserted By	Rev. No.	Issue Date	Date Inserted	Inserted By
1	Apr/03	Apr/03	HPI				
2	Jun/05	Jun/05	HPI				

HARTZELL PROPELLER INC.
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AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section of this manual is FAA approved and specifies component replacement times and maintenance required under 43.16 and 91.163 of the Federal Aviation regulations. Chapter 1, paragraph 10 of this manual identifies the applicable airworthiness limitations.

FAA APPROVED

by: Donald P. Michal date: 12-31-92

Donald P. Michal
Manager, Chicago Aircraft Certification Office,
ACE-115C
Federal Aviation Administration

HARTZELL PROPELLER INC.
Manual No. 156A

Log of Revisions to Airworthiness Limitations

Rev. No.	Description of Revision	FAA Aproval *signature/title*	FAA Approval Date

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RECORD OF TEMPORARY REVISIONS

Update this page to show all TEMPORARY REVISIONS inserted into this manual.

TR Number	Issue Date	Date Inserted	Inserted By	Date Removed	Removed By
All temporary revisions through TR-006 have been incorporated in revision 2.					
TR-007	Oct/12	Oct/12	HPI		
TR-008	Sep/14	Sep/14	HPI	Jul/21	HPI
TR-009	Jul/21	Jul/21	HPI		

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Update this page to show all TEMPORARY REVISIONS inserted into this manual.

TR Number	Issue Date	Date Inserted	Inserted By	Date Removed	Removed By

LIST OF EFFECTIVE PAGES

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Chapter	Page	Revision Level	Date
COMPOSITE BLADE SECTION- Damage Definitions and Descriptions	3-1 thru 3-14	Original	Nov/92
COMPOSITE BLADE SECTION-Inspection	4-1 thru 4-10	Original	Nov/92
COMPOSITE BLADE SECTION-Overhaul Procedures	5-1 thru 5-40	Original	Nov/92
COMPOSITE BLADE SECTION-Overhaul Procedures	5-41	Rev. 2	Jun/05
COMPOSITE BLADE SECTION-Overhaul Procedures	5-41.1 thru 5-41.4	Rev. 2	Jun/05
COMPOSITE BLADE SECTION-Overhaul Procedures	5-42	Rev. 2	Jun/05
COMPOSITE BLADE SECTION-Overhaul Traveler	n/a	Original	Nov/92
COMPOSITE BLADE SECTION-Repair Report	n/a	Original	Nov/92
COMPOSITE BLADE SECTION-Overhaul Inspection Form	n/a	Original	Nov/92
COMPOSITE BLADE SECTION-Dimensional Inspection Form	n/a	Original	Nov/92
COMPOSITE BLADE SECTION-Minor Repair	6-1 thru 6-22	Original	Nov/92
COMPOSITE BLADE SECTION-Major Repair	7-1 thru 7-8	Original	Nov/92
COMPOSITE BLADE SECTION-De-icer Boot	8-1 thru 8-10	Original	Nov/92
COMPOSITE BLADE SECTION-Finish Procedures	9-1 thru 9-32	Original	Nov/92
COMPOSITE BLADE SECTION-Parts	10-1 thru 10-5	Original	Nov/92
COMPOSITE BLADE SECTION-Parts	10-6	Rev. 2	Jun/05
COMPOSITE BLADE SECTION-Parts	10-7 thru 10-16	Original	Nov/92
COMPOSITE BLADE SECTION-Parts	10-17	Rev. 2	Jun/05
COMPOSITE BLADE SECTION-Parts	10-18 thru 10-20	Original	Nov/92

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List of Illustrations

LIST OF ILLUSTRATIONS

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1-1. General Instructions

This publication, Hartzell Manual No. 156, provides information for the Hartzell HC-E4P-5/E11990K series four-blade "lightweight" turbine propeller assemblies. It primarily provides overhaul and parts list information for use by FAA approved propeller repair stations.

Although installation, removal, and troubleshooting data is included in this publication, the airframe manufacturer's manuals should be the primary source for such data due to possible special requirements for specific aircraft applications.

This instruction manual is written to the basic A.T.A. Specification No. 100. It is assumed that persons using this manual have sufficient training for following instructions and procedures to accomplish the work properly.

Hartzell regularly schedules factory training classes specifically related to each propeller assembly series. Participation is strongly recommended.

NOTE: Item references are to Figure 10-1 unless otherwise noted.

The propeller assembly should be inspected, maintained, repaired and overhauled in accordance with recommended procedures. Consult the applicable Hartzell publications for additional information regarding specific recommendations and procedures:

Manual No. 148-( ), Composite Spinner Assembly Maintenance Guide - repair procedures for the spinner assembly.

Manual No. 149-( ), Propeller Owner's Manual and Log Book

Consult the applicable manufacturer's manual for de-icer system inspection, repair and overhaul instructions.

Consult the owner's manual or applicable airframe manufacturer's manual for propeller assembly installation procedures—and, as necessary, for setting blade pitch.

1-2. Definitions of Propeller Life and Service

Terms used in this manual with regard to propeller assembly service and life are defined as follows:

A. Overhaul is the periodic disassembly, inspection, repairing and reassembly of the propeller assembly which is constructed of a number of moveable, detachable parts.

1) The period between overhauls generally is based on hours of service (operating time) or on calendar month time.

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

3) Overhaul is to be accomplished in accordance with the latest revision of this manual and other publications applicable to, or referenced in, this manual.

HC - E4P - 5( )( ) / Blade Model

Direction of Rotation
L = Left Hand

Minor Modification

Operational Features
Internal Beta System

Propeller Hub Assembly Mounting Flange Type

Number of Blades

Blade Retention System

Hartzell Controllable

NOTE: Refer to composite blade section in the back of this manual for blade model designation system.

Model Designation System
Figure 1-1

4) Overhaul is to be accomplished only by an approved propeller shop that meets facility, personnel, tooling and sampling requirements.

5) Hartzell propeller time between overhauls (TBO) specifications are provided in the latest revision to Hartzell Service Letter 61.

B. Reconditioning is the rework of minor or major blade damage caused by erosion or by small objects striking the blade during normal operation.

1) Reconditioning is done on an irregular basis, as necessary and required. The propeller assembly must be rebalanced after reconditioning.

C. Repair

1) Minor Repair - correction of damage that may be safely performed in the field by a certified aircraft mechanic (preferably a mechanic who has completed Hartzell training).

2) Major Repair - correction of damage that cannot be performed by elementary operations. Major repairs must be performed by a propeller shop that has been approved by Hartzell for the specific type of major repair. Propeller shops must meet facility, tools and personnel requirements and may require approval of samples.

D. Propeller Life is expressed in terms of total hours of service (TT, or Total Time), time between overhauls (TBO) and in terms of hours of service since overhaul (TSO, or Time Since Overhaul). Overhaul returns the propeller assembly to zero hours TSO (Time Since Overhaul), but *not* to zero hours TT (Total Time). Occasionally, a part may be "life limited" which means that it must be replaced after a specified period of use. All references are necessary in defining the life of the propeller.

1-3. Definitions of Damage

A. Terms used in this manual with reference to damage to the propeller assembly (Figure 1-2) are defined as follows:

1) Brinelling - depression caused by failure of the material in compression.

2) Corrosion - gradual wearing away or deterioration due to chemical action.

3) Crack - irregularly shaped separation within a material, usually visible as a narrow opening at the surface.

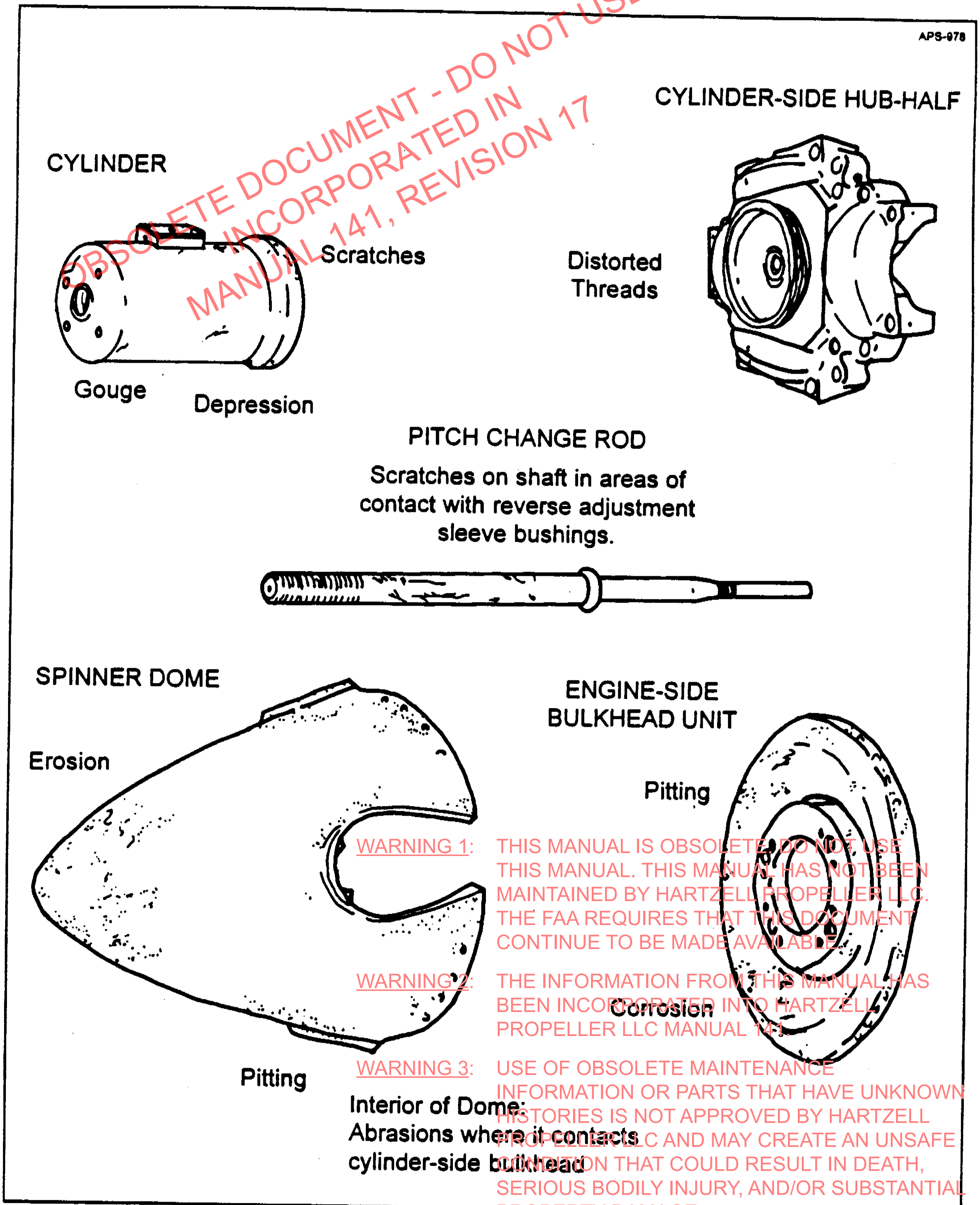
4) Depression - surface area where the material has been compressed but not removed.

5) Distortion - alteration of the original shape or size of a component.

6) Erosion - gradual wearing away or deterioration due to action of the elements.

7) Exposure - leaving material open to action of the elements.

8) Gouge - surface area where material has been removed.



Examples of Damage to Propeller Assembly
Figure 1-2

9) Impact Damage - occurs when the propeller blade or hub assembly strikes or is struck by an object, either in-flight or on the ground.

10) Nick/Scratch - removal of paint and possibly a small amount of material.

11) Overspeed Damage - occurs when the propeller hub assembly rotates at a speed more than ten per cent (10%) in excess of the maximum for which it is designed. Overspeed damage may not produce visible indications.

12) Pitting - number of extremely small gouges caused by corrosion or wear.

B. Refer to the composite blade section in the back of this manual for composite blade definitions.

1-4. General Description and Components (Figure 1-3)

A. The Series HC-E4P-5 is a constant-speed type of propeller with feathering and reversing capabilities. It is designed primarily for use with Garrett TPE-331 Series turboprop engines.

B. The piston and cylinder of the hub assembly are lengthened to provide the extra pitch travel necessary for reversing. A 110-degree (110°) pitch range is possible.

C. The propeller assembly is hydraulically actuated. Propeller RPM is controlled by a governor which is installed on the engine and supplies oil under pressure to the hub assembly through a beta rod.

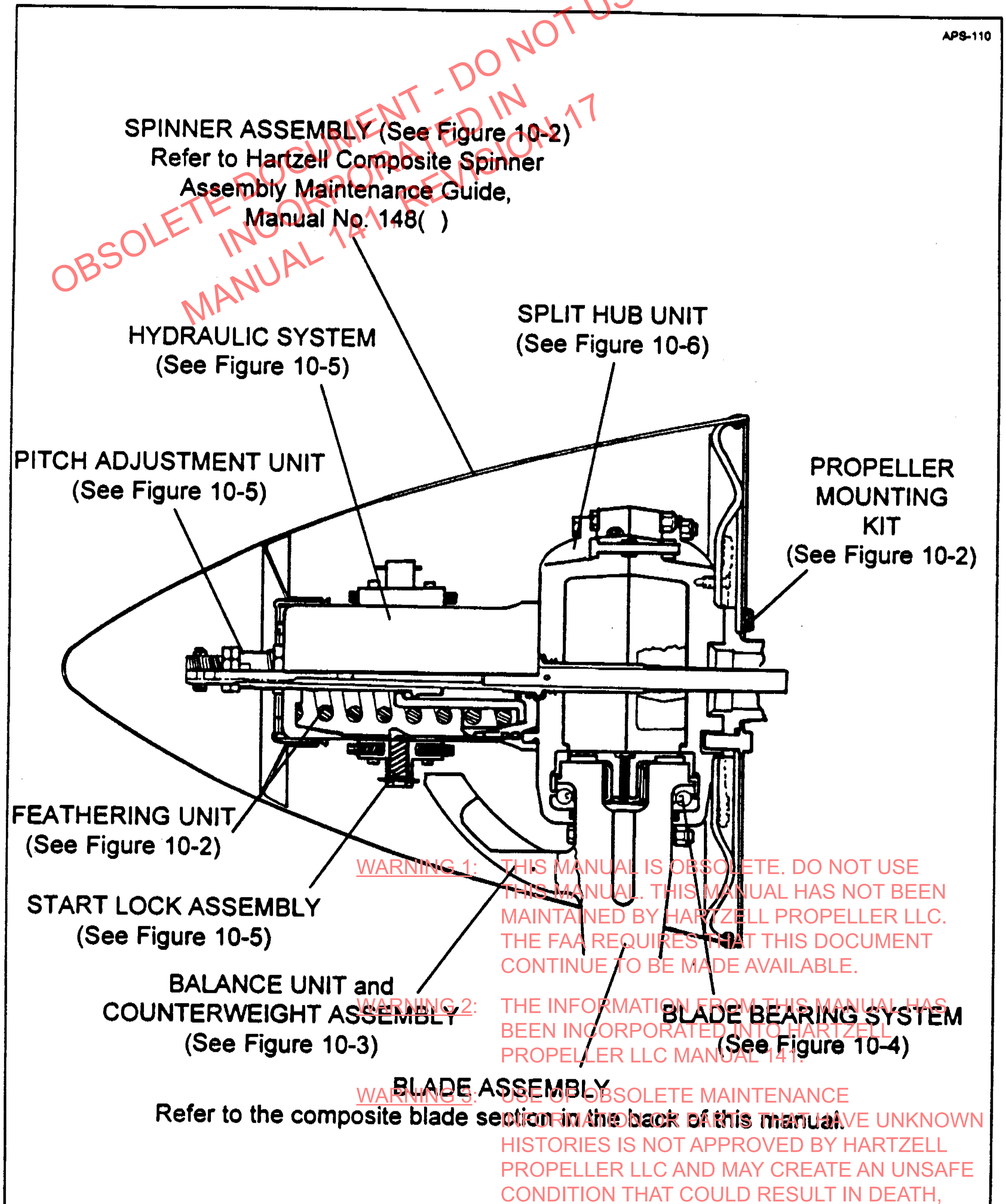
D. The engine oil is forced into a cavity inside the hub between the piston and the cylinder and moves the piston forward from low pitch position into reverse pitch range. This motion is transmitted from the piston to the blade assembly through a pitch change rod, blade pitch change assembly and slotted fork unit.

E. Each blade is supported by a retention split-bearing which permits pitch change. Counterweights mounted on the blades and a feathering spring inside the cylinder oppose governor oil pressure and increase pitch to the feathered position.

F. Increasing oil pressure from zero (0) psi to approximately 385 psi (27.07 kg/cm²) causes propeller pitch to decrease in the positive range and to increase in the negative (reversing) range. A loss of oil supply results in feathering the propeller rather than reversing it, since the combined action of feathering spring and blade counterweights forces oil from the propeller back through the beta rod and governor into a drain.

G. In beta mode, the propeller pitch control functions as a variable low pitch stop by metering the flow of oil from the governor into the propeller through the beta rod. The beta valve shuts off oil supply when the piston reaches a predetermined low pitch setting and prevents the governor from moving the piston beyond the prescribed low pitch position. For ground operations, the prescribed position can be varied by the power lever in the cockpit to allow reversing the propeller.

H. The hydraulic low pitch stop also prevents the propeller from going below flight idle pitch in flight.



Basic Components of the HC-E4P-5 Four-Blade
Lightweight Turbine Propeller
Figure 1-3

1-5. Basic Operating Principles

A. Feathering the Propeller

1) The propeller is feathered by releasing the governor oil pressure. This allows the counterweights and feathering spring to feather the blades.

2) Pulling the governor pitch control back to the limit of its travel opens a port in the governor. This allows the feathering spring to force oil out of the propeller back into the engine and increase blade angle to the feathered position.

3) Because of such variables as blade design and counterweight mass, elapsed time up to fifteen (15) seconds is typical for feathering with this system.

B. Unfeathering the Propeller

1) The propeller is installed (or removed) with the blades in a feathered position to prevent the feathering spring from distorting the start lock arrangement.

2) If the propeller is not on the start locks, the power lever must be placed in reverse position and the unfeathering pump turned on to rotate the propeller to full reverse position. Then, when the unfeathering pump is turned off, oil will leave the propeller, and the feathering spring will move the blades toward a higher angle until the start locks are activated.

3) When the propeller is unfeathered in flight, "windmilling" occurs and reduces the time required to accomplish unfeathering.

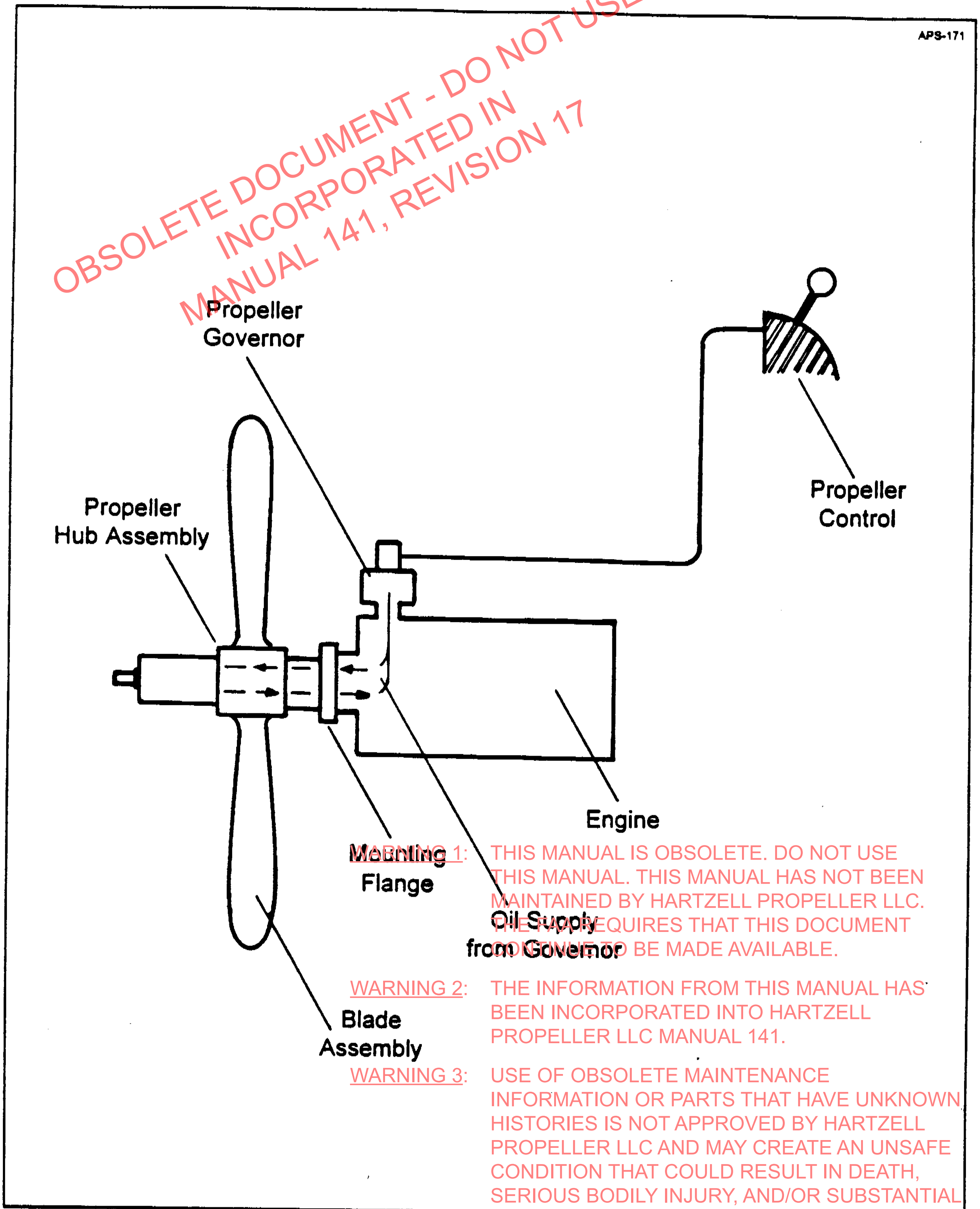
C. Reversing the Propeller

1) Blade movement below the predetermined low pitch angle is manually controlled through the beta valve.

2) The propeller is reversed by pulling back on the power lever so the beta valve will assume control of blade pitch. The governor then pumps oil through the engine beta rod into the propeller, and the piston moves into reverse range.

3) Pushing forward on the power lever repositions the low pitch stop at normal low pitch. The beta valve then drains oil from the propeller cylinder, and the blades return to normal pitch.

4) System operation does not depend on maintaining a pressure or leakproof mechanism to prevent unintended reversal. A loss of oil at low pitch results in feathering, not reversal, because the combined action of the blade counterweights and feathering spring forces oil out of the propeller back through the engine beta rod and into a drain.



Propeller Control Mechanism (oil flow to and from engine)
Figure 1-4

1-6. Spinner Assembly Maintenance

The spinner should be maintained in accordance with the aircraft maintenance manual. There is no specific requirement for spinner overhaul as there is with propeller overhaul. Refer to the spinner manual for additional information.

1-7. Propeller Blade Assembly Inspection, Repair and Overhaul

Refer to the composite blade section in the back of this manual for overhaul, repair and inspection.

1-8. Propeller Hub Assembly Inspection and Maintenance

A. Inspect visible hub parts daily for surface damage.

B. Look for evidence of grease and/or oil leaks. If evidence is present, remove spinner to locate problem area (Figure 1-5).

C. Lubricate the assembly periodically in accordance with inspection and maintenance procedures detailed in the owner's manual.

D. If the cadmium plating wears off of a steel part, clean the surface, treat it, and apply Hartzell Polane paint as a temporary measure until the part can be re-plated. Refer to Chapter 6 for Cadmium Re-Plating Procedures.

E. Re-plate and bake steel parts at overhaul in accordance with instructions in Chapter 6.

1-9. Recommended Overhaul Periods

CAUTION: PROPELLERS EXPOSED TO IMPACT DAMAGE, LIGHTNING STRIKE OR OVERSPEED GREATER THAN 10% OF THE MAXIMUM RATING OF THE PROPELLER MUST BE OVERHAULED PRIOR TO RETURN TO SERVICE.

A. The recommended Time Between Overhauls (TBO) for a Hartzell propeller is influenced by several factors:

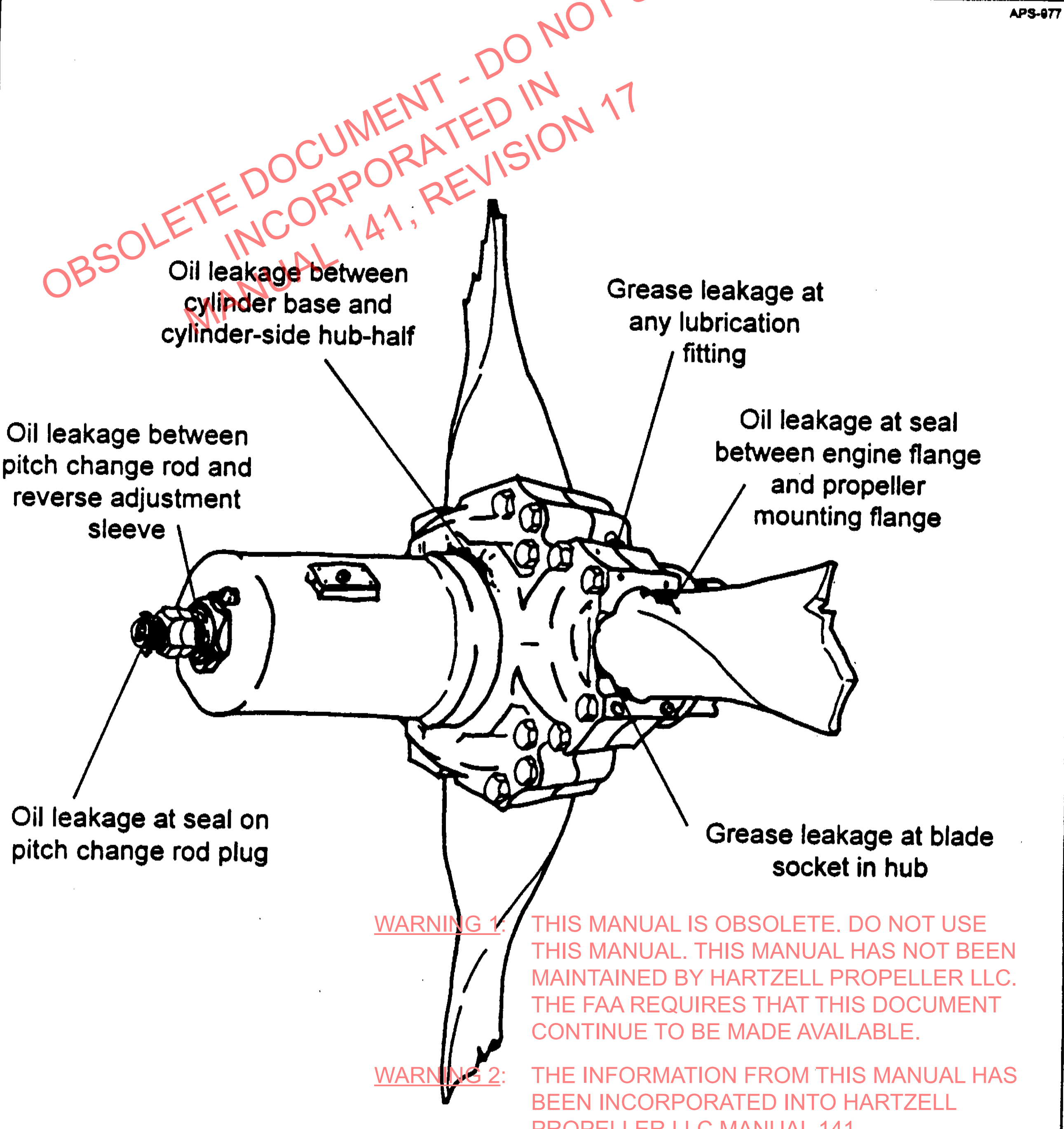
1) Pattern of vibration or stress the propeller must absorb from a specific engine.

2) Whether the propeller has been maintained in service in strict accordance with procedures recommended in Hartzell manuals.

3) Length of time the blades, seals and other components have been subjected either directly or indirectly to corrosion, erosion or exposure to the elements.

NOTE: Propeller must comply with all applicable FAA Airworthiness Directives, some of which may affect overhaul periods.

B. The recommended TBO for the Hartzell propeller covered by this manual is typically 3000 hours of operation or 60 calendar months, whichever occurs first. See Hartzell Service Letter 61( ) for detailed TBO specifications.



NOTE: The blade retention split-bearing is the only potential source for grease leakage.

Areas to Inspect Daily for Evidence of Leaking Oil or Grease
Figure 1-5

1-10. Airworthiness Limitations

A. Certain component parts as well as the entire propeller may have specific life limits established by the FAA. Such limits call for replacement of items after a specific number of hours of use.

B. There are no life limited items in propellers covered by this manual. Any revision to the life limit will be specified in a revision to this document.

1-11. Mandatory Parts Retirement Procedures

A. Serialized parts and accessories manufactured by Hartzell Propeller Inc. which are no longer airworthy must be retired from service in the following manner to prevent the possibility of a part being returned to service (either in a certificated or an experimental type aircraft) after the part no longer meets Hartzell airworthiness standards.

1) Attach a scrap tag to the part.

2) Stamp or etch a line through the serial number.

3) Stamp a letter "S" over the "TC" (Type of Certificate) number.

4) Use the three-part Hartzell Retirement Form 101DA (Figure 1-6) to record and report all required information about a part that is retired.

5) Every Hartzell authorized distributor is required to use Form 101DA for serialized parts found not airworthy. Every certified propeller repair facility is requested to institute the use of the Mandatory Parts Retirement Procedures.

NOTE: Supplies of Form 101DA are available from the factory.

a) Once a month, forward to the factory the original (white) copies of completed Form 101DA. Original copies of the form will be kept on file at the factory for quality assurance, FAA, and insurance record purposes.

b) Retain the yellow copies of completed Form 101DA in distributor or repair facility files.

c) Give the pink copies of the completed form to customers.

6) Record the serial number(s) of retired part(s) on customer and in-house copies of the work order involved.

7) Record disposition of the part(s) on customer and in-house copies of the work order involved.

8) The following critical parts of the Series HC-E4P-5 Lightweight Turbine Propeller assembly are serial-numbered to aid in correct assembly and to prevent re-use of parts which have been retired from service:

   a) Engine-Side Spinner Bulkhead Unit

   b) Split-Hub Unit (each half)

   c) Cylinder

   d) Pitch Change Rod

B. Prompt and regular use of the Mandatory Parts Retirement Procedures is an important aid in tracking failure trends.

1-12. Allowable Wear Tolerances for Propeller Assembly Parts

A. Certain propeller assembly parts are subject to normal wear and require replacement when dimensions exceed the permissible range.

B. Refer to the Allowable Wear Limits Table, Figure 4-3, for maximum/minimum dimensions on parts subject to normal wear. Replace these parts as necessary for safe operation.

1-13. Torque Values for Reassembly Hardware

A. Threaded fasteners and hardware are the weakest components in an assembly. Vibration can cause an improperly tightened fastener to fail in a matter of minutes.

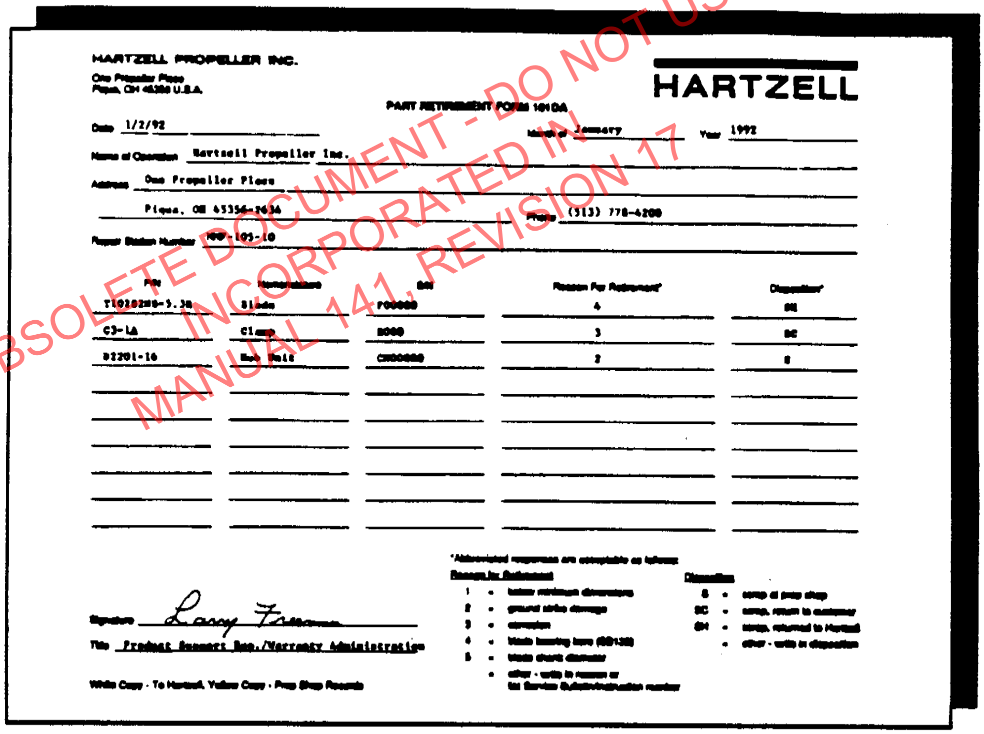
B. Proper tension in a fastener depends on a variety of known stress factors, plus the safety factor required for unknown additional stresses. It is achieved by application of measured torque.

C. Accurate wrenches and professional procedures will result in precision tensioning.

D. Refer to the Torque Values Table, Figure 7-1, for proper torque values on Hartzell reassembly hardware.

E. When an adapter is used with a torque wrench, Figure 1-7, use the following equation to determine torque value:

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



HARTZELL PROPELLER INC.
One Propeller Place
Piqua, OH 45356 U.S.A.

HARTZELL

PART RETIREMENT FORM 101DA

Date 1/2/92 Month of January Year 1992

Name of Operation Hartzell Propeller Inc.

Address One Propeller Place

Piqua, OH 45356-2634 Phone (513) 778-4200

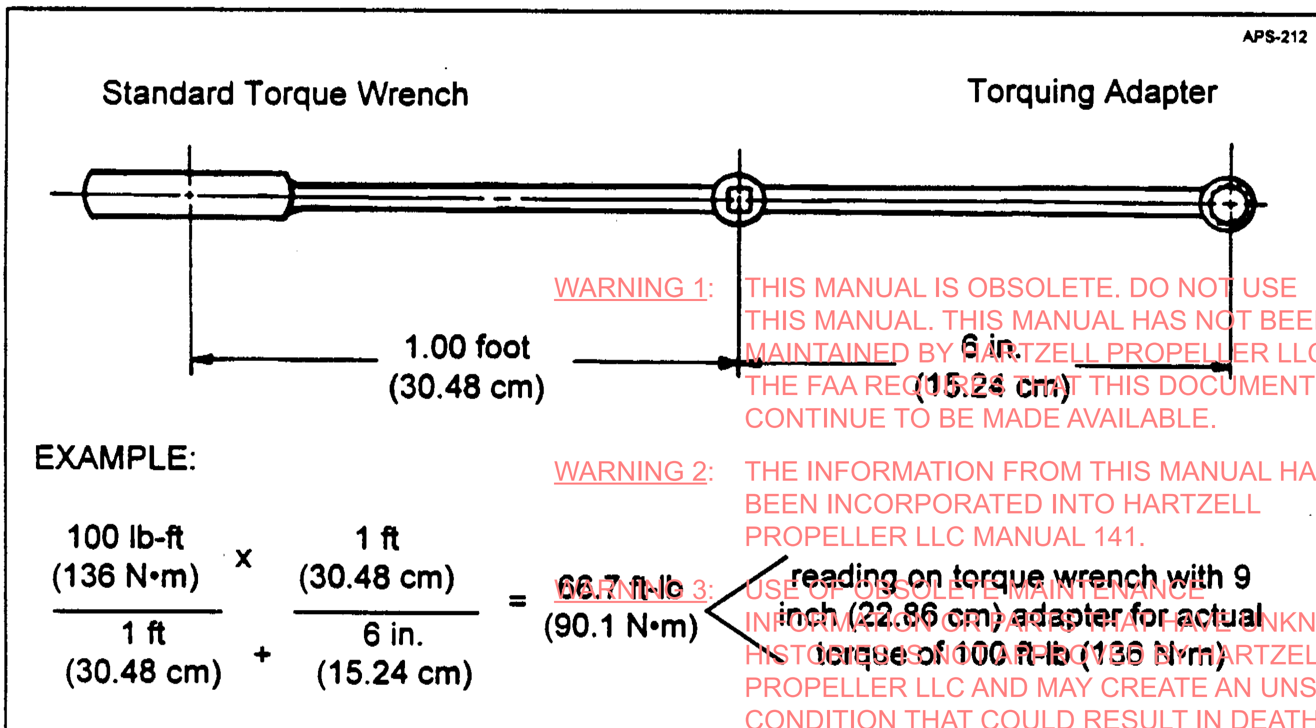
Repair Station Number 10-105-10

P/N	Nomenclature	S/N	Reason For Retirement*	Disposition*
T10282HB-5.3R	Blade	F00000	4	S
C3-1A	Clamp	0000	3	SC
B2201-16	Hub Unit	CH00000	2	S

Signature Larry F.

Title Product Support Rep./Warranty Administration

Properly Completed Part Retirement Form 101DA
Figure 1-6



Determining Torque Value
of a Standard Torque Wrench with Torquing Adapter
Figure 1-7

1-14. Approved Lubrication Procedures

A. Proper and regular lubrication is essential to efficient, long-life operation of the Hartzell propeller.

CAUTION: LUBRICATION PROCEDURES MUST BE FOLLOWED CORRECTLY TO MAINTAIN ACCURATE DYNAMIC BALANCE OF THE PROPELLER BLADE AND HUB ASSEMBLIES.

B. Inspect the propeller assembly daily for evidence of leaking oil or grease. If evidence is present, remove spinner and locate problem area (Figure 1-5).

C. Use the Troubleshooting Guide in Chapter 2 to correct any leakage immediately.

D. Proceed as follows to lubricate the propeller assembly:

CAUTION: USE HARTZELL APPROVED LUBRICANTS ONLY.

NOTE: To avoid dislodging the hub O-rings, remove the four (4) lubrication fittings on one half of the hub unit before adding grease through the four fittings on the other half of the hub unit.

1) As shown in Figure 1-8, remove the four grease fittings from the engine-half of the hub unit.

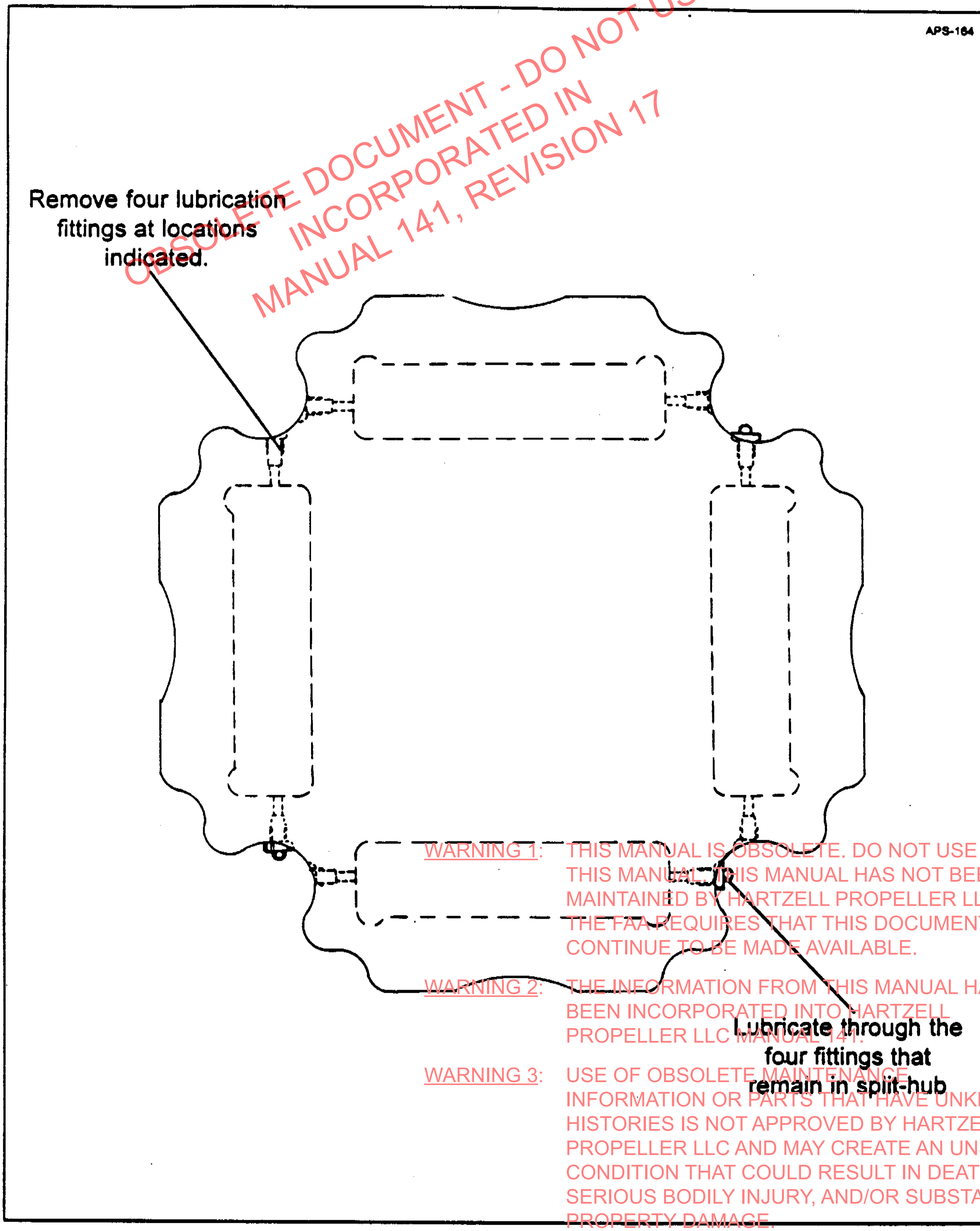
2) Add an equal number of pumps of grease, a maximum of 1 ounce, through each of the grease fittings on the cylinder-half of the hub unit.

3) Work a probe (such as a loop of wire) in and out of the open holes in the engine-half of the hub to help release air pockets in the grease.

NOTE: Make sure the ball of each lubrication fitting is properly seated.

E. Make an entry in the Log Book verifying that these inspection and lubrication procedures have been completed.

NOTE: For additional information on lubrication procedures, see Hartzell Service Advisory 17( ).



Procedure for Lubricating Blade Retention Split-Bearings
Figure 1-8

1-15. Approved Lubricants

A. The following greases are approved by Hartzell Propeller Inc.:

Aeroshell 5 with certain limitations, see Service Bulletin 159( ).

Aeroshell 6

Aeroshell 7

Aeroshell 22

Exxon 5114EP

Royco 22C

NOTE: Other, previously issued, Hartzell documents indicate additional greases by brand name and/or MIL-specification. Not all of these greases meet our current performance standards. Hartzell has chosen to specify only those greases which have sufficient testing or field experience to establish that they are acceptable.

B. Generally, Aeroshell 6 is now the recommended grease for all Hartzell propellers with a couple of important exceptions: Piaggio P180 and Grob Egrett aircraft are to use only Aeroshell 22 grease.

NOTE: For further information on approved grease and lubrication procedures, see Service Advisory 17( ).

1-16. Approved Adhesives

A. Apply General Electric IS 802 (white) at the O-ring (33) between the cylinder half of the split hub (67) and the cylinder (39) to seal the hydraulic system.

NOTE: This compound must be unaffected by shock, vibration, pulsating pressure and temperatures to 180° F (82° C).

B. Hysol Epoxi-Patch 0151 Clear must be applied to bond bushing(s) (60) to the interior of the reverse adjustment sleeve (59).

C. Apply General Electric IS 802 (white) to the mating surfaces of the two halves of the split-hub unit.

D. Hysol Epoxi-Patch 0151 Clear must be applied to the inner races of the blade retention split-bearing to fill all voids between the bearing and the blade surface in the blade retention radius.

NOTE: As necessary, use Hysol Dissolver AC-4079 to dissolve the epoxy adhesive after it has cured.

E. Hysol Epoxi-Patch 0151 Clear must be applied to the guide bushing (68) before it is installed into the engine-side hub-half.

1-17. Approved Anti-Seize Compound

A. A petrolated graphite lubricant conforming to MIL-T-83483 must be applied to the threaded surface of each of the eight (8) propeller mounting bolts (1) at reassembly.

B. The following kits are available from the factory for this installation:

Part No.	Net Weight Ounces	Net Weight Grams	MIL SPEC
A-3338-4	1/3	9	MIL-T-83483
A-3338-5	1	28	MIL-T-83483
A-3338-6	2	57	MIL-T-83483

1-18. Approved "Build-Up" Material

Use 3M EC776 on the hub when the blade retention bearing (23) has a loose fit after the hub has been re-anodized.

1-19. Approved Cleaning Mediums

A. Clean surfaces as preparation for applying structural adhesive or retaining compounds using Methyl-Ethyl-Ketone (MEK).

B. Trichloroethane is required for parts that will be inspected by a penetrating dye method.

C. Aluminum parts must be cleaned prior to re-anodizing with either Taskleen D4 or Wyandotte Spray Altrex.

1-20. Approved Rust Preventive Compound

Winsor No. 307 Rust Preventive must be applied to steel parts after they have been cleaned, unless they will be reassembled immediately.

1-21. Approved Sealant

A bead of General Electric IS 802 (white) must be applied in bolting areas of the engine-half of the split-hub prior to reassembly.

1-22. Approved Solvent

CAUTION: THE APPROVED INDUSTRIAL SOLVENT IS NOT SUITABLE FOR USE ON THERMOPLASTICS.

Safety Solvent Product 755 is required to remove traces of oil and grease from parts without leaving a residue.

1-23. General Precautions

A. Observe the following general precautions during disassembly and reassembly of the Hartzell propeller:

1) The propeller assembly is highly vulnerable to damage when it is removed from the engine. Properly protect it at all times until it is reinstalled on the engine.

2) Carefully follow all instructions for cleaning parts, keeping them clean and dry until they have been reassembled, and all instructions for visual and magnetic inspection, correcting any potential problem immediately.

3) Protect partially disassembled or reassembled components against entry of foreign matter or other possible damage if they are left unattended for a length of time.

4) Observe allowable wear limits for parts, and follow the mandatory parts retirement procedures as necessary. (Refer to the Allowable Wear Limits Table, Figure 4-3.)

5) Observe applicable torque values during reassembly. (Refer to the Torque Values Table, Figure 7-1.)

6) In accordance with instructions, bake any steel parts which have been cadmium re-plated during overhaul.

7) Statically balance the propeller assembly before reinstalling it on the engine.

CAUTION: DO NOT USE METAL STENCILS, PUNCHES OR SCRIBES TO MARK ANY PARTS EXCEPT THE COUNTERWEIGHTS—OR PARTS BEING RETIRED.

8) Metal stencils or scribes may have been used at the factory to serial-number some parts. However, in the field, do not use metal stencils, punches or scribes to mark any parts except the counterweights and parts being retired.

a) As necessary, use a soft pencil or crayon to make identifying marks on parts of the propeller.

b) The chemically etched split-hub part number may be obliterated during re-anodizing procedures. The part number must be recorded prior to overhaul and restored on each hub half after overhaul to preserve identity of the hub unit.

c) Use a round-bottomed metal stamp, as necessary, to re-stamp part numbers, serial numbers, design numbers and other identification on overhaul parts.

NOTE: Locate the restored number in the same place on the part as the original number was located.

B. Follow the specified procedures for a thorough final inspection.

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2-1. The Troubleshooting Guide which follows helps isolate probable causes and suggests possible remedies for some of the more common propeller service problems.

2-2. In any case, the remedy for a problem should follow the procedures (not in any fixed sequence) detailed in the applicable section of this manual.

Problem		Probable Cause	Remedy
A. Excessive Friction in Hub Mechanism		Insufficient clearance between various moving parts in the pitch change mechanism	Check the moving parts individually Increase clearances between individual parts as necessary to decrease friction in the mechanism
	or	Balls in the blade retention split-bearing are unusually rough or chipped	Replace the blade retention split-bearing assembly
B. Excessive Friction in Piston		Blade preload is excessive	Disassemble the propeller, and readjust blade preload
	or	Lack of lubrication	Add approved lubricant
	or	Balls in the blade retention split-bearing are unusually rough or chipped	Replace the blade retention split-bearing assembly
	or	Insufficient clearances between various moving parts in the pitch change mechanism	Increase clearances between the individual parts as necessary to decrease friction in the mechanism

Problem		Probable Cause	Remedy
C. Failure to Change Pitch (Sluggish RPM in both directions)		Excessive friction in moving parts	Refer to Problem A, "Excessive Friction in Hub Mechanism"
	or	Oil passages are not clear and open	Check out the hydraulic system
	or	New governor has been installed with wrong direction of rotation	Refer to governor manufacturer's manual for instructions on correct installation if necessary
D. Surging RPM or Torque		Excessive friction in pitch change mechanism	Refer to Problem A, "Excessive Friction in Hub Mechanism"
	or	Air is trapped in the propeller actuating piston or in the engine shaft	The engine should have provision for allowing trapped air to escape from the system during one-half of the pitch cycle Before each flight, exercise the propeller by changing pitch or feathering
	or	Governor pressure is too low	Refer to governor manufacturer's manual for instructions on adjusting relief pressure
	or	Governor does not have sufficient dampening	Refer to governor manufacturer's manual for instructions on providing sufficient dampening

Problem		Probable Cause	Remedy
E. Oil Leakage		Faulty O-ring seal between hub-half and cylinder	Disassemble the propeller, and inspect the O-rings and the surfaces they seal
Refer to Figure 1-6			Replace defective O-rings
	or	Faulty O-ring seal between pitch change rod and reverse adjustment sleeve	
	or	Faulty O-ring seal on pitch change rod plug	
	or	Faulty O-ring seal between engine flange and propeller mounting flange	

Problem		Probable Cause	Remedy
F. Grease Leakage Refer to Figure 1-6		NOTE: The blade retention split-bearing is the only source for grease leakage	
		Defective lubrication fitting	Replace defective lubrication fittings
	or	Missing lubrication fitting cap	Replace missing lubrication fitting caps
		NOTE: Wire the lubrication fitting with 0.020 inch (0.51 mm) minimum diameter stainless steel wire	Make two wraps around the caps small diameter of each lubrication fitting cap, and tighten the wire enough to just bury it below the rubber surface of the cap
	or	Faulty seal at blade socket in hub	Disassemble the propeller and replace faulty blade-to-hub seals; inspect sealing surfaces on hub and blade; repair/replace as necessary

Problem		Probable Cause	Remedy
G. End-Play in Blade		CAUTION: NO END-PLAY IN BLADE IS ALLOWED.	
		Buildup of manufacturing tolerances	Disassemble the propeller, and reset the preload
			Replace pitch change unit if necessary
	or	Blade retention bearing is worn	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures
	or	Blade alignment bearing is worn	Blade alignment bearing must be replaced

Problem	Probable Cause	Remedy
H. Fore-and-Aft Movement in Blade	CAUTION: NO FORE-AND-AFT BLADE MOVEMENT IS ALLOWED.	
	Buildup of manufacturing tolerances	Disassemble the propeller, and reset the preload Replace pitch change unit if necessary
or	Blade retention bearing is worn	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures
or	Blade alignment bearing is worn	Blade alignment bearing must be replaced
I. In-and-Out Movement in Blade	CAUTION: NO IN-AND-OUT BLADE MOVEMENT IS ALLOWED.	
	Buildup of manufacturing tolerances	Disassemble the propeller, and reset the preload Replace pitch change unit if necessary
or	Blade retention bearing is worn	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures
J. Excessive Radial Play in Blade (backlash)	Blade retention bearing is worn NOTE: Radial play of ±0.5° is allowed	Follow Blade Retention Split-Bearing Inspection and Replacement Procedures

Problem	Probable Cause	Remedy
K. Blades Not Tracking	Ground strike damage	Refer to Blade Specifications Manual No. 133-( ) for Repair Procedure
or	Blade face(s) are out of alignment	Refer to Blade Specifications Manual No. 133-( ) for Face Alignment Procedure NOTE: If blade tip angle is not correct according to specifications, reject the blade
L. Incorrect RPM	Static RPM is set too low NOTE: The governor has a high RPM stop as well as propeller low pitch stop	To determine whether the governor high RPM stop or the propeller low pitch stop is causing incorrect RPM, open the engine throttle and slowly move the governor control back and forth
	Either stop can limit maximum RPM	If the propeller reaches maximum RPM before the throttle reaches the governor stop, the propeller probably is limiting the maximum RPM Refer to governor manufacturer's manual for instructions on reducing blade angle to increase RPM
or	Static RPM is set too high	Refer to governor manufacturer's manual for instructions on readjusting the governor stop

2-3. Lightning Strike on Hub or Blade

A. Refer to the composite blade section in the back of this manual for guidance on repair of a blade which has been exposed to lightning strike.

B. In every confirmed case of lightning strike, the blade retention split-bearing and the blade alignment bearing are subject to damage, and both must be replaced.

C. In every lightning strike case, the flow of current has magnetized all of the steel parts.

1) Follow Replacement Procedure for the blade retention split-bearing.

2) Demagnetize all steel parts of the assembly.

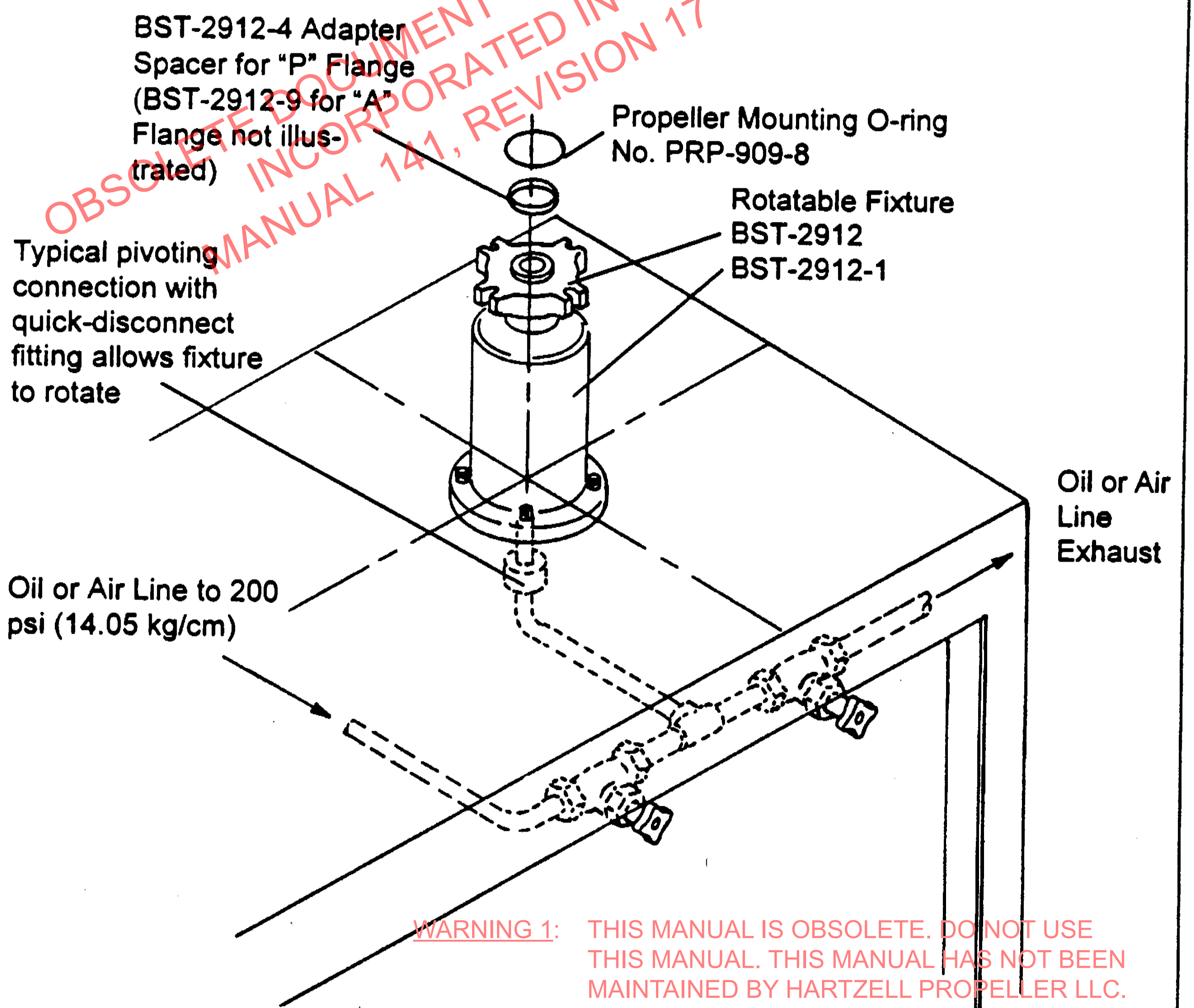
3) Follow Replacement Procedure for the blade alignment bearing.

3-1. Various special tools and fixtures are required for proper and efficient disassembly and reassembly of the Hartzell Series HC-E4P-5 propeller.

3-2. Most of these tools and fixtures are available from the factory. Order by Part Number and Description. Following is a list of tooling used for this particular propeller model, most of which are illustrated in this chapter.

Part Number	Description
57AST2877	AST-2877 Torquing Adapter for Propeller Mounting Bolt Wrench
57BST3045	BST-3045 Gear Puller for Bearing Inner Ring
57BST2912, -1	BST-2912, -1 Rotatable Mounting Fixture for Propeller Assembly Table
57BST2921	BST-2921 Wrench to Remove or Install Cylinder
57BST2922	BST-2922 Deep-Well Socket to Remove or Install Piston Nut
57CT1075	CT-1075 Riser Fixture for Bench-Top Protractor
57CST2800	CST-2800 Clamp for Blade Retention Split-Bearing
57CST2960	CST-2960 Hand-Held Protractor for Setting Blade Angles
9943SC038	SC038 Crowfoot Adapter (Snap-On)
9943SC042	SC042 Crowfoot Adapter (Snap-On)
9943SC048	SC048 Crowfoot Adapter (Snap-On)
9943SC060	SC060 Crowfoot Adapter (Snap-On)
791912276	1227-6 Extracting Tool (Heli-Coil)
791975524	7552-4 Prewinder for Hand Insertion of Heli-Coil
791990009	KHT 9000-9 Tool for Removing or Installing K-Sert Insert
	Tooling to Remove or Install Torq-Set Screw
57BST2901	Table Drawing
	170-1/4 Torque Set Screw Driver
	REC110 Easy Out G
	23/32 Bit

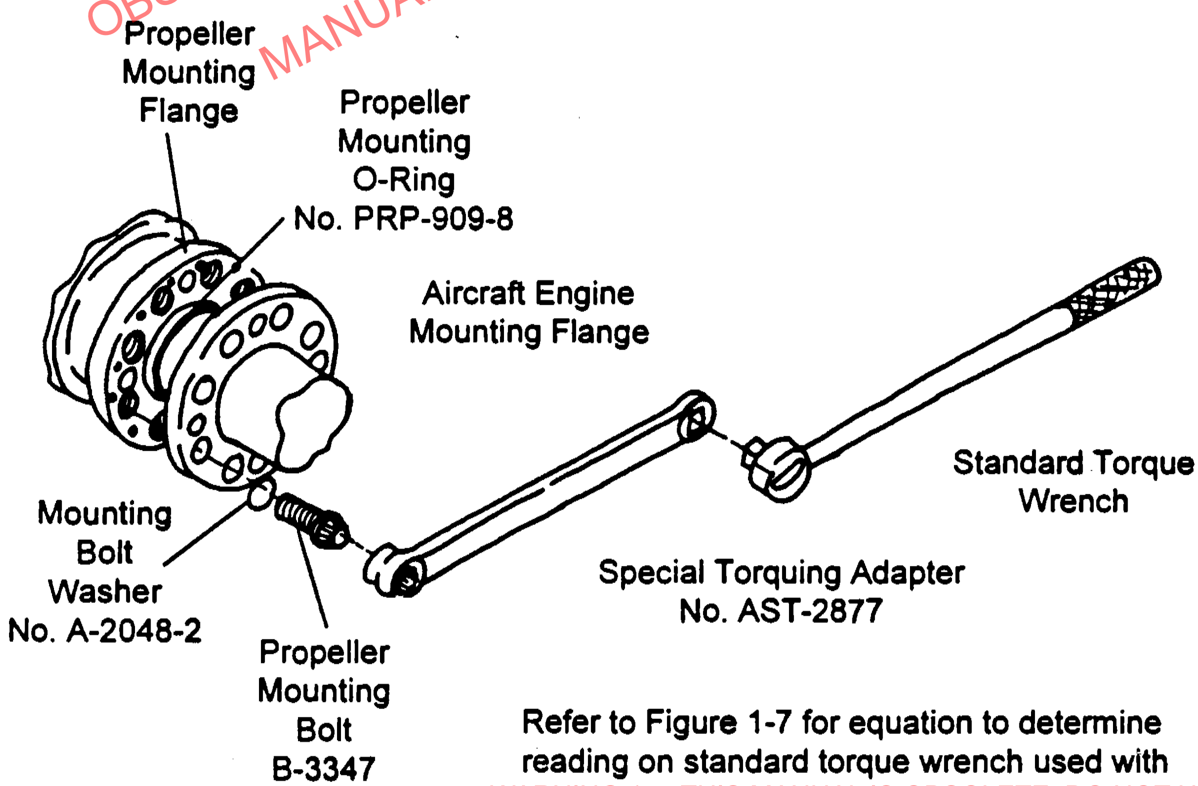
NOTE: Centerline of base of Rotatable Fixture establishes Station Reference for setting blade angle.



SPECIFICATIONS FOR RECOMMENDED TABLETOP
Tool Steel: 24 inches (60.96 cm) wide 72 inches (182.88 cm) long machined one side flat within 0.002 inch (0.051 mm) over entire surface anchored with lag screws at four corners of built-up timber structure

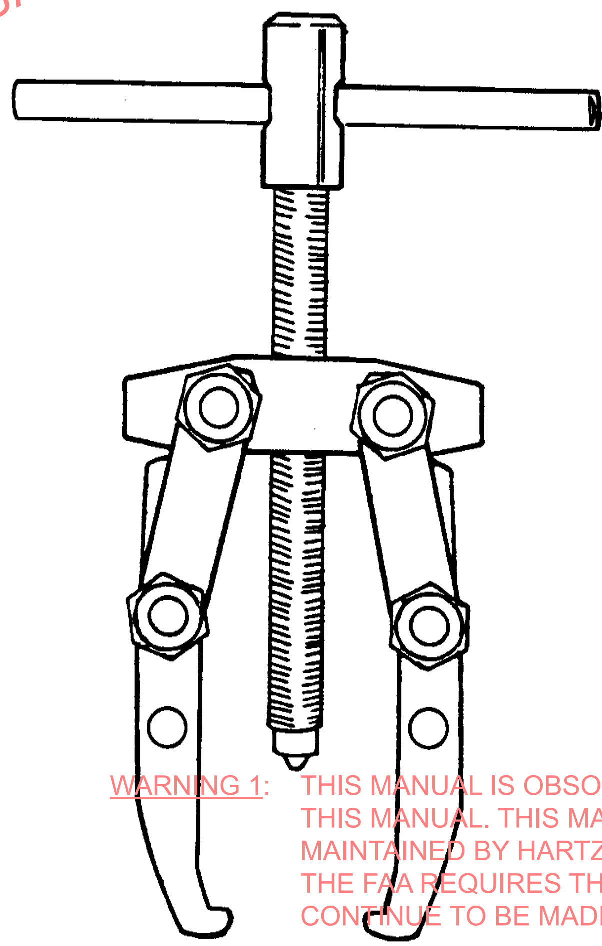
Table for Propeller
Disassembly and Reassembly
Figure 3-1

APS-988

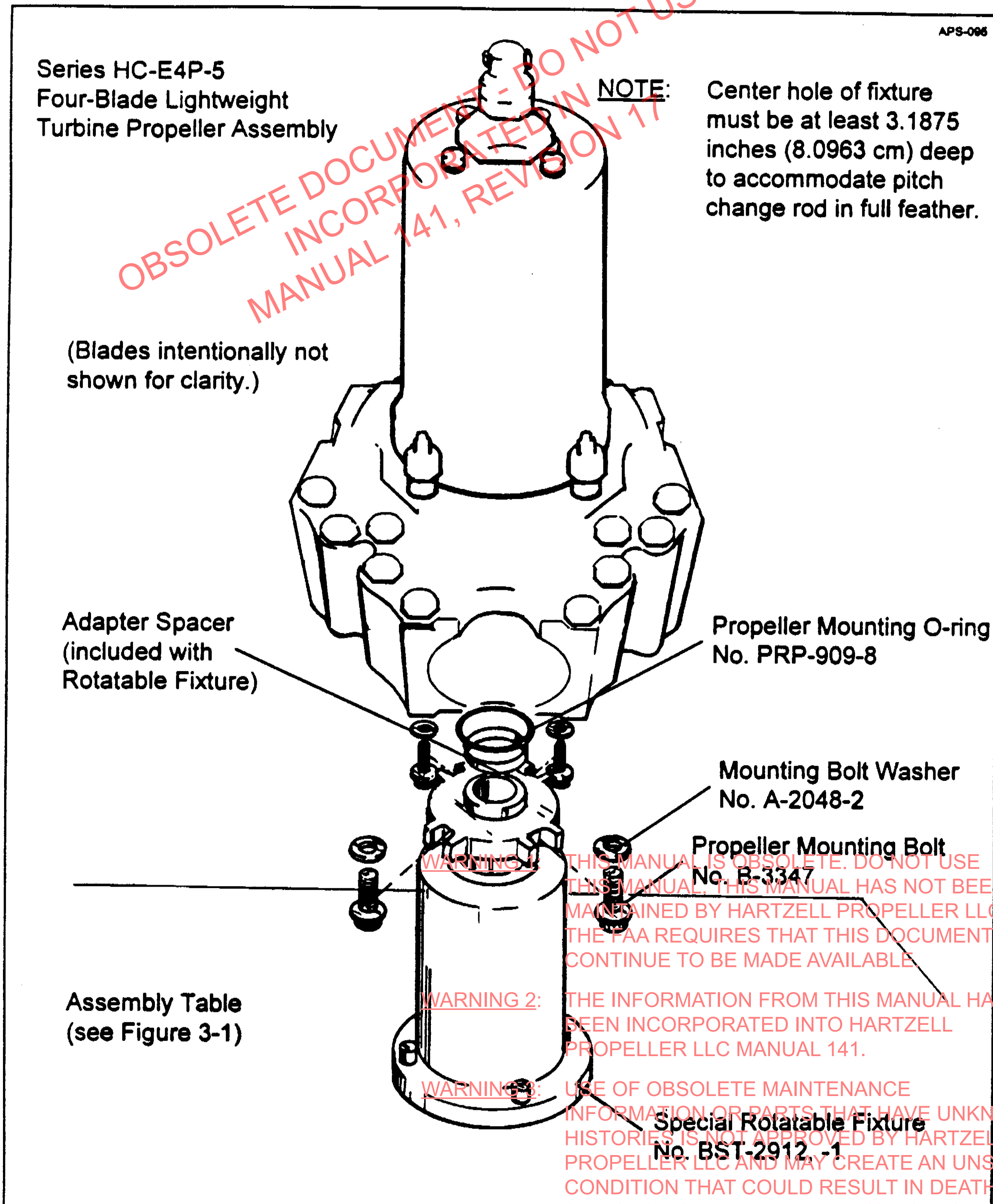


Refer to Figure 1-7 for equation to determine reading on standard torque wrench used with special torquing adapter AST-2877.

Torquing Adapter (AST-2877)
for Propeller Mounting Bolt Wrench
Figure 3-2



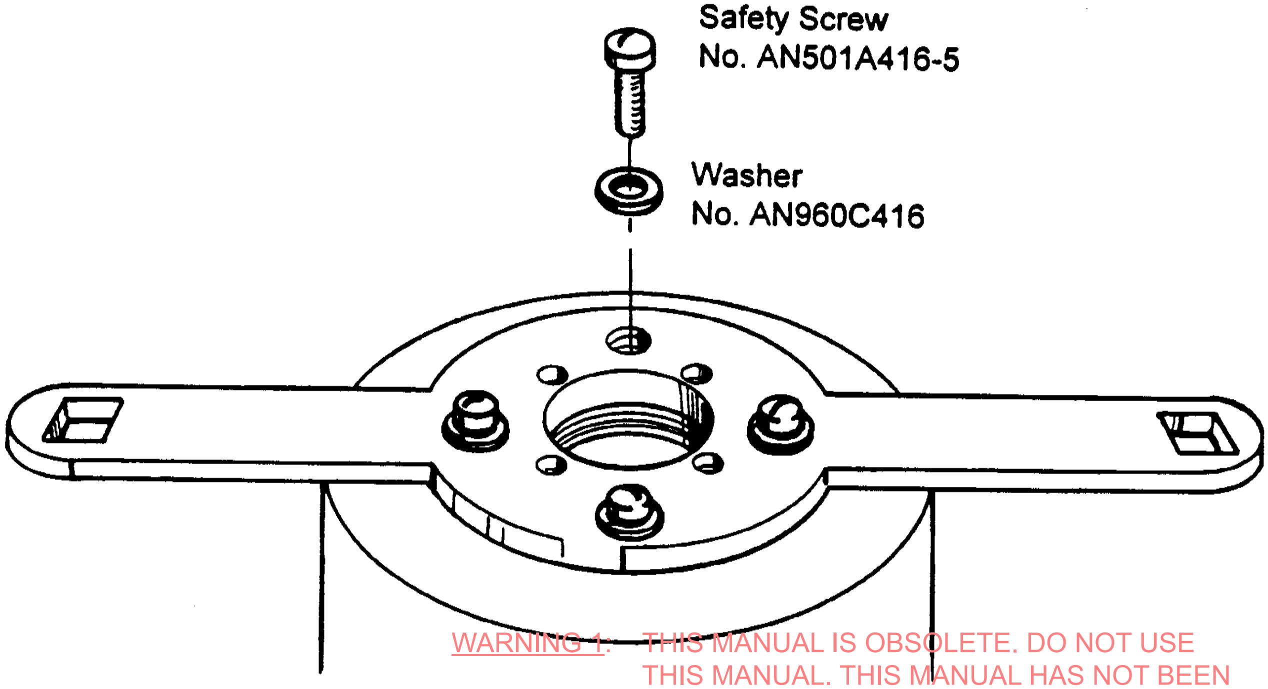
Gear Puller (BST-3045) for Bearing Inner Ring
Figure 3-3



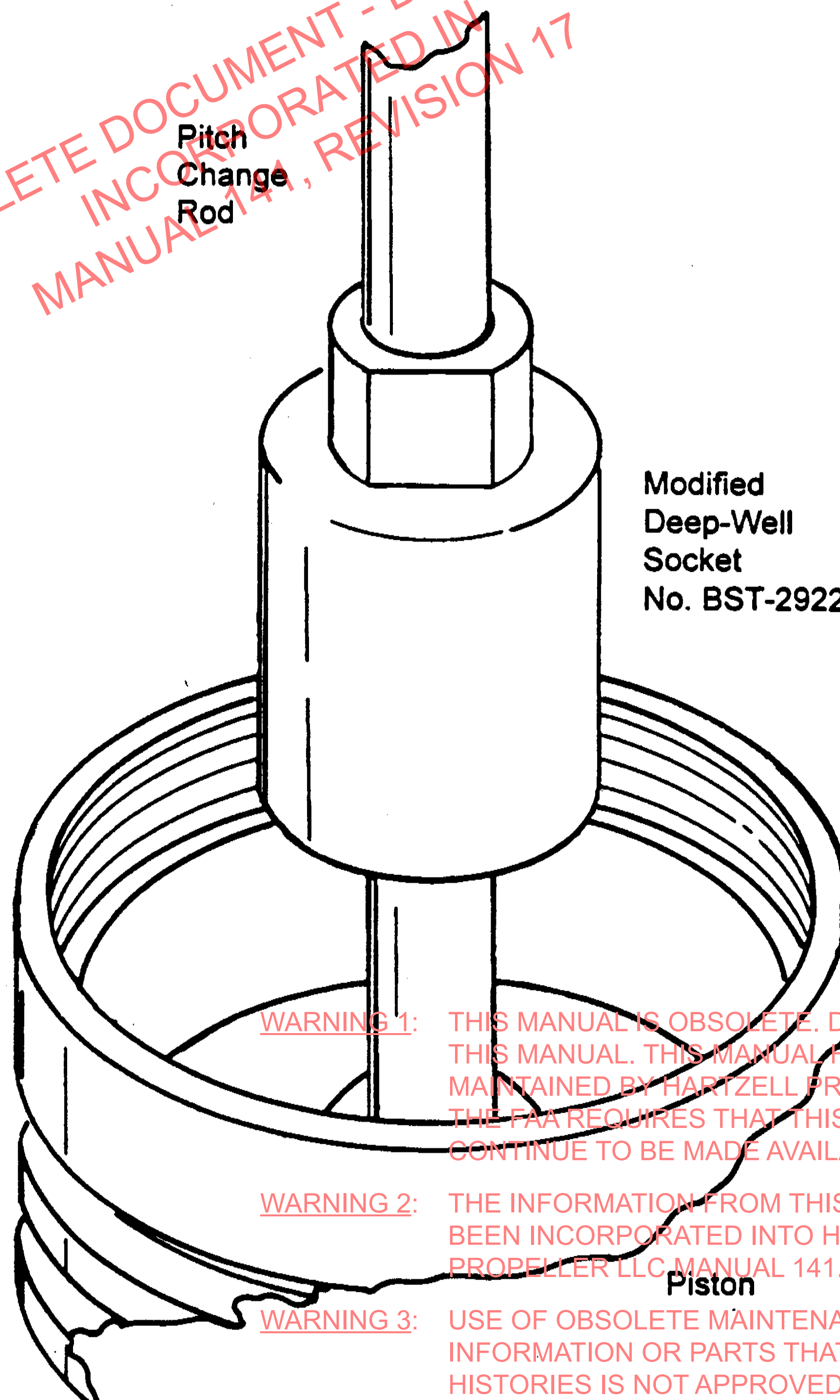
Rotatable Mounting Fixture (BST-2912, -1)
for Propeller Assembly Table
Figure 3-4

APS-175

NOTE: Tighten the four safety screws until they securely engage the cylinder threads.

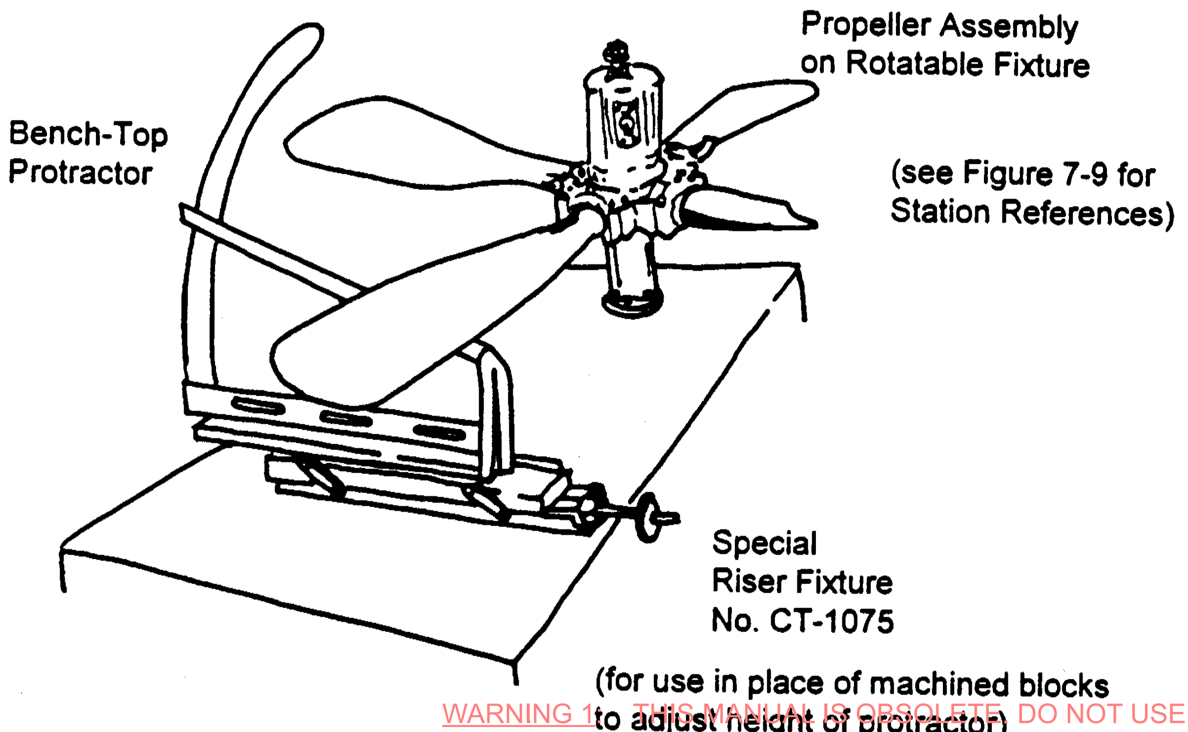


Wrench (BST-2921)
to Remove or Install Cylinder
Figure 3-5

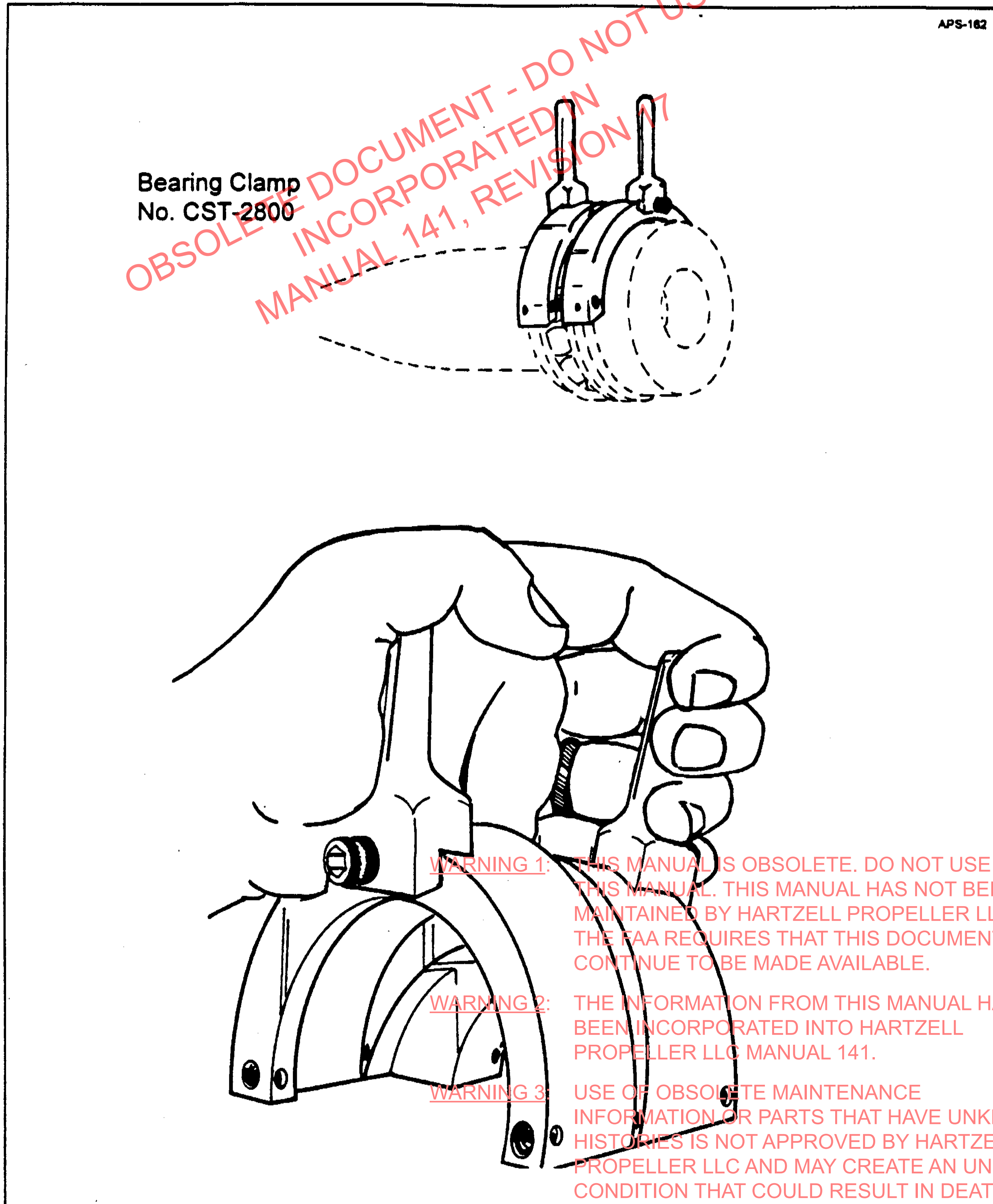


Deep-Well Socket (BST-2922) to Remove
or Install Piston Nut
Figure 3-6

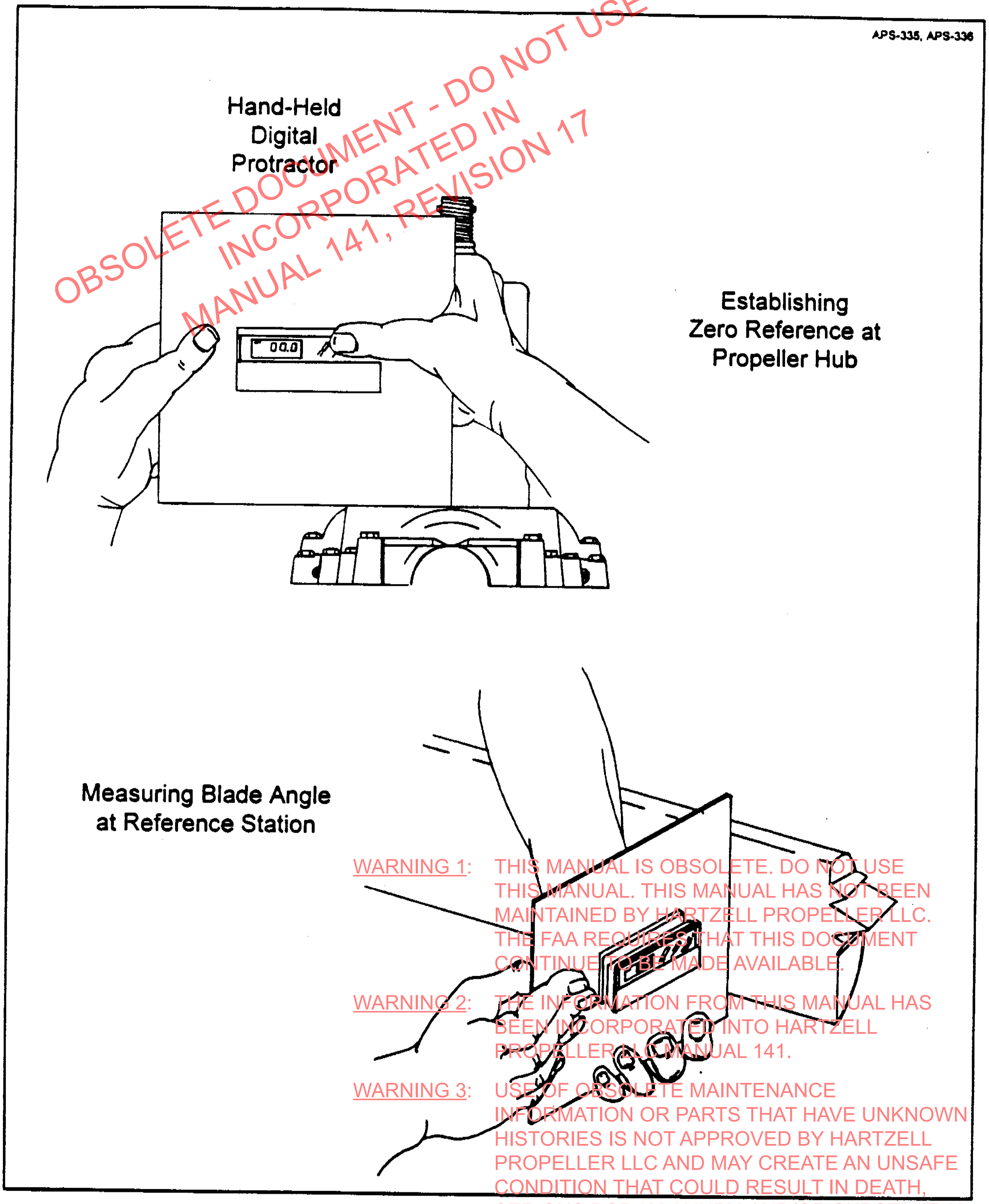
APS-973



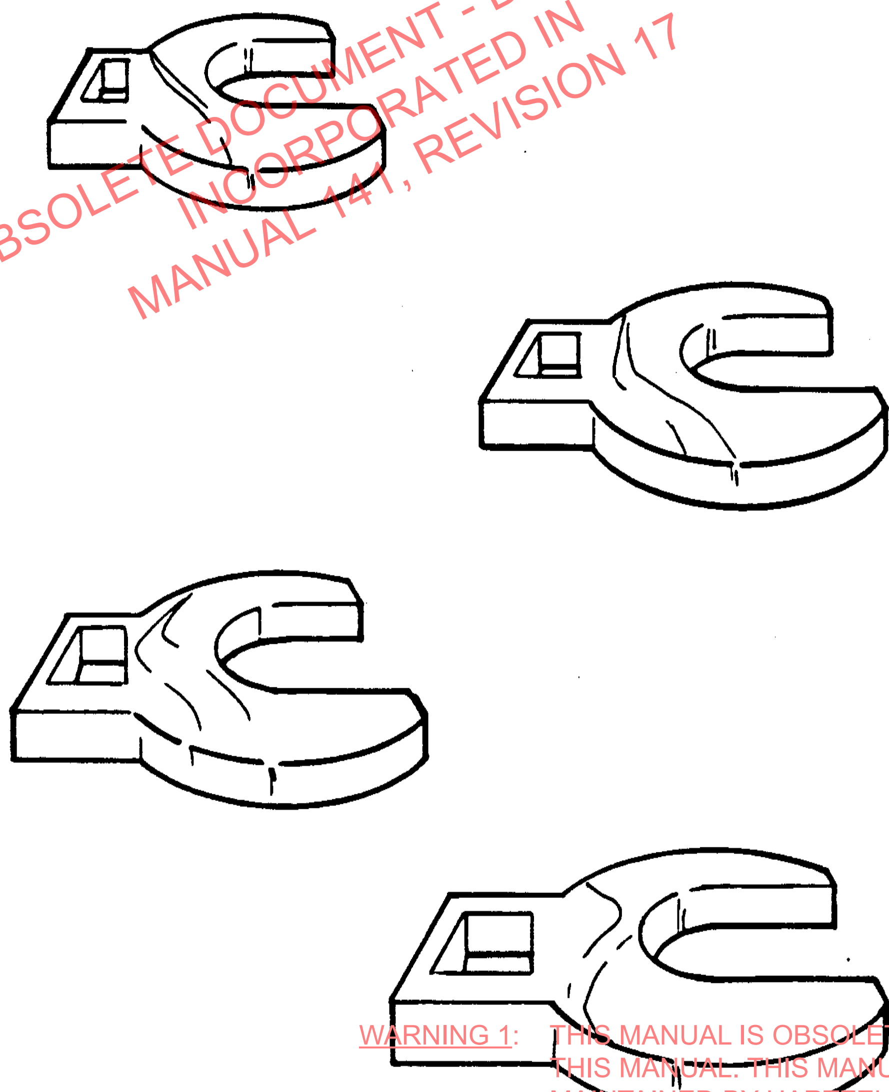
Riser Fixture (CT-1075)
for Bench-Top Protractor
Figure 3-7



Clamp (CST-2800)
for Blade Retention Split-Bearing
Figure 3-8

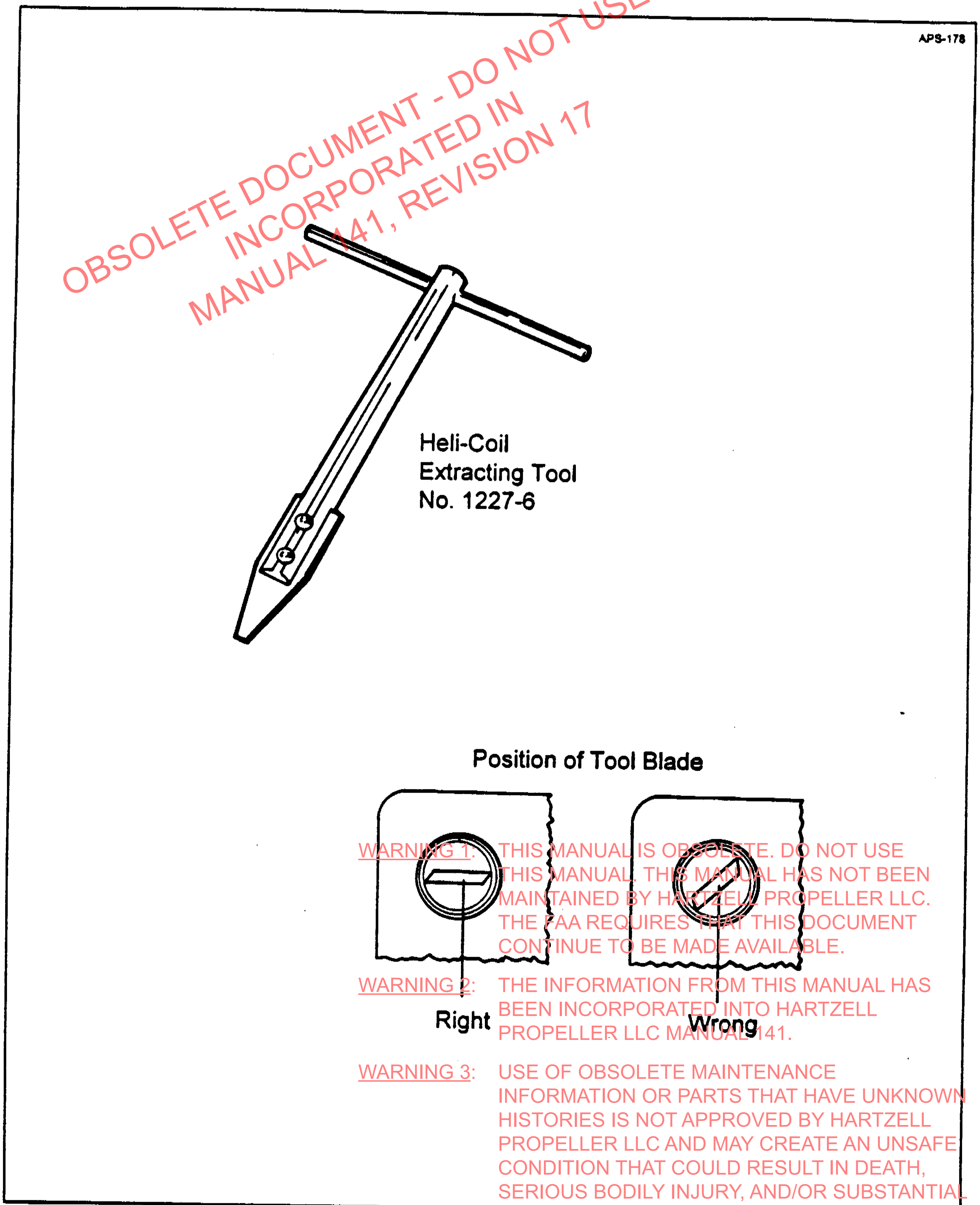


Hand-Held Protractor (C-2960)
for Setting Blade Angles
Figure 3-9

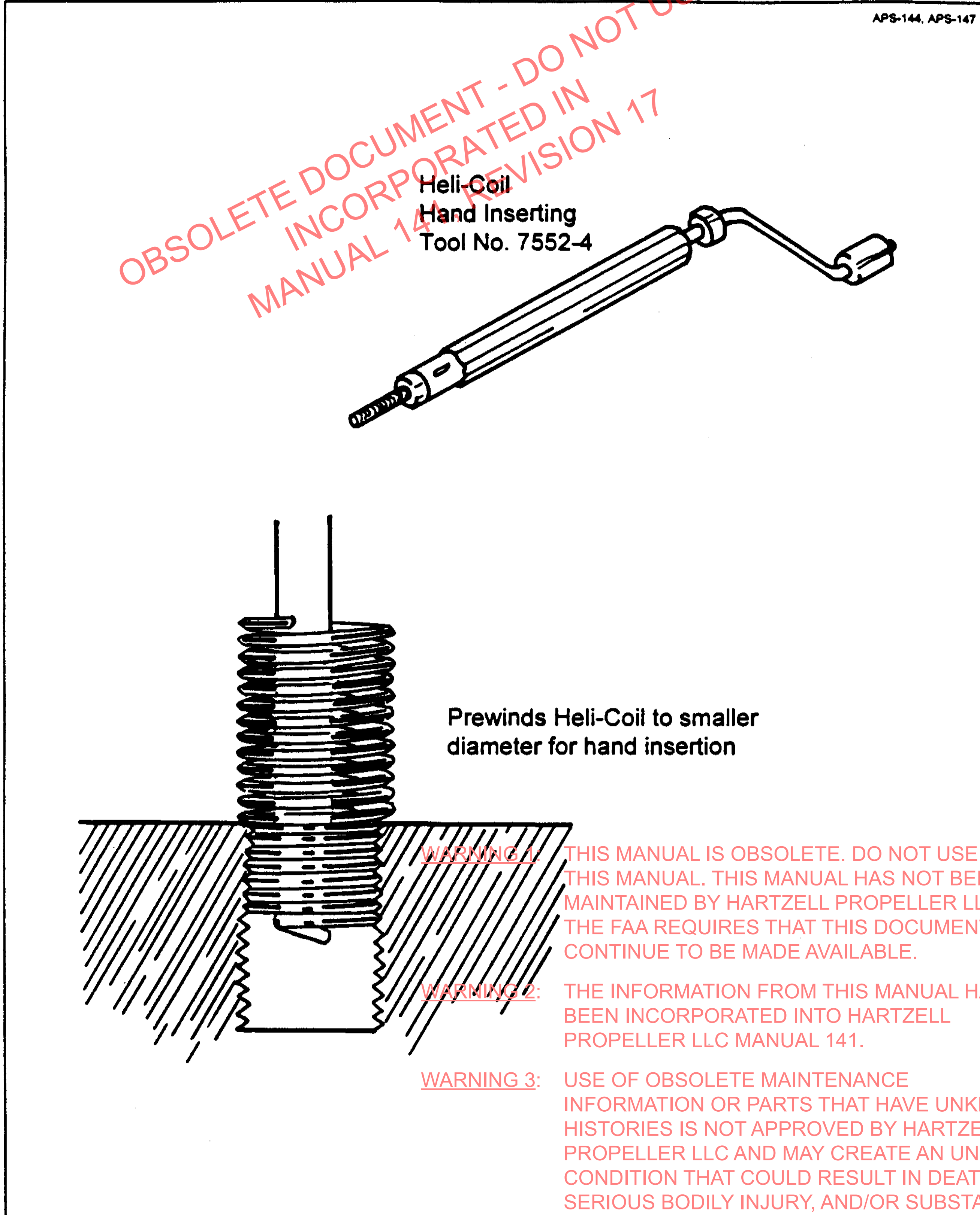


Crowfoot Adapter - 1.1875 inches - Snap-On No. SC038
Crowfoot Adapter - 1.3125 inches - Snap-On No. SC042
Crowfoot Adapter - 1.500 inches - Snap-On No. SC048 (two required)
Crowfoot Adapter - 1.875 inches - Snap-On No. SC060

Crowfoot Adapters for Special Tooling
Figure 3-10



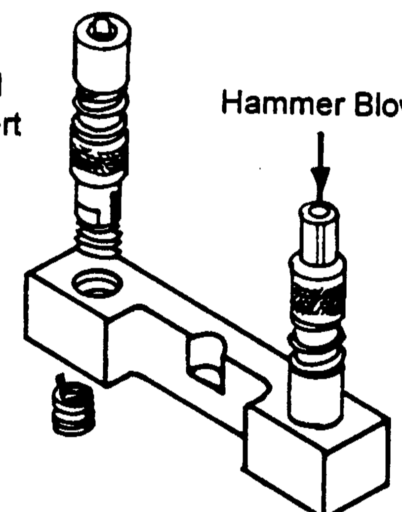
Extracting Tool
Figure 3-11



Prewinder for Hand Insertion of Heli-Coil
Figure 3-12

APS-147

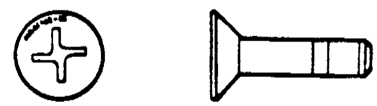
NOTE: Tool may be used with a hammer or held in an arbor press.



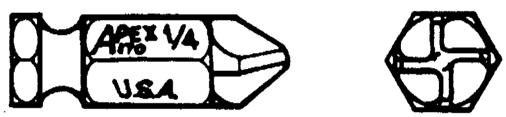
Tool (KHT 9000-9) for Removing or Installing
K-Sert Insert
Figure 3-13

APS-145, APS-146

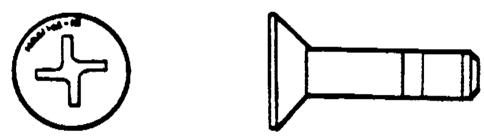
SPECIAL BIT for Pickup Plate Screw
No. 212-8



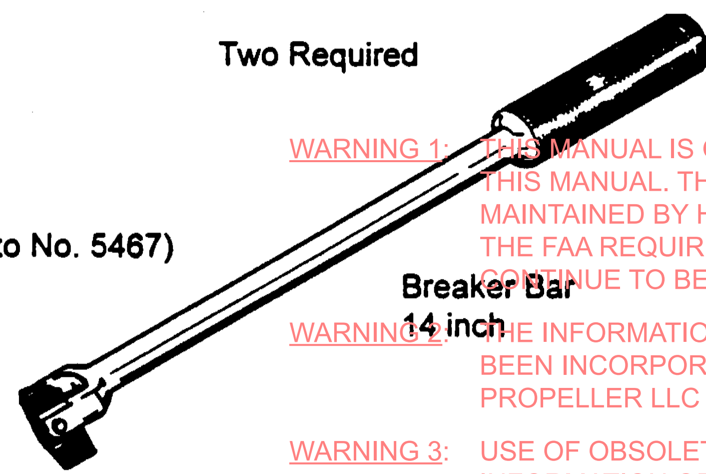
PICKUP PLATE TORQ-SET SCREW
Part No. NAS1162-2B



SPECIAL BIT for Pitch Change Unit Screw
No. 170-1/4



PITCH CHANGE UNIT TORQ-SET SCREW
Part No. NAS1164-3B



Special Tooling to Remove or Install Torq-Set Screws
Figure 3-14

4-1. Removing the Propeller Assembly from the Aircraft Engine

NOTE: The propeller blades should be reassembled in the same sequence they are in at disassembly. With crayon or soft pencil, number the blades "one" through "four" counterclockwise from the serial number of the propeller hub unit.

A. With a suitable sling and mobile hoist, proceed as follows to disengage the propeller assembly from the aircraft engine:

1) Spinner Disassembly

a) Remove and discard the screws (4) and fibre washers (5) that attach the spinner dome (7) to the engine-side bulkhead unit (6).

NOTE: If the propeller is equipped with a de-icer system, follow instructions in the appropriate manufacturer's manual for removal of the slip ring and other components.

b) Remove the spinner dome and hoop unit (79), and store them with care.

2) Remove safety wire and discard mounting bolts (1) and washers (2).

3) Carefully remove the propeller assembly from the aircraft engine.

4) Discard the propeller mounting O-ring (3).

4-2. Disassembling the Propeller

CAUTION: BE SURE THE PROPELLER IS IN FEATHERED POSITION BEFORE BEGINNING DISASSEMBLY PROCEDURES.

NOTE: Perform appropriate inspection procedures before beginning to disassemble the propeller.

A. Proceed as follows to disassemble the Hartzell Series HC-E4P-5 Lightweight Turbine Propeller:

1) Mount the propeller assembly on the rotatable fixture on the assembly table, as shown in Figure 3-4.

2) Counterweight Clamp Removal

Refer to the "Removal of the Counterweight Clamps from E11990K" in the Composite Blade Overhaul Procedures section.

3) Hydraulic System and Pitch Adjustment Unit Disassembly

a) Remove and discard the plug safety bolt (76) and plug safety nut (77).

b) Apply sufficient air or oil pressure to move the smaller jam nuts (55) off the reverse adjustment sleeve (59).

c) Remove and discard the two jam nuts (55) from the pitch change rod (40).

d) Release the air (or oil) pressure from the propeller.

e) Clip safety wire, and then remove and discard safety screw (57) and washer (58).

f) Remove and discard the larger jam nut (56).

<u>WARNING</u>: THE FEATHERING SPRING IS PRELOADED TO APPROXIMATELY 800 POUNDS (362.4 KG) FORCE.

g) Turn the reverse adjustment sleeve counterclockwise to back the sleeve out of the cylinder (39) and fully compress the feathering spring (10) into the cylinder.

<u>NOTE</u>: To ensure full compression of feathering spring, rotate blades by hand out of feather. There should be some movement if the feathering spring is fully compressed. If the blades cannot be moved, reinstall the feathering adjust nut and feathering adjust jam nut approximately $^1/_4$ inch to $^1/_2$ inch (6.35 to 12.70 mm) above fully unthreaded reverse adjustment sleeve as a safety precaution as shown in Figure 4-1.

h) As shown in Figure 3-5, use four safety screws and washers to fasten the special wrench to the cylinder.

<u>CAUTION</u>: UNSCREW THE CYLINDER SLOWLY AND CAREFULLY SO AS NOT TO DAMAGE THE THREADS.

i) Carefully unscrew the cylinder from the cylinder-half of the split-hub unit (67).

j) Remove the special wrench from the cylinder, and back the reverse adjustment sleeve out of the cylinder.

<u>NOTE</u>: The sleeve bushing (60) should remain in the sleeve.

k) Use the special tool, Figure 3-6, to remove and discard the self-locking piston nut (38).

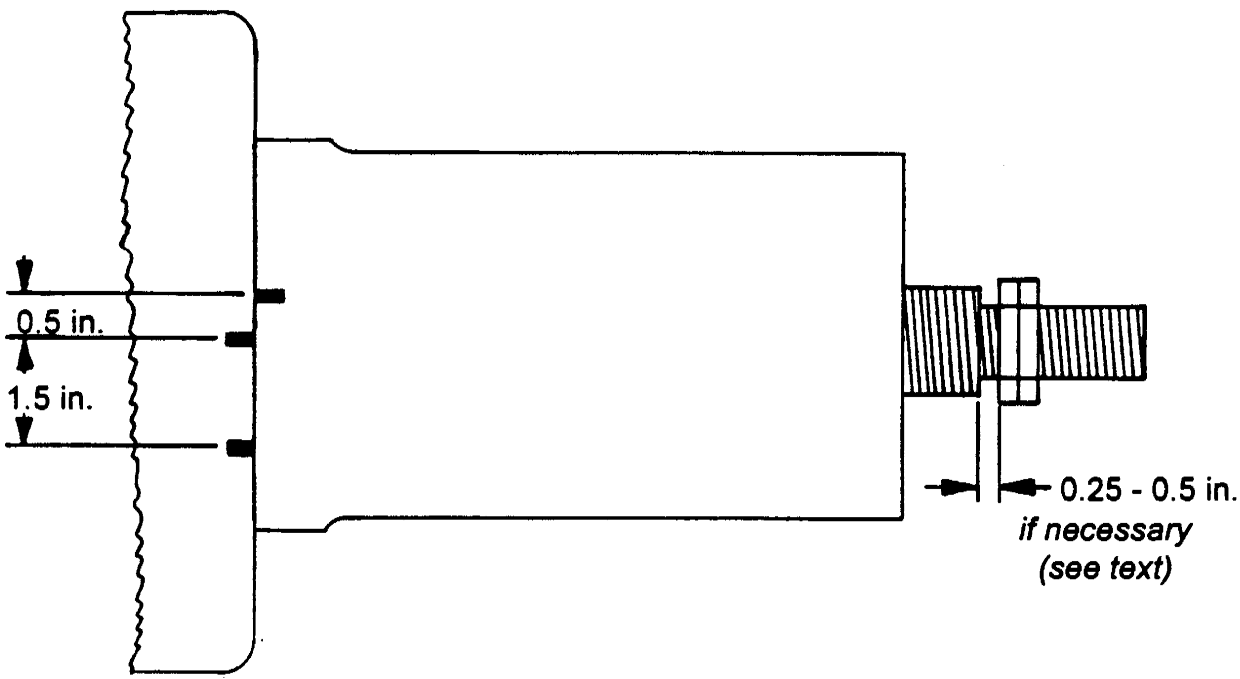
l) Remove and discard the felt dust seal (35) and the large piston O-ring (34).

m) Set aside the piston unit after removal for start lock disassembly.

n) Discard the small piston O-ring (37) and the cylinder-half hub shoulder O-ring (33).

o) Use a crowfoot adapter (Figure 3-10) on flat surfaces of pitch change rod to unscrew the rod from the fork (44).

p) Remove the pitch change rod from the split-hub unit.



Metric Equivalency

0.25 in.	=	6.35 mm
0.50 in.	=	12.70 mm
1.50 in.	=	3.81 cm

Cylinder Removal
Figure 4-1

4) Start Lock Disassembly

a) Discard the socket head cap screws (49) and remove the start lock cover (48).

b) Discard clevis pin (78), cotter pin, start lock spring (51) and socket set screws (47).

c) Remove the start lock housing (50) and discard if aluminum. Steel housings can be identified by magnetic test and/or presence of cadmium plating and may be re-used after thorough inspection (refer to Chapter 5).

NOTE: Aluminum start lock housings are to be replaced with new steel housings.

5) Split-Hub Unit Disassembly

a) Discard all hex head bolts (61) and (62), washers (63), and self-locking nuts (64) from the split-hub unit (67).

b) With a soft mallet, lightly tap the end of one blade to loosen the halves of the split-hub.

NOTE: If the propeller is equipped with a de-icer system, tap the blade in a place outside the boot area.

CAUTION: DO NOT USE A SCREWDRIVER OR OTHER SHARP TOOL IN AN ATTEMPT TO PRY HUB HALVES APART.

c) Use a plastic wedge, or similar tool, to gently pry the hub halves apart.

d) Remove the cylinder-side half of the split-hub unit and discard the engine-half hub O-ring (36).

6) Blade Bearing System Disassembly

NOTE: Each blade should be reinstalled in the hub socket from which it is removed. With a crayon or soft pencil, number each blade and its matching hub socket "one" through "four," beginning with the first blade counterclockwise from the hub serial number.

NOTE: The propeller assembly should be in low pitch position.

a) With the special hand clamp, Figure 3-6, in position over the preload and one-half of the blade retention split-bearing (23), remove Blade Number One from its hub socket.

NOTE: As necessary to dislodge a blade assembly, tap the bottom of the blade with a soft mallet. If the blade is equipped with a de-icer system, do not tap in the boot area.

b) Catch the bearing balls and bearing race halves in a suitable container—such as an open-weave basket which can be used in the cleaning procedure.

c) Store the blade—base up—in a suitable rack.

d) Repeat this procedure for the other three blades.

7) Hydraulic System Disassembly (resumed)

a) Remove the fork unit and take off the fork bumpers (45). Discard the buttons (46) and cylinder-half hub O-ring (32).

b) Disconnect de-icer system components if propeller is so equipped.

c) Discard the spinner mounting bolts (73).

NOTE: This allows the engine-side bulkhead unit (6) to drop clear of the engine-half of the hub which remains on the rotatable fixture.

8) Blade Bearing System Disassembly (resumed)

a) Remove the preload plate unit from Blade Number One.

b) Discard the jam nut (29) and set screw (31).

c) Use small gear puller, Figure 3-3, to remove and discard the inner bearing ring (30).

d) Use driver with special bit, Figure 3-14, to loosen, remove and discard the Torq-Set screw (20).

e) Remove the blade pitch change knob (17), dowel pin (21), bearing retention ring (25) and the other race-halves of the blade retention split-bearing (23).

f) Discard the ball spacer (24), O-ring (22), needle roller bearing (27), and blade plug (26).

g) Repeat the disassembly procedures for each of the other three preload plate units.

9) Split-Hub Unit Disassembly (resumed)

Remove the engine-half of the split-hub from the rotatable fixture, and proceed as follows to disassemble the hub unit:

a) As shown in Figure 4-2, use a standard drill and E-Z Out type of tool to remove and discard the K-Sert inserts (70).

b) Use the extracting tool, Figure 3-11, to remove and discard the Heli-Coil inserts (69).

1 Apply the tool to the insert.

NOTE: Refer to Figure 3-11 for illustration of right and wrong position of tool blade.

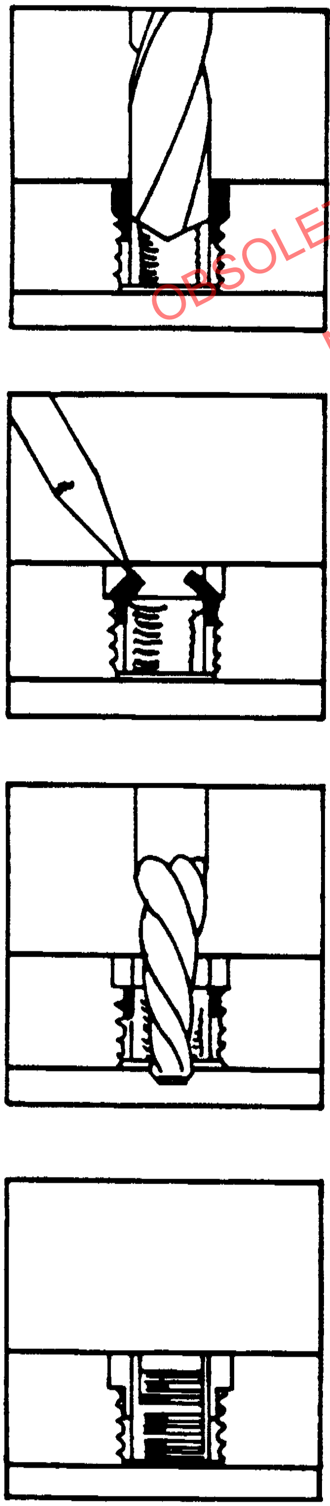
2 Strike the head of the tool a light blow.

3 Turn the tool counterclockwise while maintaining steady downward pressure on it until the Heli-Coil is extracted.

c) Discard the guide bushing (68), all lubrication fittings (65) and their caps (66).

NOTE: Record the serial number and model number of the hub unit so the numbers can be restored to the split-hub following rework procedures. (Refer to Figure 6-11.)

APS-147



1 Drill, with a standard drill just large enough to expose the insert keys.

2 Deflect keys inward and break them off.

3 Unscrew insert with an E-Z Out type of tool.

4 A same-size insert can be reinstalled in the original hole.

Procedure for Removing K-Sert Insert
Figure 4-2

Item No.	Part Number	Description	Specified Dimension inches max	min	Replace if Exceeds inches max	min
-9	57B0442	B-442 Retainer, Feathering Spring, O.D.	2.285	2.275	—	2.265
-17	57B0464-1	B-464-1 Pitch Change Bracket, bearing surface	0.6539	0.6531	—	0.6527
-23	57C0792	C-792 Blade Bearing, depth of pitting (or other damage	—	—	0.002	—
-30	57A1272	Bearing Inner Ring	—	—	—	0.0005
-39	57D0488	D-488 Cylinder, I.D.	5.130	5.127	5.130	—
-40	57D0494	D-494 Pitch Change Rod Minimum O.D. 3 locations	0.810	0.808	—	0.806
-41	57C0492	C-492 Piston, O.D.	5.123	5.122	—	5.119
-44	57D0495	D-495 Fork, width of channel	1.256	1.253	1.266	—
		Runout	0.004	—	0.006	0.006
-50	57B0444-1	B-444-1 Start Lock Housing	—	—	0.0005	—
-60	57A0441	A-441 Bushing, Reverse Adjustment Sleeve, I.D.	1.003	1.001	1.004	—
-67	57D0389-1	D-389-1 Split Hub Unit, bolt holes, O.D.	—	—	3.583	—
		Engine Half, bore I.D.	0.813	0.812	0.815	—
		Cylinder Half, bore I.D.	0.938	0.937	0.940	—
		Blade O-ring groove with hub halves together	3.729	3.724	3.735	—
	57B0497	B-497 Piston Unit, O.D.	5.1230	5.1220	—	5.1210

WARNING 1: THIS MANUAL IS OBSOLETE. DO NOT USE THIS MANUAL. THIS MANUAL HAS NOT BEEN MAINTAINED BY HARTZELL PROPELLER LLC. THE FAA REQUIRES THAT THIS DOCUMENT CONTINUE TO BE MADE AVAILABLE.

WARNING 2: THE INFORMATION FROM THIS MANUAL HAS BEEN INCORPORATED INTO HARTZELL PROPELLER LLC MANUAL 141.

WARNING 3: USE OF OBSOLETE MAINTENANCE INFORMATION OR PARTS THAT HAVE UNKNOWN HISTORIES IS NOT APPROVED BY HARTZELL PROPELLER LLC AND MAY CREATE AN UNSAFE CONDITION THAT COULD RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR SUBSTANTIAL PROPERTY DAMAGE.

Allowable Wear Limits Table
Figure 4-3

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Page

5-1. Wear Limits to be Observed

A. During cleaning and inspection procedures, observe the wear limits for specific parts as specified in the Allowable Wear Limits Table, Figure 4-3.

B. Make the following specific checks for problems that may require correction:

1) Bench Check on Blades

a) Check for pitting on blade retention split-bearing (Figure 5-4). Follow Replacement Procedure if pitting in races is deeper than 0.002 inch (0.051 mm).

b) Check blade balance. Follow Static Balancing Procedures for adding balance weight(s) to the blade assembly if necessary.

c) Check blade track (Figure 7-10).

NOTE: Height at tip of each blade can vary within ± 0.0625 inch (1.5875 mm).

d) Check end-play in blade. There should be no end-play when the blade is pushed into the hub and pulled back.

e) Gently push and pull the blades in the direction of fore and aft (as propeller is mounted on aircraft). There should be no fore and aft movement if blade is properly pre-loaded.

f) Check blade pitch settings. Maintain the following maximum limits:

1 Between Blades at Low Pitch = ± 0.20°

2 From Specified at Reverse = ± 0.50°

3 From Specified at Feather = ± 0.50°

5-2. General Procedures for Cleaning Parts

CAUTION: ANY SOLVENT USED IN CLEANING PROCEDURES MUST NEITHER SOFTEN NOR DESTROY THE BOND INTEGRITY BETWEEN CHEMICALLY ATTACHED PARTS.

CAUTION: DO NOT LEAVE PARTS IN A SOLVENT FOR AN EXTENDED PERIOD OF TIME.

A. Using the approved solvent, remove dirt and grease from all metal parts after disassembly of the propeller and allow parts to dry after cleaning.

NOTE: Vapor degreasing is permissible provided temperature is closely controlled.

B. Apply the approved rust preventive compound to all steel parts.

C. Store parts in a clean, dry place until time for Inspection/Rework Procedures prior to reassembly.

5-3. Specific Cleaning Procedures

Observe the following specific procedures for cleaning certain parts:

A. Cleaning Steel Parts for Magnetic Particle Inspection

1) Steel parts must be cleaned of dirt, grease, and scale to prevent obscure readings, false indications or excessive contamination of the inspection medium. Follow the General Procedures for Cleaning Parts in Paragraph 5-2.

B. Cleaning Steel Parts after Magnetic Particle Inspection

1) The magnetic particle medium must be used to clean off parts as quickly as possible after inspection because the dry concentrate powder used in the process is mildly corrosive when allowed to remain on a steel part for any length of time.

2) Lengthy exposure to the dry concentrate powder used in this process will permanently stain the cadmium or chrome plating on parts. Follow the General Process for Cleaning Parts in Paragraph 5-2.

C. Cleaning Steel Parts for Re-Cadmium Plating Procedures

Certain steel parts must be re-cadmium plated at overhaul.

1) Refer to the Re-Cadmium Plating Procedure in Chapter 6 for full instructions.

CAUTION: OLD CADMIUM PLATING MUST BE STRIPPED FROM A PART BEFORE IT IS RE-PLATED.

2) A soak-type alkaline solution should be used to pre-clean a part before stripping. Temperature of a solution must be maintained between 180° F(82° C) and 205° F (96° C).

3) Depending on how oily or dirty it is, the part must remain in the soak-type alkaline solution for two (2) to five (5) minutes.

4) An alkaline cleaner energized by reverse DC power may be used to clean steel parts prior to stripping them for re-plating.

a) If an energized solution is used for pre-cleaning steel parts, the temperature of the solution must be maintained within specified limits.

b) Depending on how oily or dirty it is, the part must remain in the energized solution for five (5) to fifteen (15) minutes.

5) If the steel part is not very oily or dirty, and if the soaking time can be prolonged, a chlorinated solvent may be used for the pre-cleaning procedure.

5-4. General Inspection Procedures

A. Inspect all wearing parts to determine whether or not they meet the specifications in the Allowable Wear Limits Table, Figure 4-3.

NOTE: The following parts found not airworthy must be retired in accordance with the Mandatory Parts Retirement Procedures in Chapter 1: hub, cylinder, pitch change rod, fork, blade, counterweight clamp, and spinner bulkhead.

B. Visually inspect all bearing surfaces and wear surfaces for pitting, scratches, gouges, depressions and/or distortions.

C. Follow approved procedures for magnetic particle inspection of steel parts for cracks.

D. Use the approved fluorescent dye penetrant method to inspect aluminum parts for cracks or defects.

5-5. Magnetic Particle Inspection Procedures

A. Acceptable Procedures and Personnel

1) Magnetic Particle Inspection shall be performed in accordance with a procedure which meets the requirements of MIL-STD-1949 or with the Magnetic Particle Procedure described below.

2) The Wet Continuous Magnetic Particle Method is the only method approved by Hartzell Propeller Inc.

3) Repair station specialist and other authorized personnel performing Magnetic Particle Method of Inspection must be properly certified. Refer to FAR Part 145 for description of personnel requirements.

B. General Requirements

1) In solid parts, the direction of the magnetizing field should be perpendicular to the major direction of the potential or suspected defect area.

2) Assure full coverage by applying the current in at least two directions—as nearly as possible at right angles to each other.

3) On very complicated configurations, several angles of magnetism may be required.

C. Circular Magnetization (Figure 5-1)

1) In circular magnetization, where the current is passed through a part which is mounted between the heads, the transformer taps should be set to produce 300 to 800 amperes per inch (25.4 mm) of diameter.

NOTE: When copper braid conductor pads are used for circular magnetization, the contact must be tight and the current must be carefully controlled to prevent arcing between the head pads and the part.

2) If the part has diameters of different dimensions, the current used to magnetize the larger diameter(s) must not overheat the smaller diameter(s).

3) For magnetic inspection of hollow parts, place a copper or aluminum central conductor rod in the hollow area.

NOTE: The conductor rod should be as close to the full size of the bore as possible.

4) The magnetizing current for hollow parts should be approximately 500 amperes per inch (2.54 cm) of central conductor rod diameter.

D. Longitudinal Magnetization (Figure 5-1)

1) Longitudinal magnetization is accomplished by passing a current through a coil which surrounds the part. This produces a magnetic field parallel to the axis of the coil.

2) Magnitizing current shall be within ±10% of the ampere-turns value determined as follows:

$$NI = \frac{45,000}{L/D}$$

Where:

NI = Ampere-turns (K)

L = Length of part

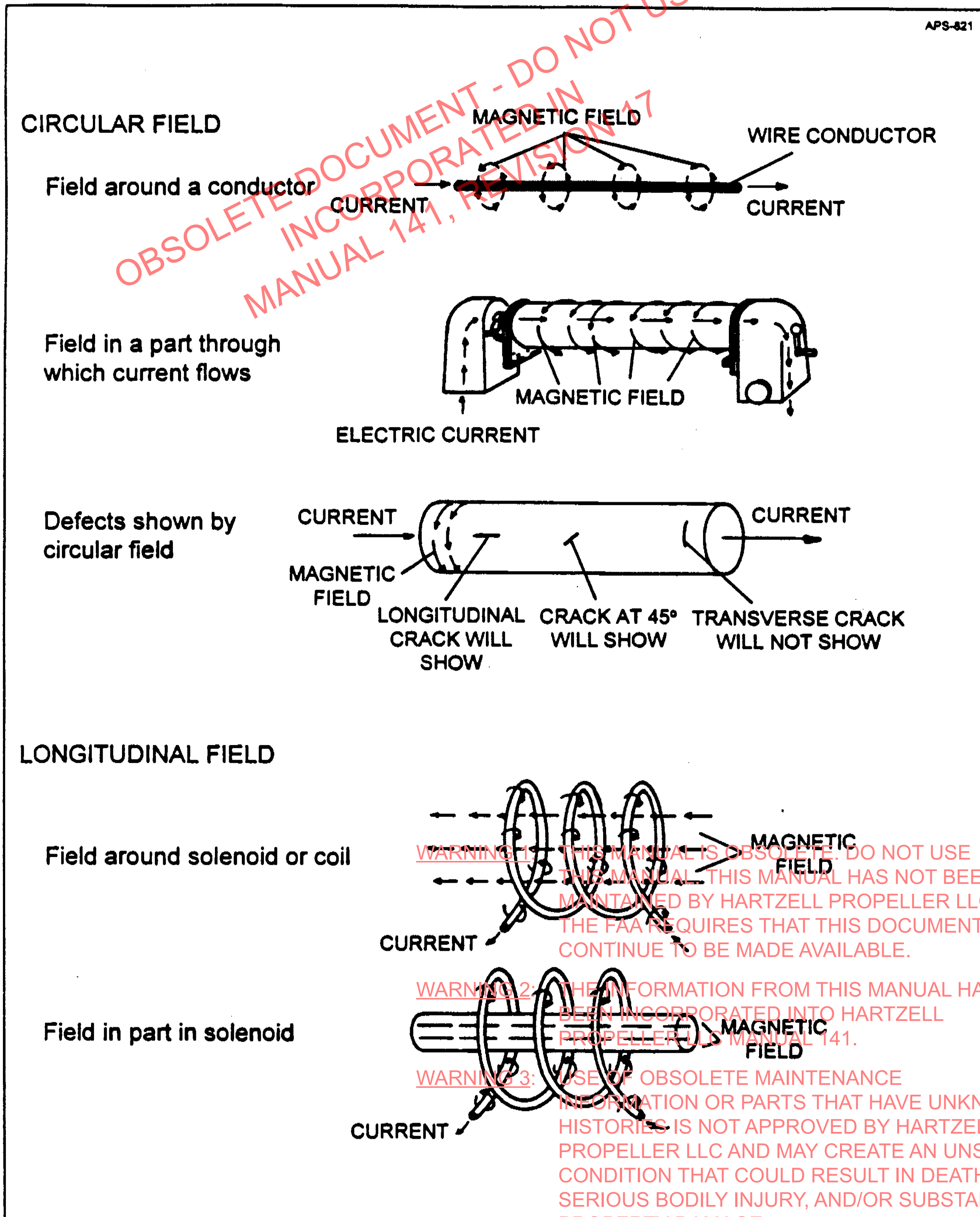
D = Diameter in same units or length

3) Example

A part 18 inches (45.72 cm) long x 6 inches (15.24 cm) diameter has a ratio of 4 to 3. Therefore,

$$\frac{45,000}{3} = 15,000 \text{ Ampere-turns}$$

Current required to obtain the necessary magnetizing field strength shall be determined by dividing the ampere-turns by the number of turns in the coil, normally 5 as stamped on the coil. For 15,000 ampere-turns, divide by the number of coils (5) which gives 3,000 amperes (meter reading).



Producing Magnetic Field for Steel Parts Inspection
Figure 5-1

4) The largest dimension of the part being inspected must be parallel to the axis of the coil to produce proper magnetism of the part.

5) The cross-sectional area of the part being magnetized must fill at least 25 per cent of the total enclosed area of the coil.

E. Wet Magnetic Particle Application

1) Fluorescent particles suspended in a liquid vehicle at the required concentration shall be applied by gently spraying or flowing the suspension over the area to be inspected.

2) Proper sequencing and timing of part magnetization and application of particle suspension are required to obtain proper formation and retention of indications.

3) Care should be taken not to overheat the part.

F. Process Requirements

Final magnetic particle inspection must be performed after such operations as machining, grinding, straightening, acid pickling or plating, but before applicaiton of paint or solid film lubricant.

NOTE: Refer to Hartzell Process Manual H-S-7 for specific instructions on Magnetic Particle Inspection Preparation and Procedures.

1) Preparation of the Medium

Concentration:

1/4 ounce (7 grams) No. 14A Magnaglo dry concentrate

one gallon (3.79 liters) Magnaflux Carrier No. 2

Preparation:

a) In a small container, mix the required quantity of dry concentrate with a suitable quantity of oil to form a thin slurry.

b) Add oil to the inspection machine tank, and stir in the slurry, making sure all lumps are dissolved.

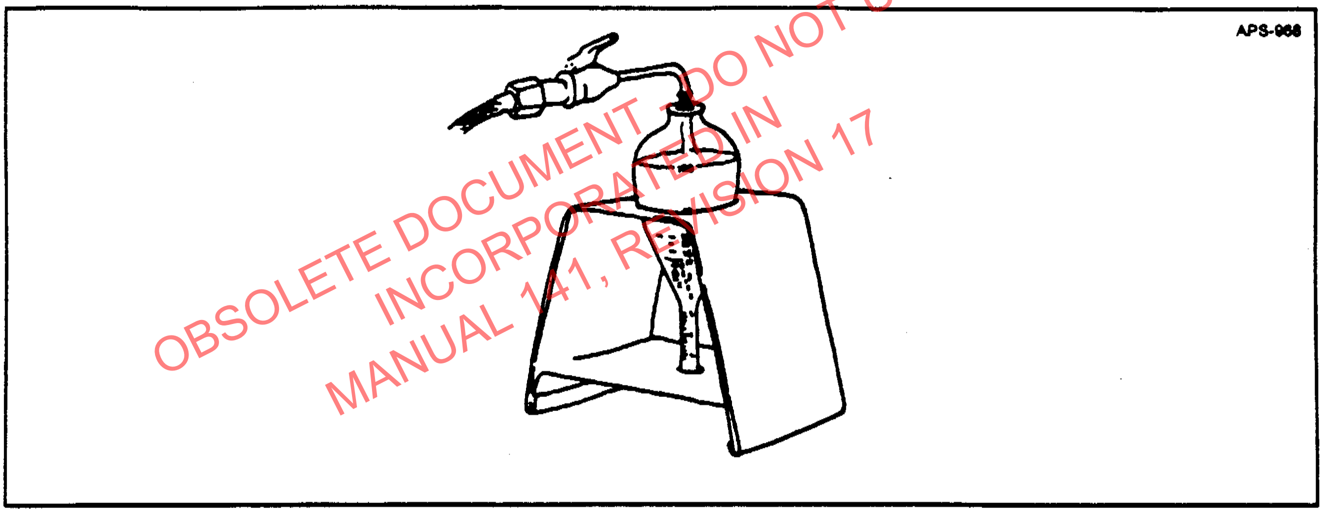
c) Turn on the circulation system and allow it to pump for 30 minutes.

d) When the medium is completely agitated and mixed, check the concentration, and log the results.

e) If ingredients are added to correct the concentration of the medium, allow the circulation system to pump for another 15 minutes. Then, recheck the concentration, and log the result.

2) Control of the Medium

a) At the start of each working day, turn on the circulation system and allow it to pump for 30 minutes.



Filling Graduated Centrifuge to Check Strength
of Magnetic Particle Inspection Medium
Figure 5-2

b) As shown in Figure 5-2, fill an ASTM-100 ml graduated centrifuge to the 100 ml mark directly from the nozzle which pours the magnetic particle medium over the parts.

c) Use a demagnetizing unit to remove any magnetic field retained in the solution.

d) Allow the centrifuge tube to stand for 30 minutes—or until all solid material has settled out.

e) At the end of the settling period, read and record the height of the solids in the centrifuge tube.

f) Either correct or maintain the proper concentration by adding No. 14A Magnaglo dry concentrate or Magnaflux Carrier No. 2 as required.

3) <u>Checking Function of Magnetic Particle Inspection Equipment</u>

a) Keep a part with known magnetic inclusion or defect in the area of the magnetic particle inspection machine.

b) At the start of each working day, check the function of the machine by running a complete magnetic particle inspection on the part having the known magnetic inclusion or defect.

<u>NOTE</u>: A Magnaflux Test Block No. 75130 can be used for this test.

c) If the known defect indicates that concentration of the medium is not correct, or that the circuits are not operating properly, do not use the machine for testing until the condition has been corrected.

5-6. Dye Penetrant Inspection Procedures

CAUTION: FINAL DYE PENETRANT INSPECTION MUST BE PERFORMED AFTER SUCH OPERATIONS AS MACHINING, GRINDING, STRAIGHTENING, OR ACID PICKLING, BUT BEFORE THE APPLICATION OF ANODIZE, PAINT OR A SOLID FILM LUBRICANT.

A. Acceptable Procedures and Personnel

1) Fluorescent Penetrant Inspection

Fluorescent Penetrant shall be performed in accordance with a procedure which meets the requirements of MIL-STD-6866 or with the procedure described below. The penetrant system may be one of the systems shown below.

Acceptable Systems per MIL-STD-6866

Type	Method	Sensitivity Level	Developer Form	Remover Class
I Fluorescent Dye	A Water Washable B Post Emul. Lepophilic D Post Emul. Hydrophilic	3 High	a Dry Powder b Water Soluble c Water Suspendible d Nonaqueous	2 Nonhalogenated

2) Penetrant Procedure

The Fluorescent Penetrant Procedure described below meets the following system requirements.

System Requirements

Type	Method	Sensitivity Level	Developer Form	Remover Class
I Fluorescent Dye	A Water Washable	3 High	b Water Soluble	2 Nonhalogenated

3) Personnel Requirements

Repair station specialists and other authorized personnel using a penetrating dye inspection system must be properly certified.

NOTE: Refer to FAR Part 135 for description of personnel requirements.

B. General Requirements

1) The aluminum propeller hub requires inspection by a fluorescent dye penetrant method for cracks at overhaul.

2) The anodize coating must be stripped from the parts prior to fluorescent dye penetrant inspection.

3) The steel inserts and helicoils must be removed before anodize and replaced after.

C. Equipment and Material Required for Dye Penetrant Inspection

1) See Figure 5-3 for components and arrangement of a typical fluorescent water washable dye penetrant inspection system.

2) Equipment Required

a) Pre-Cleaner Tank

b) Dye Penetrant Solution Tank

c) Spray Rinse Tank

d) Wet Developer Solution Tank

e) Electric Drying Element and Fan

f) Filtered Black Light Checking Equipment

g) White Light Meter

h) Steam Cleaning/Industrial Grade Cleaner

i) Tool to remove inserts and helicoils and replace

3) Approved Materials

a) Magnaflux ZL-67 Fluorescent Dye Penetrant (water soluble)

b) Magnaflux ZP-14A Water Soluble Developer

c) Anodize Stripper

D. Fluorescent Dye Penetrant Inspection

1) Pre-Cleaner

a) Clean all contaminants from the part with steam or industrial grade cleaner before proceeding with fluorescent dye penetrant inspection.

NOTE: In particular, remove oils, resins and greases.

b) Allow the pre-cleaner to evaporate until the part is dry.

2) Dye Penetrant

a) Dip the part in the fluorescent dye penetrant solution.

b) Immediately remove the part and allow the penetrant to dwell on the part for 30 to 35 minutes.

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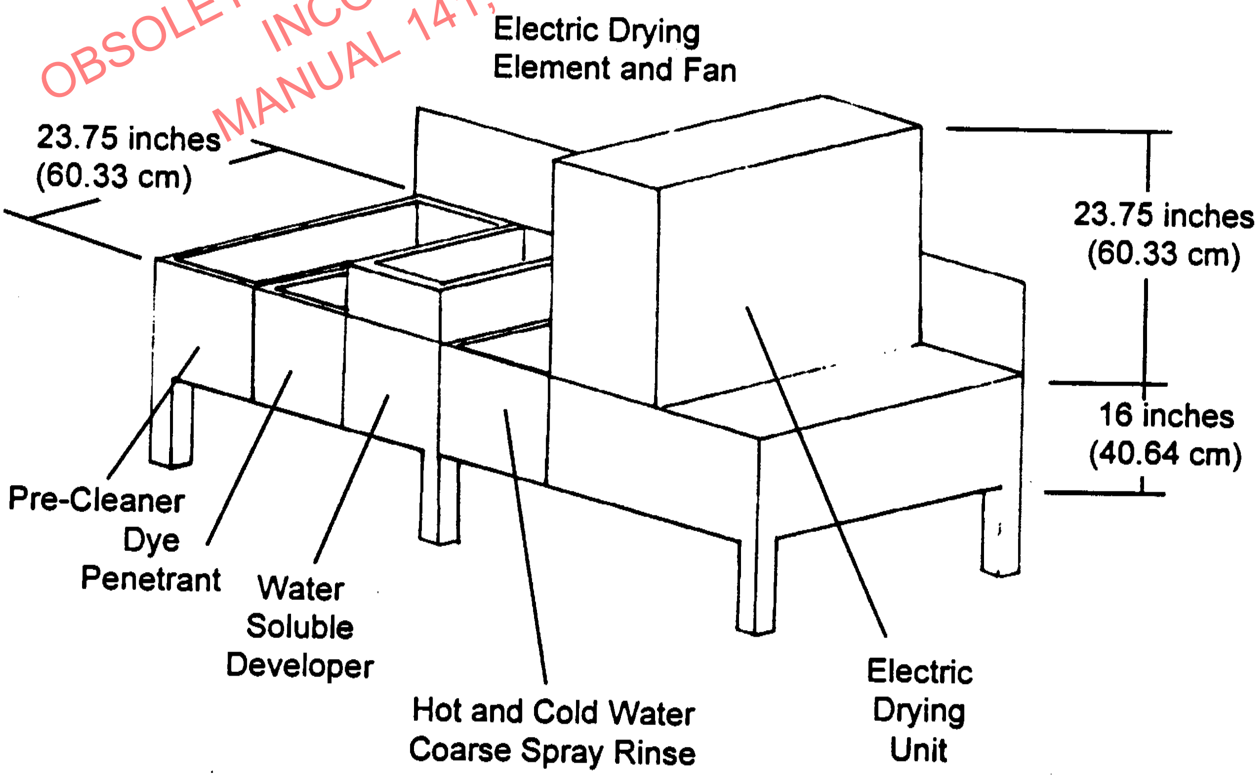


<u>NOTE</u>: Water Temperature:
60 - 100° F (15.6 - 37.8°C)

Water Pressure:
30 psi (2.11 kg/cm²) maximum

Typical Arrangement of Fluorescent
Water Washable Dye Penetrant Inspection System
Figure 5-3

3) Coarse Water Spray Rinse

NOTE: Be careful not to over-rinse the part or to flood a threaded hole. A black light mounted over the rinse tank helps prevent excessive wash-off.

a) Use a coarse spray of low pressure warm water to remove residual penetrant dye solution from the part.

NOTE: Water temperature of the rinse spray should be between 60° F (15.6° C) and 100° F (37.8° C). Water pressure of the rinse spray should not exceed 30 psi (2.11 kg/cm²).

4) Wet Developing

Immerse the part in the water-soluble developer solution for the period of time required to obtain complete coverage of the material.

5) Drying

Place parts in a hot air circulating oven for drying developer on part.

NOTE: Do not dry the part at a temperature higher than 180° F (82° C).

6) Inspection

NOTE: To prevent eye strain and the possibility of questionable readings, limit continuous inspection time to 30 minutes.

a) Use a filtered black light unit in an area with subdued lighting to check the part. The ambient white light background shall not exceed 2 foot-candles (20 lx/m²) for inspection area.

b) Look carefully for cracks indicated by red fluorescent indications.

7) Post-Cleaner

a) Follow the Pre-Cleaner procedure to clean a part after the fluorescent dye penetrant inspection.

E. Control of Dye Penetrant Inspection Solutions

The pre-cleaner, dye penetrant and water soluble developer solutions used in dye penetrant inspection procedures should be checked weekly.

1) Pre-Cleaner Control

a) Keep a bottle of pre-cleaner solution for which the amount of contamination has been established in the inspection room.

b) Once a week, take a sample from the solution in the pre-cleaner tank.

NOTE: Collect the sample of tank solution in a bottle just like the one used for the established solution.

c) Visually compare the tank solution sample with the established solution.

d) If the tank solution sample is as dark as (or darker than) the established solution, drain and clean the tank, and prepare a fresh solution of the approved pre-cleaner.

2) <u>Dye Penetrant Control</u>

a) Once a week, use an approved test panel to check the fluorescent brilliance and color of the fluorescent dye penetrant solution.

<u>NOTE</u>: The test panel should be marked in gradations of one micron wide and 10 microns deep.

b) Dip one half of the test panel in the master sample solution of uncontaminated fluorescent dye penetrant.

c) Dip the other half of the test panel in the tank of working solution of fluorescent dye penetrant.

d) Run the test panel through the normal sequence of test procedures: Coarse water spray rinse, wet developing, drying and inspection.

e) Under the black light unit, visually compare the master sample half of the test panel with the working sample half the panel.

f) If the halves of the test panel are not equal in fluorescent brilliance and color, drain and clean the tank of dye penetrant solution.

g) Prepare a fresh solution of the approved dye penetrant.

3) <u>Wet Developer Control</u>

a) Once a week, use a hydrometer to test the strength of the water soluble developer solution.

b) The hydrometer reading for the wet developer suspension should range from 1.007 through 1.015 inclusive.

c) If the hydrometer reading is above or below the established limits, add either water or developer powder to the solution as necessary to get a reading within the limits.

d) Use the following guidelines for controlling the developer concentration:

Developer Powder per Gallon (3.785 l) of Water	Hydrometer Reading
0.25 pound (0.113 kg)	1.007
0.33 pound (0.150 kg)	1.010
0.50 pound (0.227 kg)	1.015

4) Maintain accurate records of all tests of penetrating dye inspection solutions.

F. Checking Function of "Black Light" Unit

1) Use an ultraviolet meter to check intensity of the "black light" unit daily.

NOTE: Accuracy of the ultraviolet meter must be checked every two years by an outside source.

2) Maintain the black light intensity above the following minimum requirements:

Distance Between Meter and Light Source	Medium Reading
15 inches (38.1 cm)	800 uW/cm

3) Allow the black light unit to warm up for at least 15 minutes before using it.

G. White Light

The ambient white lights background shall not exceed 2 foot-candles (20 lx/m^2) for a stationary inspection area. Viewing areas for portable flourecent dye inspection shall utilize black photographers canvas, or other methods to reduce white light background to its lowest possible level during inspection and black light intensity shall be adequate.

H. Daily Checking Procedures for Dye Penetrant Inspection Solutions and Equipment

1) Keep a part with known defect in the dye penetrant inspection area.

2) At the start of each working day, use this part to check the operating condition of solutions and black light unit.

3) Maintain a daily record of test runs on the part with known defect.

I. Identification of Dye Penetrant Inspected Parts

1) Each time a part passes dye penetrant inspection, the part should be ink-stamped in an appropriate area with a large letter "P" that is completely enclosed in a circle.

NOTE: Scrap any defective part for which there is no rework procedure.

2) If penetrating dye inspection indicates a crack or defect in a part, the defect may be ground out or otherwise removed by an approved rework procedure as long as dimensions are maintained within tolerance (Figure 4-3).

CAUTION: IT MAY BE NECESSARY TO LOCALLY ETCH AREA OF GRINDING IF THE SURFACE OF THE MATERIAL WAS SMEARED BY THE GRINDING OPERATION.

NOTE: A reworked part must be re-examined by dye penetrant inspection procedures and appropriately tagged.

3) Maintain a log book for all parts that are found defective by dye penetrant inspection procedures.

5-7. Specific Inspection Procedures

A. Refer to the Owner's Manual & Log Book for Daily Inspection Procedures.

B. Observe the following inspection procedures for specific assemblies and units and follow replacement procedures if necessary:

1) Propeller Blade Assembly Inspection

a) Refer to the composite blade section in the back of this manual for specific instructions on inspection procedures.

b) De-Icing System Inspection

If the propeller has a de-icing system, refer to the appropriate manufacturer's manual for specific instructions on inspection procedures.

2) Spinner Assembly Inspection

Refer to the appropriate spinner manual for specific instructions on spinner assembly inspection procedures.

3) Feathering Unit Inspection

a) Visually inspect the feathering spring retainer (9) for cracks and distortion and check the feathering spring (10) for pitting and corrosion.

b) Magnetically inspect the feathering spring for cracks.

4) Blade Bearing System Inspection

a) Visually inspect the blade retention split-bearing (23) for brinelling, fretting or corrosion on bearing balls and/or races.

b) As shown in Figure 5-4, use a ball-type pressure-sensitive gauge with dial indicator to measure depth of pitting (or other damage) to the races of the split-bearing.

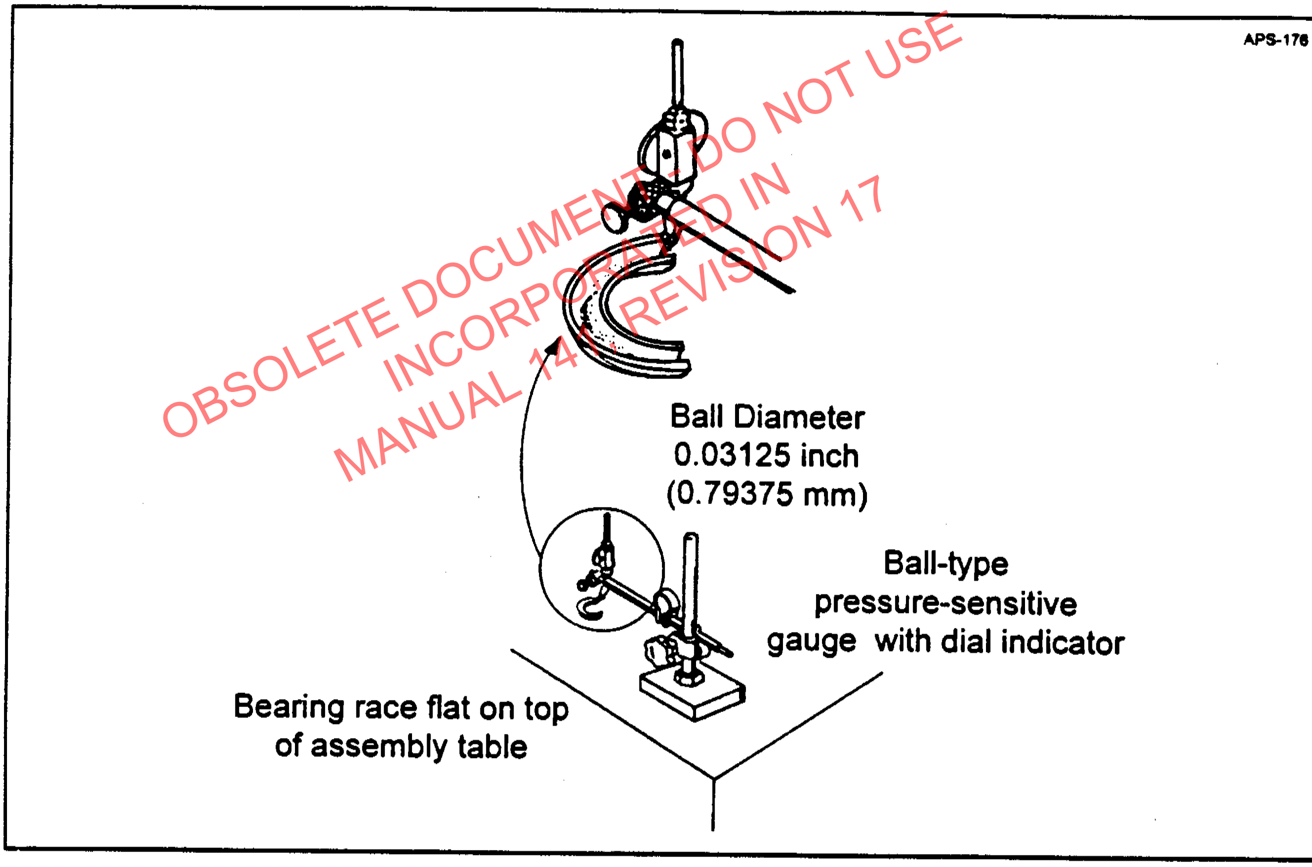
NOTE: Replace bearing races if depth of pitting (or other damage) exceeds maximum allowable depth of 0.002 inch (0.051 mm).

5) Hydraulic System Inspection

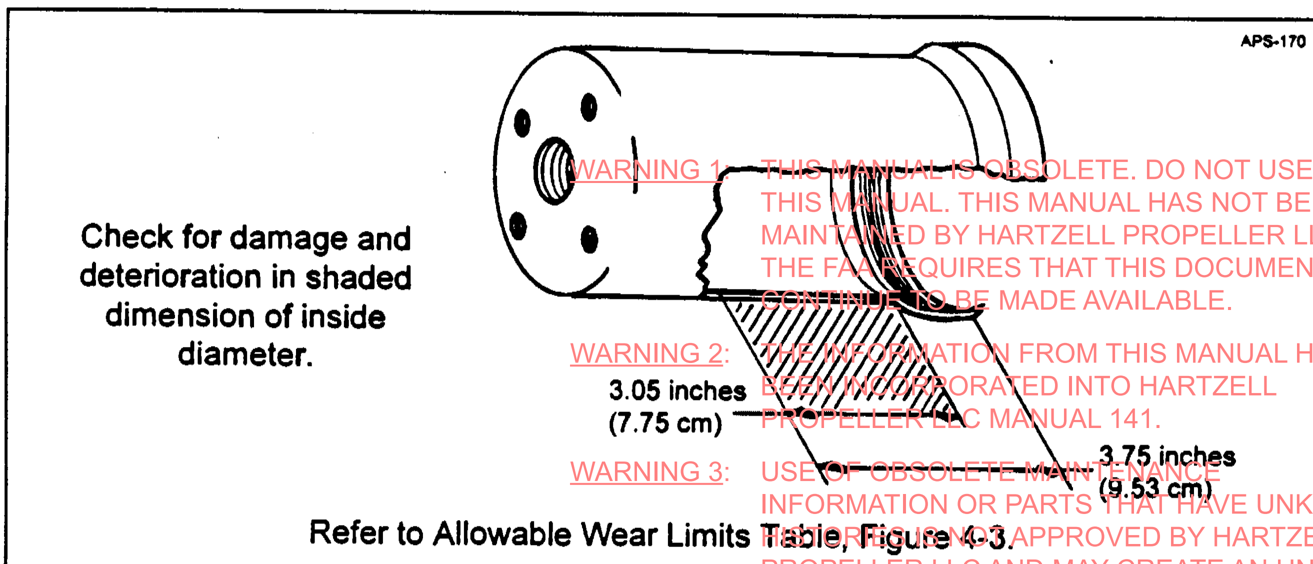
a) Visually inspect the cylinder (39) for damage to the threads.

b) Check inside diameter of cylinder at critical area beginning just inside the threaded surface and extending 3.05 inches (7.75 cm). (Refer to the shaded area in Figure 5-5.)

c) Check outside diameter of the pitch change rod at three critical lengths as shown in Figure 5-6.



Measuring Depth of Pitting in Race
of Blade Retention Split-Bearing
Figure 5-4



Critical Area of Cylinder Inside Diameter (ID)
to be Checked at Overhaul
Figure 5-5

d) Check piston (41) for scratches deeper than maximum allowed in grooves for small O-ring (37) and for large O-ring (34).

NOTE: Extremely shallow scratches may be eliminated by light polishing, but follow replacement procedure if any scratch in O-ring grooves is deeper than 0.002 inch (0.051 mm).

e) Check outside diameter (OD) of piston as shown in Figure 5-7. (Refer to Allowable Wear Limits Table, Figure 4-3.)

f) Check for damage or distortion in areas where the start lock pins engage the lip of the steel ring. Lip should not be distorted or damaged deeper than 0.002 inch (0.051 mm).

g) Check for damage or distortion in threads of the piston and/or the steel ring. Threads should not be distorted or damaged.

h) Magnetically inspect the steel ring for cracks.

i) Use approved dye penetrant method to inspect for cracks in piston.

j) Visually inspect for evidence of pitting in the steel ring. Pitting should be no deeper than 0.002 inch (0.051 mm).

k) Check width of each channel in fork (44). Width of any channel should not exceed maximum specified in Allowable Wear Limits Table, Figure 4-3.

l) Magnetically inspect the fork for cracks.

m) Visually check the fork bumper (45) for thread damage.

6) Start Lock Assembly Inspection

a) Magnetically inspect the high pitch stop pin (53) for cracks.

b) Magnetically inspect the steel start lock housing (50) for cracks.

7) Pitch Adjustment Unit Inspection

a) Visually check for damaged or distorted threads on the reverse adjustment sleeve (59).

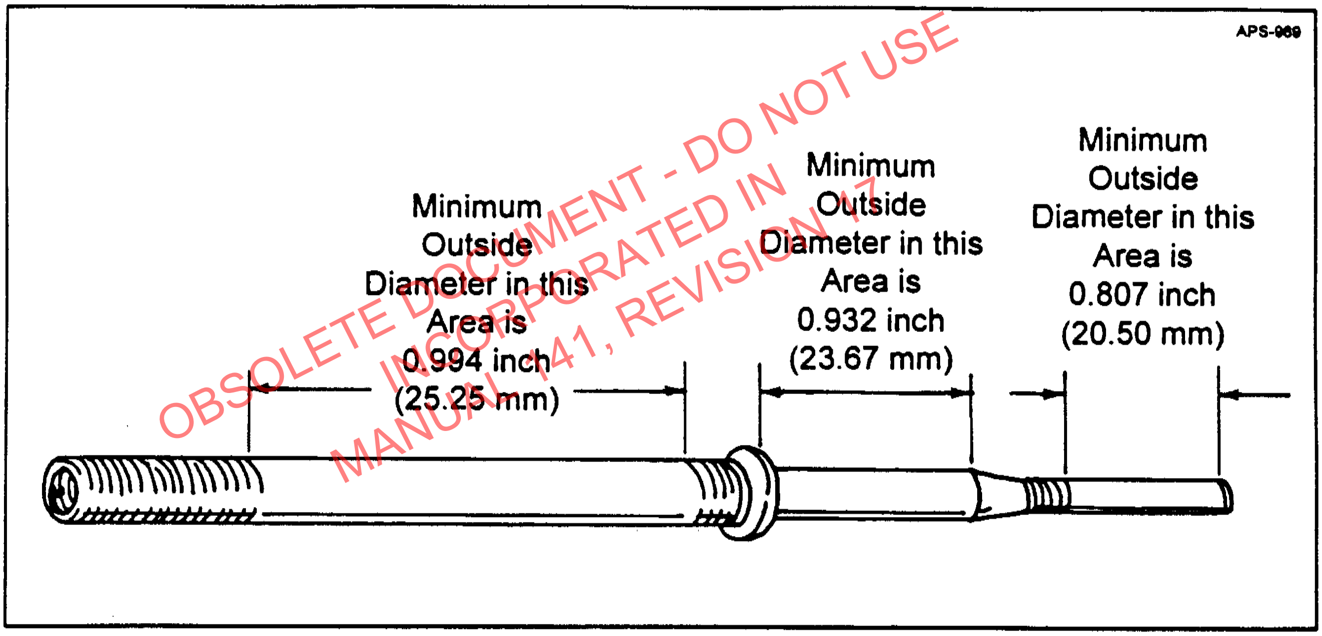
b) Inspect the condition and fit of the bushing (60) inside the reverse adjustment sleeve.

8) Split-Hub Inspection

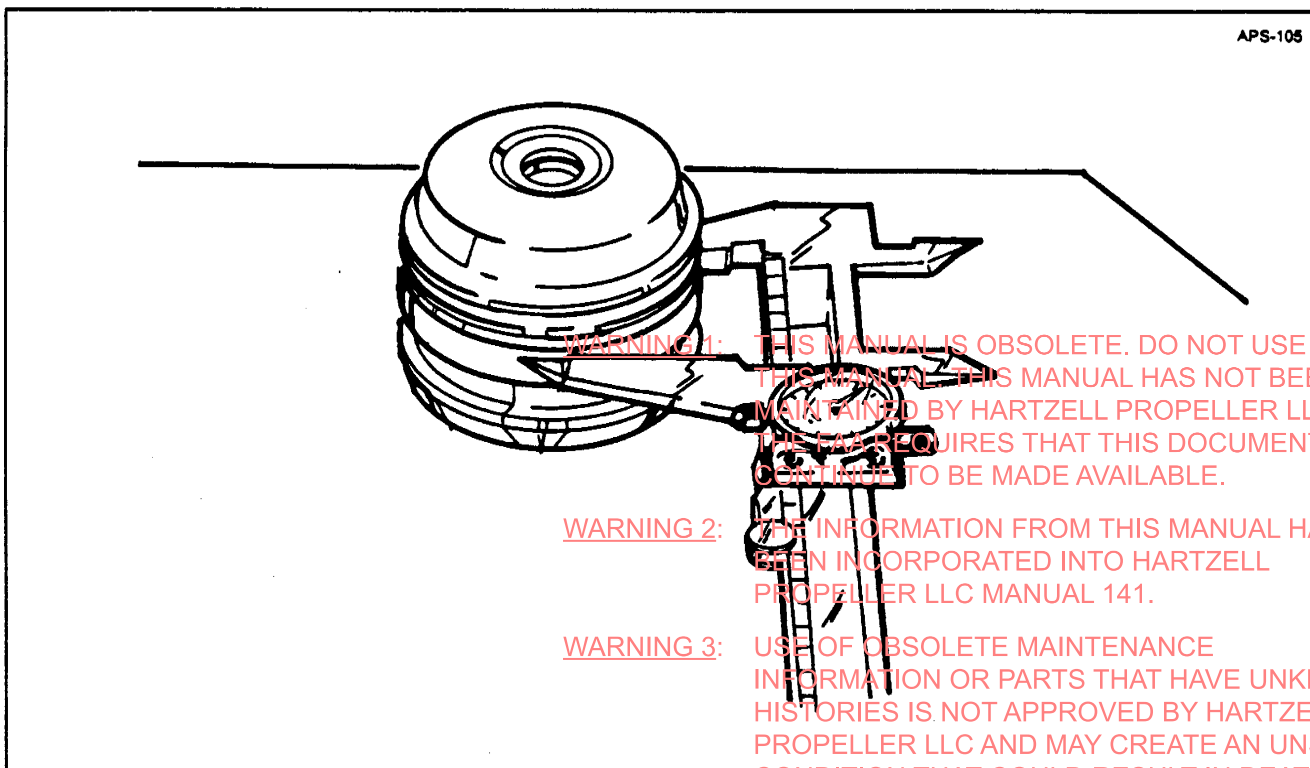
a) Check edges of all bolt holes, lubrication fitting holes and balance weight holes in both halves of hub unit.

CAUTION: DO NOT DAMAGE A SHOT PEENED SURFACE WHEN REMOVING SHARP EDGES FROM A THREADED HOLE IN THE HUB UNIT.

b) Carefully remove any rough edges from bolt holes, lubrication fitting holes and balance weight holes in hub unit.



Critical Outside Diameter (OD) Areas of Pitch Change Rod to be Checked at Overhaul
Figure 5-6



Checking Outside Diameter (OD) of Piston Unit
Figure 5-7

c) Use the approved chemical process for removing anodic coatings (refer to Chapter 6), and strip all anodizing from surfaces of the split-hub unit.

NOTE: Aluminum oxide cleaning is an acceptable mechanical method for stripping anodized surfaces. (Refer to Chapter 6.)

d) Use the approved dye penetrant method to inspect both halves of the hub unit for cracks.

e) If dye penetrant inspection detects a crack, return the entire hub unit to the factory for evaluation.

f) Refer to Chapter 6 for Re-Anodizing and Re-Inspection Procedures to be performed before the split-hub unit is returned to service.

NOTE: Alodine methods are an acceptable alternative to re-anodizing the split-hub unit. (Refer to Chapter 6.)

g) Use a 10-power magnifying glass to inspect areas of the hub where outboard bearing races seat (Figure 5-8).

h) Follow re-shot peening procedure if necessary.

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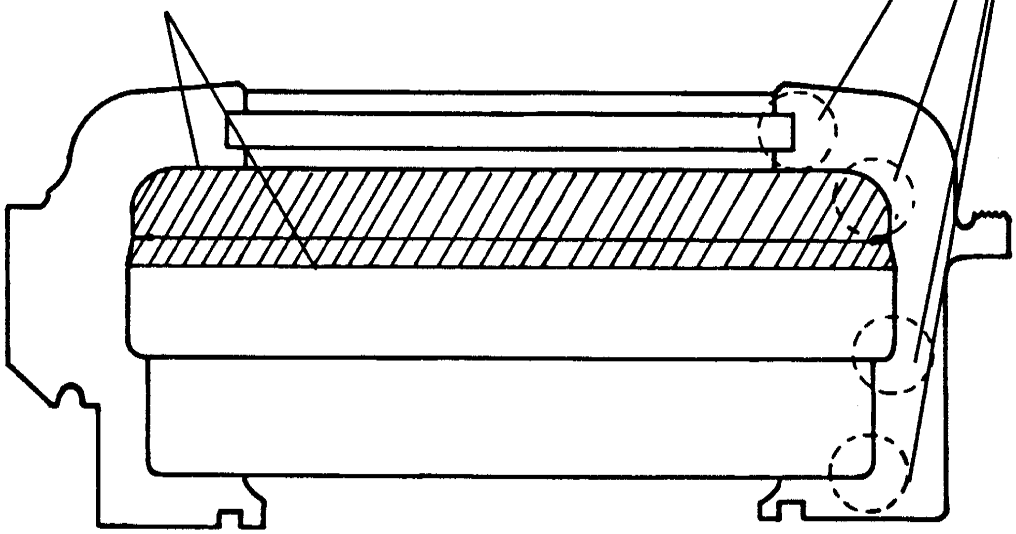
WARNING: RETIRE THE HUB FROM SERVICE IF THERE IS A CRACK IN ANY BLADE SOCKET RADIUS.

CAUTION: NO WEAR IS ALLOWED WHICH EXCEEDS THE DEPTH OF THE SHOT PEEN "PEBBLE GRAIN" SURFACE IN THE AREAS INDICATED.



Use a ten-power magnifying glass to visually check for cracks in radii of blade sockets.

NOTE: After stripping anodic coating from the hub and before re-anodizing it, inspect the areas indicated.

Inspecting Blade Retention Areas of Split-Hub Unit
Figure 5-8

CAUTION: DO NOT ATTEMPT IN THE FIELD ANY REPAIR, REPLACEMENT, REWORK, RE-PLATING, RE-ANODIZING OR RE-SHOT PEENING PROCEDURE WHICH IS NOT SPECIFICALLY AUTHORIZED BY HARTZELL AND/OR WHICH IS NOT SPECIFICALLY REFERRED TO IN THIS MANUAL.

6-1. General Repair Procedures

NOTE: The ball peen marks on certain propeller parts are not tool marks and should not be removed.

NOTE: Most parts may be polished or lightly dressed out for repair of damage provided the required dimensions can be maintained.

NOTE: Contact the factory for guidance as to airworthiness of any part on which there is evidence of unusual wear or damage.

A. Certain surfaces of propeller assembly parts have been shot peened at the factory to improve fatigue strength.

B. Shot peened surfaces may need re-shot peening due to rust, galling or nicks.

1) Before attempting this specialized process in the field, refer to the Re-Shot Peening Procedures section of this manual—or contact the factory for specific instructions.

6-2. Specific Repair Procedures

A. Counterweight

1) Use a soft cotton wheel to dress out and polish minor damage to the counterweight (16) from impact, corrosion, gouging, pitting or scratching.

B. Blade Bearing System

1) Use a soft cotton wheel to dress out and polish minor pitting or corrosion damage to the blade retention split-bearing races (Figure 5-4).

2) Use a soft cotton wheel to dress out and polish minor scratch damage to the preload plate (28).

NOTE: Replace blade retention split-bearing races if depth of pitting or other damage exceeds maximum allowable depth of 0.002 inch (0.051 mm).

C. Hydraulic System

NOTE: Replace pitch change rod if any outside diameter is less than the minimum allowed.

1) Use a soft cotton wheel to dress out and polish minor scratch damage on the outside diameters of the pitch change rod (40).

6-3. General Replacement Procedures

A. At overhaul of the Hartzell propeller, replace all of the following components with new components.

1) Replace all bolts, washers, nuts, screws, roll pins, dowel pins, cotter pins, clevis pins and safety wire.

2) Replace all seals, O-rings, snap rings, lubrication fittings and lubrication fitting caps.

NOTE: If the propeller is equipped with a de-icing system repair or replace the slip ring, and replace the boots on all blades according to instructions in the manufacturer's manual.

6-4. Overhaul Replacement Parts Kit

A. Overhaul Replacement Parts Kit No. A-3725 is available from the factory to simplify procedures for the Series HC-E4P-5 propeller.

B. Kit No. A-3725 contains the following parts (refer to Chapter 10):

Fig No.	Item No.	Part No.	Description	Qty.
10-2	-1	57B3347	B-3347 Double Hexagon Bolt	8
	-2	57A2048-2	A-2048-2 Washer, Mounting Bolt	8
	-3	450909008	PRP-909-8 O-ring, Propeller Mounting	1
	-4	791924693	MS24693C272 Screw	32
	-5	3620116910	NAS1169C10L Washer, Fibre	32
	-8	362000100	AN960-10 Washer	1
	-9	57B0442	B-442 Retainer, Spring	1
	-73	57A2070-10	A-2070-10 Capscrew, Socket, Buttonhead	8
	-76	57B3383-15	B-3383-15 Safety Bolt	1
	-77	792190103	H10-3 Nut	1
10-3	-13	57A0065	A-65 Dowel Pin	8
	-14	57B3822	57B3822 Screw	8
	-15	791004500	31-S-094-0500 Pin, Spring (SPS)	8
	-18	362006160	AN960-616 Washer	8
	-19	790960768	NAS607-6-8 Dowel Pin	4
	-82	57A2036-12	A-2036-12 Screw	8
	-83	57B3386-28H	B-3386-28H Bolt	8
	-84	57B3384-9H	B-3384-9H Bolt	8
10-4	-20	57B3825	B-3825 Screw	8
	-21	790960767	NAS-607-6-7 Dowel Pin	4
	-22	4509020423	PRP-902-42-3 O-ring, Dry Silicone Lubed	4
	-24	57B0793	B-793 Ball Spacer	4
	-26	57A0665	A-665 Blade Plug	4
	-27	57A1271	A-1271 Needle Roller Bearing (INA)	4
	-29	57B3368	B-3368 Jam Nut	4
	-31	57A3204-1	A-3204-1 Screw, Set	4

Fig No.	Item No.	Part No.	Description	Qty.
10-4	-72	57B1925	B-1925 Hub Seal (cut to length)	4
		57B0475	B-475 Washer	4
		791500020	CY58402 Cam Follower	4
10-5	-32	4509020162	PRP-902-16-2 O-ring, Hub, Cylinder-Half	1
	-33	450909029	PRP-909-29 O-ring, Hub Shoulder, Cylinder-Half	1
	-34	4509020532	PRP-902-53-2 O-ring, Piston, Large	1
	-35	57B1843	B-1843 Seal, Felt, Dust (cut-to-length)	1
	-36	4509020182	PRP-902-18-2 O-ring, Hub, Engine-Half	1
	-37	450902022	PRP-902-22 O-ring, Piston, Small	1
	-38	57B0474	B-474 Nut, Self-Locking	1
	-46	57A3256	A-3256 Button	4
	-47	7931-51966-131	MS51966-131 Set Screw, Socket	4
	-49	57B3821	B-3821 Cap Screw, Socket Head	8
	-51	57B0331	B-331 Spring, Start Lock	2
	-52	791924665-1	MS24665-1 Cotter Pin (split)	2
	-53	57A2620-1	A-2620-1 Pin, Stop, High Pitch	2
	-54	57B0439	B-439 Screw, Beta Adjustment	1
	-55	3617142316	NAS1423-16 Nut, Jam	2
	-56	57B3375	B-3375 Nut, Jam	1
	-57	360005050	AN501A416-5 Screw, Safety	1
	-58	362004164	AN960C416 Washer	1
	-74	57A3365	A-3365 Back Up Ring	1
	-75	57A3366	A-3366 Back Up Ring	1
	-78	57B2877	B-2877 Clevis Pin	2
10-6	-61	57A2431	A-2431 Bolt, Hub, Hex Head	12
	-62	57A2432	A-2432 Bolt, Hub, Hex Head	8
	-63	362006161	AN960-616L Washer	20
	-64	57A2043-1	A-2043-1 Nut, Self-Locking	20
	-65	57A0279	A-279 Fitting, Lubrication	8
	-66	792200003	"B" Cap, Lubrication Fitting	8
	-68	57A2249	A-2249 Busing, Guide	1
	-69	7917535914	3591-4CN-0375 Insert (Heli-Coil)	8
	-70	57B1243	B-1243 Insert, "No Counterbore" (Microdot)	8

6-5. Specific Replacement Procedures

Replace the following parts:

A. Propeller Mounting Kit (Figure 6-1)

1) bolts (1)

2) washers (2)

3) O-ring (3)

B. Spinner Assembly (Figure 6-1)

1) screws (4)

2) fibre washers (5)

3) washers (8) *enough to press the spinner dome (7) firmly against the engine-side bulkhead unit (6)*

4) bolts (73)

C. Feathering Unit (Figure 6-1)

1) spring retainer (9) *if it is cracked, broken or distorted*

2) feathering spring (10) *if spring is cracked or if pitting and corrosion cannot be removed safely and completely*

D. Balance Unit

1) balance weights (11) *follow static balancing procedure in Chapter 8 if necessary*

2) balance weight screws (12) *refer to selection chart, Figure 10-3*

E. Counterweight Assembly

1) dowel pin (19)

2) screws (14)

3) spring pins (15)

3) counterweight (16) *if it is severely damaged*

F. Hydraulic System (Figure 6-2)

1) safety bolt (76)

2) safety nut (77)

3) cylinder (39) *if any threads are distorted or damaged, if there is damage or deterioration in the area of the inside diameter indicated in Figure 5-5, or if the inside diameter exceeds specification in Allowable Wear Limits Table, Figure 4-3*

4) piston (41) *if any scratches in the O-ring grooves are deeper than the allowable maximum of 0.002 inch (0.051 mm) or if the outside diameter is less than the minimum specified in the Allowable Wear Limits Table, Figure 4-3*

5) piston and/or the steel ring (42) *if any threads are damaged or distorted*

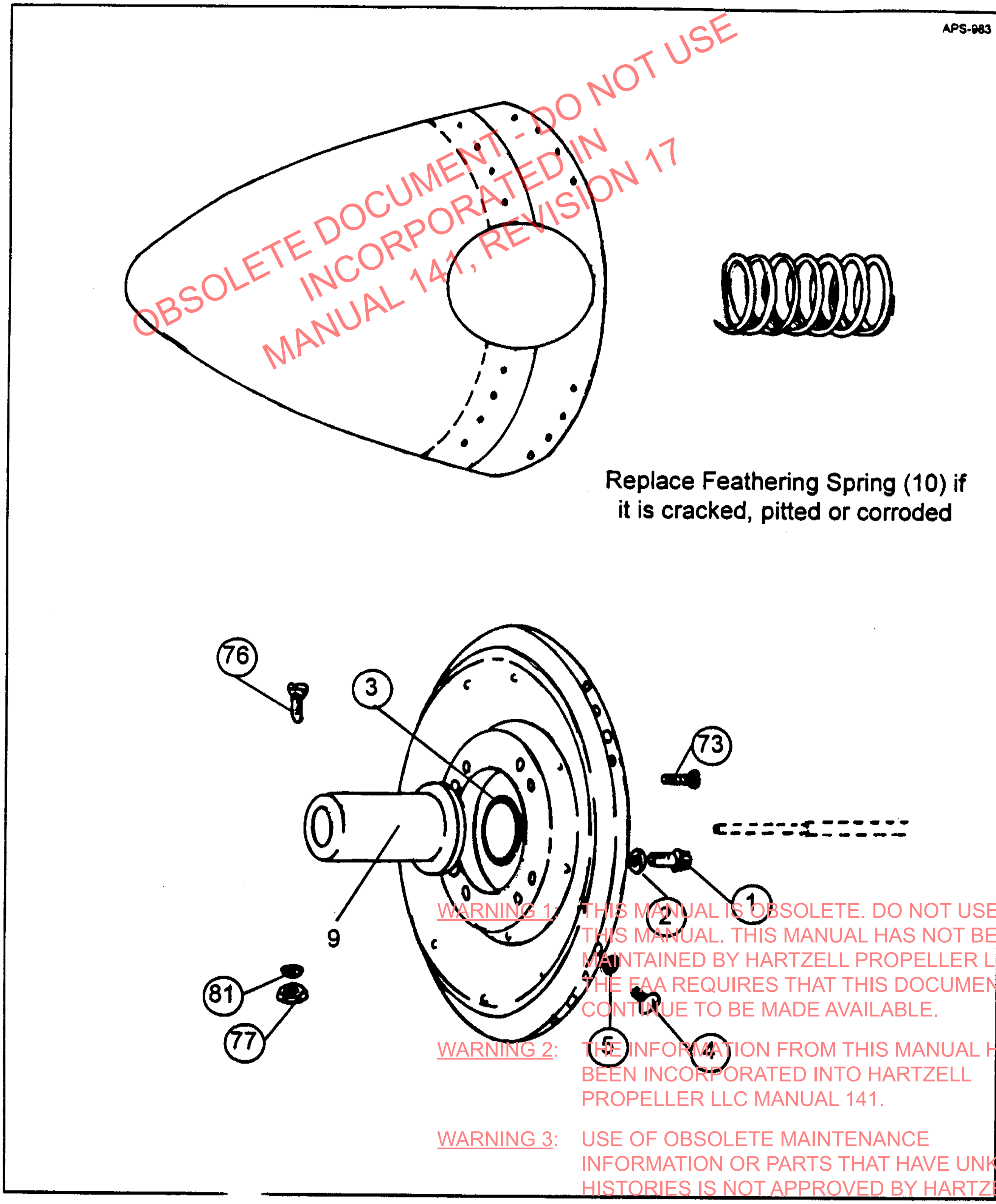
6) steel ring *if the lip where the start lock pins engage is damaged or distorted—or if pitting is deeper than the allowable maximum of 0.002 inch (0.051 mm)*

7) self-locking piston nut (38)

8) felt dust seal (35)

9) large piston O-ring (34)

10) small piston O-ring (37)



Prope r Mounting Kit, Spinner Assembly and Feathering Unit
Overhaul Replacement Parts
Figure 6-1

Replace the cylinder if there is damage or deterioration in the area of inside diameter indicated in Figure 5-5.

Replace cylinder if any threads are damaged or distorted—or if inside diameter exceeds 5.374 inches (136.50 mm).

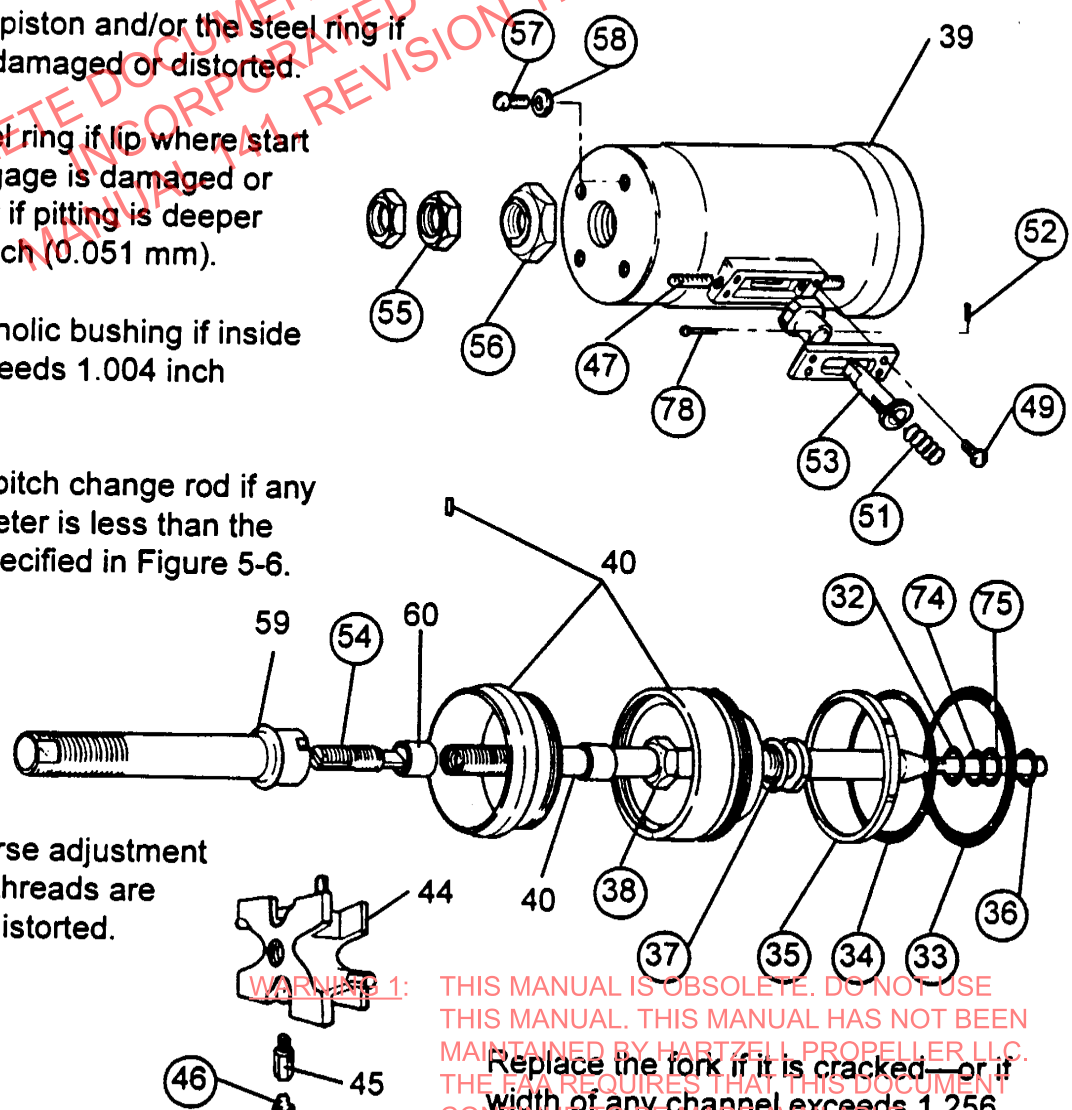
Replace the piston and/or the steel ring if threads are damaged or distorted.

Replace steel ring if lip where start lock pins engage is damaged or distorted—or if pitting is deeper than 0.002 inch (0.051 mm).

Replace phenolic bushing if inside diameter exceeds 1.004 inch (25.50 mm).

Replace the pitch change rod if any outside diameter is less than the minimums specified in Figure 5-6.

Replace reverse adjustment sleeve if any threads are damaged or distorted.



Replace the fork if it is cracked—or if width of any channel exceeds 1.256 inches (31.90 mm).

Replace the piston if outside diameter is less than 5.121 inches (130.07 mm)—or if any scratches in the O-ring grooves are deeper than 0.002 inch (0.051 mm).

Replace any fork bumper which has distorted or damaged threads.

Hydraulic System, Start Lock Assembly and Pitch Adjustment Unit Replacement Parts
Figure 6-2

11)cylinder-half hub shoulder O-ring (33)

12)fork (44) *if it is cracked or if the width of any channel exceeds specification in Allowable Wear Limits Table, Figure 4-3*

13)any fork bumper (45) *which has damaged or distorted threads*

14)fork buttons (46)

15)cylinder-half hub shoulder O-ring (32)

16)engine-half hub O-ring (36)

17)pitch change rod (40) *if any outside diameter is less than the minimums specified in Figure 5-6*

G. Start Lock Assembly (Figure 6-2)

1) socket set screws (47)

2) socket head cap screws (49)

3) springs (51)

4) cotter pins (52)

H. Pitch Adjustment Unit (Figure 6-2)

1) reverse adjustment sleeve (59) *if any threads are damaged or distorted*

2) bushing (60) *if it is worn beyond maximum inside diameter specified in Allowable Wear Limits Table, Figure 4-3*

3) jam nuts (55) and (56)

4) safety screw (57)

5) washer (58)

I. Blade Bearing System (Figure 6-3)

1) jam nut (29)

2) set screw (31)

3) inner bearing ring (30)

4) Torq-Set screw (20)

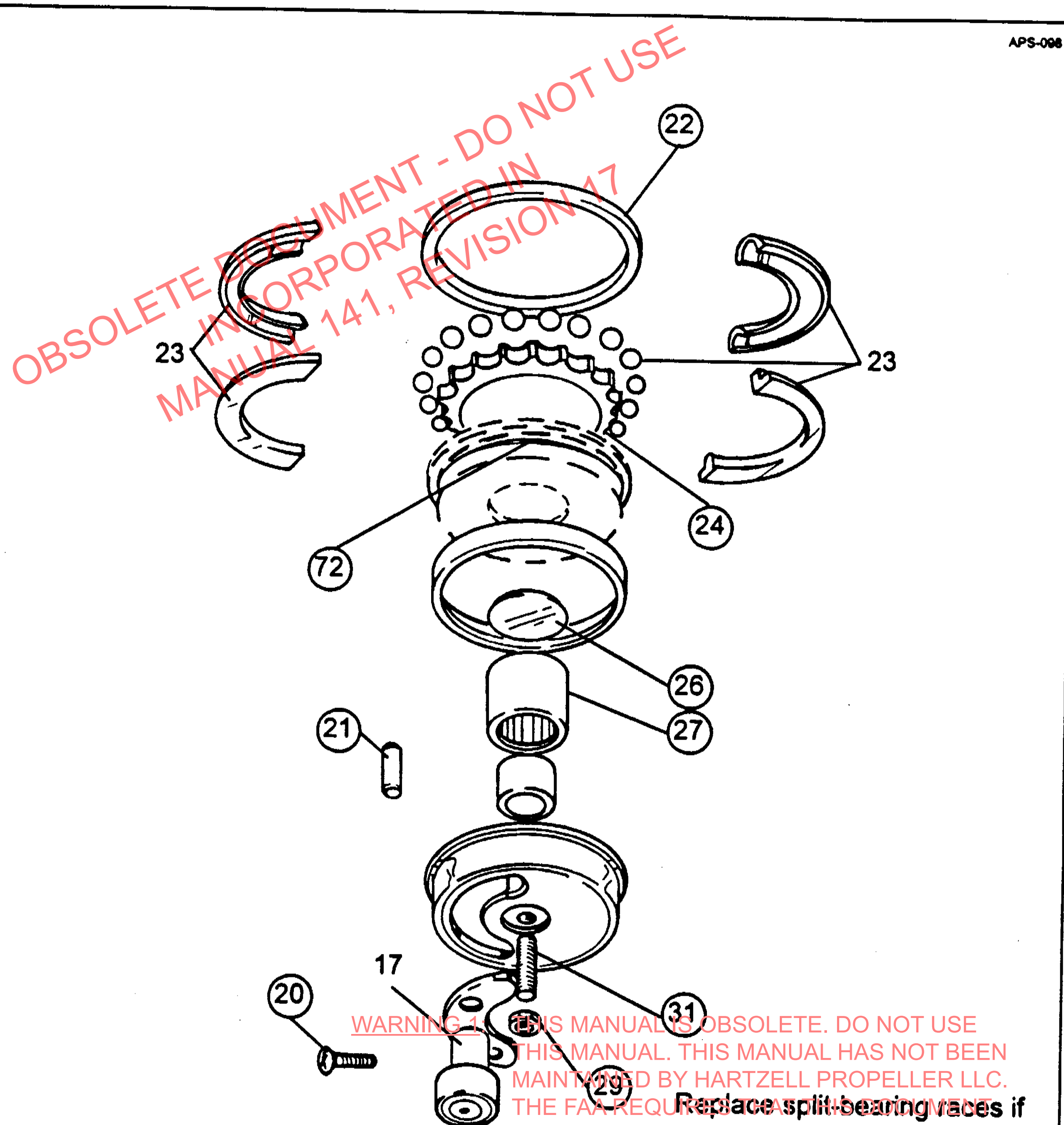
5) split-bearing races (23) *if pitting exceeds specification in Allowable Wear Limits Table, Figure 4-3 (Refer to Figure 5-4)*

6) split-bearing ball spacer (24)

7) O-ring (22)

8) needle roller bearing (27)

9) blade plug (26)



Replace split-bearing races if depth of pitting exceeds 0.002 inch (0.051 mm).

NOTE: The washer and cam follower, parts of the blade pitch change knob (item 17), are also part of the overhaul replacement parts kit.

Blade Bearing System Replacement Parts
Figure 6-3

J. Split-Hub Unit (Figure 6-4)

1) hex head hub bolts (61 and 62)
2) washers (63)
3) self-locking nuts (64)
4) guide bushing (68)
5) Heli-Coil inserts (69)
6) K-Sert inserts (70)
7) lubrication fittings (65) and their caps (66)

6-6. General Rework Procedures

A. Except for certain steel parts which must be cadmium re-plated at overhaul, the split-hub unit is the only component of the four-blade lightweight turbine propeller for which specific rework procedures in the field are permitted.

B. Any rework procedure permitted in the field must be performed in a qualified facility which has been approved by Hartzell.

6-7. Specific Rework Procedures

A. Cadmium Re-Plating Procedures

CAUTION: CERTAIN STEEL PARTS OF THE FOUR-BLADE LIGHTWEIGHT TURBINE PROPELLER MUST BE CADMIUM RE-PLATED AT OVERHAUL. PLATING PROCEDURES MUST ADHERE TO SPECIFIED CRITERIA, AND EXTREME CARE MUST BE USED IN HANDLING THE MATERIAL INVOLVED IN THE RE-PLATING PROCESS.

1) Cadmium re-plating is approved by Hartzell for use on parts made of steel to provide corrosion resistance.

2) Perform after all machining has been completed.

3) Old cadmium plating must be stripped from a part prior to cadmium re-plating procedures.

CAUTION: RE-PLATED HIGH STRENGTH BOLTS AND HYDRAULIC SYSTEM PARTS ARE PARTICULARLY SUSCEPTIBLE TO THE EFFECT OF HYDROGEN EMBRITTLEMENT. THESE PARTS MAY FAIL UNLESS PROPERLY BAKED AFTER RE-PLATING.

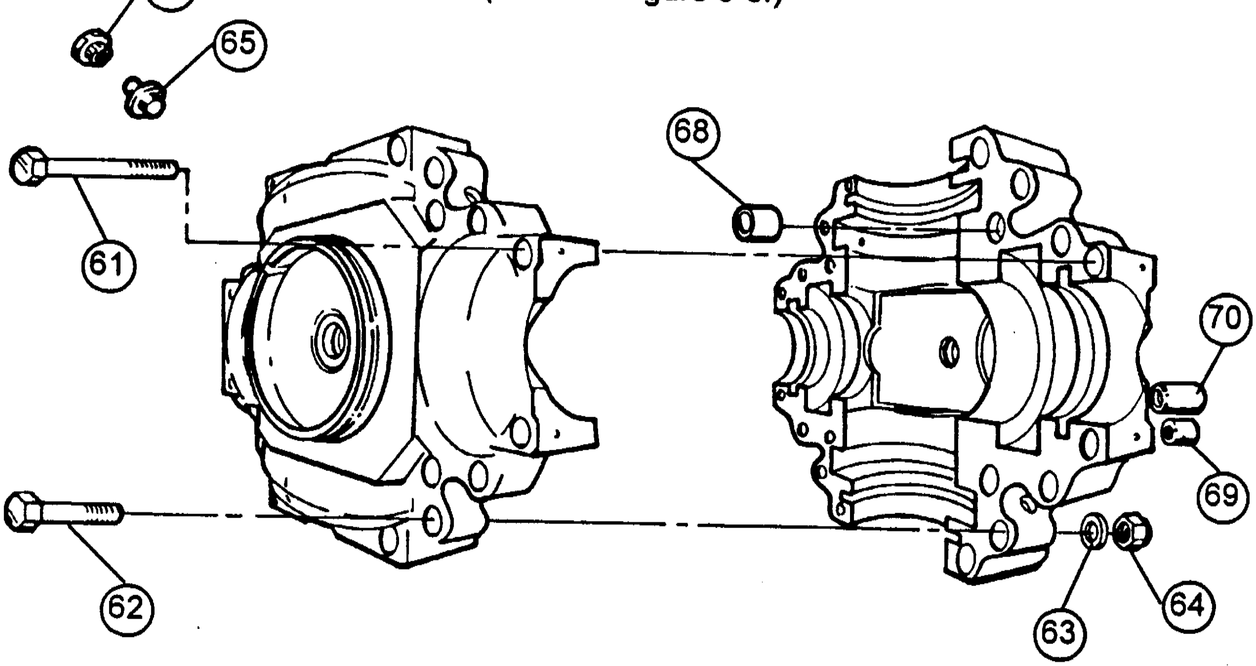
4) Follow specified pre-cleaning procedures in Chapter 5 before stripping old cadmium plating from oily, dirty or heavily soiled parts.

5) All heat treated alloy steel materials that have been cadmium re-plated must be baked in an oven at 375° F (191° C) for at least eight hours after cadmium re-plating to eliminate the possibility of hydrogen embrittlement.

APS-009

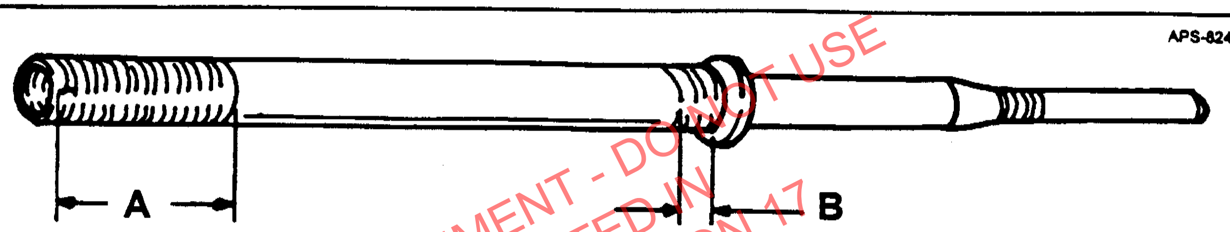
WARNING: RETIRE THE SPLIT-HUB UNIT FROM SERVICE IF OVERSIZE LUBRICATION FITTINGS HAVE BEEN INSTALLED IN IT—OR IF SLIMSERTS HAVE BEEN USED IN LUBRICATION FITTING HOLES OR IN HOLES FOR BALANCE WEIGHT ATTACHING SCREWS.

Replace the hub if visual inspection detects any cracks in radii of the blade sockets. (Refer to Figure 5-8.)



CAUTION: SPLIT-HUB UNIT MUST BE RETIRED FROM SERVICE IF ANY ASSOCIATED BLADE IS RETIRED FROM SERVICE DUE TO BEING BENT BEYOND LIMIT IN A GROUND STRIKE.

Split-Hub Unit Replacement Parts
Figure 6-4



AREA A: First 2.66 inches (67.56 mm) of external and internal threads on cylinder-end of rod

AREA B: External threads in middle of rod

Threaded Surfaces of Pitch Change Rod
Which Require Cadmium Re-Plating at Overhaul
Figure 6-5

6) The cadmium re-plating should be at least 0.0003 inch (0.008 mm) thick, unless otherwise specified. Full coverage of inner surfaces of holes and internal threads is required. However, no thickness is specified for plating on these surfaces.

7) Thickness of the cadmium re-plating on steel base metal must meet Air Force Specification QQ-P-416a.

8) The cadmium deposit must be smooth, fine-grained adherence, with no blisters, pits, burns or other surface defects.

9) The following parts of the HC-E4P-5 Four-Blade Lightweight Turbine Propeller must be cadmium re-plated at overhaul:

Fig. No.	Item No.	Part Number	Description
10-3	-16	57C0706	C-706 Counterweight
10-4	-25	57B1041	B-1041 Ring, Retention, Bearing
10-5	-40	57D0494	D-494 Rod, Pitch Change - only in threaded areas shown in Figure 6-5
	-44	57D0495	D-495 Fork
	-48	57B0446	B-446 Cover, Start Lock
	-50	57B0444-1	B-444-1 Start Lock Housing
	-59	57C0438	C-438 Sleeve, Reverse Adjustment

NOTE: Counterweights must be rematched with their corresponding blades after cadmium re-plating. Make sure that each counterweight is stamped at disassembly with the serial number of the blade from which it is removed and that this identification is preserved during cadmium re-plating.

10) Equipment, Materials and Procedures for Stripping Cadmium Plating

a) The stripping bath is composed of a concentration of eight ounces (0.237 l) of Strip-Aid per gallon (3.785 l) of city tap water and 16 to 24 ounces (0.47 to 0.72 l) of sodium cyanide per gallon (3.785 l) of city tap water.

NOTE: Dissolve strip-aid into the tank first; then, the sodium cyanide.

b) The bath is contained at room temperature in a tank fabricated of mild steel. Ventilation is not required.

c) Immersion time varies from five (5) to fifteen (15) minutes average according to thickness and condition of the plating being removed.

NOTE: A higher temperature for the solution decreases stripping time without affecting the base metal.

d) After being stripped, a part must be thoroughly rinsed in a flow of city tap water.

NOTE: Cup-shaped parts should be tipped and agitated to assure complete removal of the plating.

11) Cadmium Re-Plating Equipment and Materials

CAUTION: DO NOT USE BRIGHTENING AGENTS TO HEIGHTEN THE LUSTER OF A CADMIUM RE-PLATED PART.

a) The following materials are employed in cadmium re-plating:

acid salts (acid replacement)

cadmium ball anodes (cadmium metal)

cadmium oxide

caustic soda

city tap water

commercial alkaline cleaners

sodium carbonate (byproduct of decomposition of cyanide)

sodium cyanide

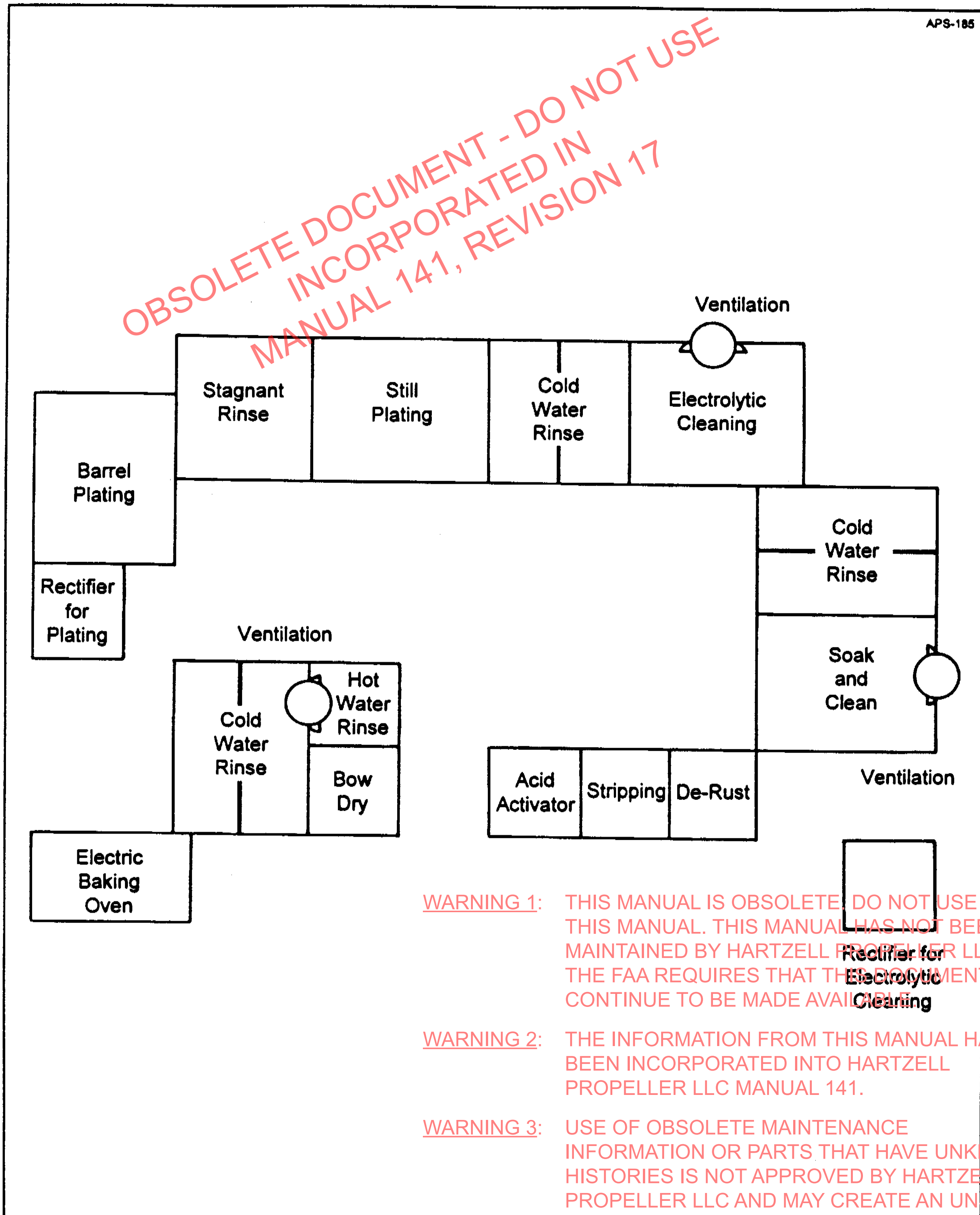
sodium hydroxide

Rust-X rust removal agent

Strip-Aid plating removal agent

b) Figure 6-6 shows typical arrangement of equipment in a cadmium plating (or re-plating) system.

c) Process small parts in wire baskets, except for the plating cycle when small parts may be transferred to a plating barrel.



Typical Cadmium Plating System
Figure 6-6

d) Maintain a master laboratory thermometer for checking accuracy of all thermometers used in the plating process.

e) Use a 26-volt meter to check accuracy of the rectifier for plating every six months. Maintain a record of these checks.

f) The operator should maintain a constant check on strength of the solutions and add materials as necessary to meet specifications.

g) An outside laboratory should analyze tank solutions at least once a month and make recommendations for addition of materials.

h) Any tank in the plating system can be fabricated of mild steel.

12) Cadmium Re-Plating Process

a) Soak Cleaning

Heat the tank of solution to between 180°F (82.2°C) and 210°F (98.9°C) by means of steam coils. Exhaust by lip ventilation.

Solution concentration can vary between 8 ounces (226.8 g) and 12 ounces (340.2 g) of chemical per gallon (3.785 l) of city tap water.

Time cycle can vary between two (2) and five (5) minutes depending on the mass of the parts and any soil on them.

b) Electrolytic Cleaning

Heat the tank of solution to between 190°F (87°C) and 205°F (96°C) by means of steel coils. Exhaust by lip ventilation.

Use reverse DC current as the activator with an alkaline-base chemical as the electrolyte.

Solution concentration can vary between 10 ounces (283.5 g) and 16 ounces (453 g) of chemical per gallon (3.785 l) of city tap water.

Time cycle can vary between five (5) and fifteen (15) minutes depending on the mass of the parts and any soil on them.

c) Cold Water Rinse

Required after cleaning cycles to remove cleaning solutions and residue soil.

Parts must be agitated in cold tap water flowing at a constant rate between 3 gallons (11.36 l) and 5 gallons (18.93 l) per minute.

Time cycle is not preset. Parts must be rinsed until completely free of the cleaning solutions.

d) Acid Activator

Cleaned and rinsed parts must be activated in preparation for cadmium plating.

Use 1 pound (0.453 kg) inhibited salts of H_2SO_4 per gallon (3.785 l) of tap water. Contain the acid salts in a plastic lined drum at room temperature.

No ventilation is required.

Time cycle varies between 15 and 30 seconds.

e) Cold Water Rinse

Required after acid activator cycle to remove all traces of acid salts from parts before they go into alkaline cyanide portion of plating cycle.

Parts must be immersed in cold tap water flowing at a constant rate between 3 gallons (11.36 l) and 5 gallons (18.93 l) per minute.

f) Still Cadmium Plating Bath (see also Cadmium Plating in Barrel)

Use the following materials in the designated concentrations for the bath solution:

	per gallon (3.78 L)
cadmium oxide	as required
cadmium ball anodes (cadmium metal)	2.2 ounces (62.37 g) to 3.75 ounces (106.3 g)
sodium cyanide	16 ounces (0.48 L) to 18 ounces (0.53 L)
sodium hydroxide	1.5 ounces (0.51 cl) to 3 ounces (1.01 cl)

CAUTION: DO NOT USE BRIGHTENING AGENTS TO HEIGHTEN THE LUSTER OF A CADMIUM RE-PLATED PART.

NOTE: Do not allow the sodium carbonate which results from decomposition of the cyanide to exceed six ounces (173.6 g) per gallon (3.785 l).

Use a DC motor generator set or rectifier as the power source.

Insulate the copper anode and cathode rails from the tank proper.

Parts being plated are suspended from the cathodic rail on special hooks or racks.

The cadmium ball anodes, contained in spiral wire baskets suspended from and in contact with the anodic rail, dissolve to provide constant cadmium metal in the solution.

Maintain voltage at from 2 to 6 volts depending on size and conformation of the parts being plated.

Hold current density at 10 to 20 ampheres per square foot (0.093 sq m).

Maintain bath temperature at room temperature.

No ventilation is required.

Immersion time for deposit of correct metal thickness varies from three (3) to ten (10) minutes.

g) Stagnant Rinse (Dragout)

Parts which have been cleaned and activated may be held in storage in the stagnant rinse tank prior to being plated.

This tank is used to rinse parts after plating and contains the dragout from the plating tank. It contains no overflow.

Maintain a concentration of at least 3 ounces (1.01 cl) of sodium cyanide per gallon (3.785 l) of tap water in the tank

No heating or ventilation is required.

NOTE: Cup-shaped parts should be tipped to assure complete drainage of the cadmium cycle materials.

h) Cold Water Rinse

Required after stagnant rinse to remove any remaining cyanide material.

The tank should be fabricated with an overflow drain for the cold tap water flowing at a constant rate between 3 gallons (11.36 l) and 5 gallons (18.93 l) per minute.

No heating or ventilating is required.

i) Hot Water Rinse

Required immediately after cold water rinse for drying and spot removal. Hot water rinse tank must be stainless steel—or lined with lead or rubber—to prevent rust on surface of hot water and deposits on plated parts.

Water must be clean and maintained at temperature between 180° F (82.2° C) and 210° F (98.9° C).

Ventilation is recommended for operator comfort.

Approved alternate drying methods include:

centrifugal air drying

sawdust drying

wiping with hot wet rags

j) <u>Baking</u>

CAUTION: ALL HEAT-TREATED ALLOY STEEL PARTS MUST BE BAKED AFTER CADMIUM PLATING TO ELIMINATE ABSORBED HYDROGEN AND PREVENT HYDROGEN EMBRITTLEMENT.

Transfer applicable parts from hot water drying cycle to a preheated electric baking oven.

Bake the parts for at least three hours at a temperature of 375° F (191° C) ±25° F (24° C).

NOTE: Do not begin the time cycle until top and bottom oven shelves are stabilized within the allowed temperature range.

CAUTION: STRESS RELIEF TREATMENT MUST BE STARTED WITHIN FOUR (4) HOURS AFTER THE PART IS PLATED.

Start the baking cycle as soon as possible after an applicable part has been cadmium re-plated.

Check the oven temperature monthly against an established master thermometer, and maintain a log of temperature readings and baking time cycles.

Verify the baking operation by ink stamping a "BA" on the part (if size of part allows).

k) <u>Cadmium Plating in Barrel</u>

An alternative method for plating small parts.

The horizontal barrel is self-motorized for tumbling action.

The barrel is suspended from the cathodic power rail, and a dangler-type anode is suspended from the trunnions.

After small parts have been stripped, cleaned and activated, they are transferred from wire baskets to the barrel.

Plating time varies from 6 to 60 minutes at 5 to 25 ampheres per square foot (0.093 sq m).

When the plating-in-barrel cycle is completed, small parts are returned to the wire baskets for baking (if applicable) and rinse cycles.

B. Shot Peening Procedures

CAUTION: IN HONING AN AREA OF RAISED MATERIAL, DO NOT REMOVE ANY PEENED AREA IN ITS ENTIRETY. REMOVE THE LEAST POSSIBLE AMOUNT OF STOCK TO ACCOMPLISH THE HONING OPERATION.

1) A shot peened surface may be polished, but the pebble grain surface must be maintained, otherwise re-shot peening is necessary.

a) Use a 180-grit or finer polishing wheel.

b) Remove only the necessary amount of the top of the shot peened surface.

c) If the pebble grain surface is removed, re-shot peen the piece.

2) General Shot Peening Procedures for Steel Parts

a) Heat treatment of steel parts must be completed prior to shot peening procedures.

b) Follow the Magnetic Particle Inspection Procedure for a steel part after re-shot peening.

3) General Shot Peening Procedures for Aluminum Parts

NOTE: Avoid temperatures over 212° F (100° C) in all post-peening procedures on aluminum parts. An aluminum hub exposed to temperatures in excess of 212° F (100° C) must be re-shot peened both internally and externally before further rework.

a) Follow the Anodic Coating Stripping Procedure for an aluminum part prior to re-shot peening.

b) Follow the Penetrating Dye Pentrant Inspection Procedure for an aluminum part prior to re-shot peening and re-anodizing procedures.

4) Masking and Preparation for Shot Peening

a) A part usually is shot peened only in a selected area, and finished areas of the part must be protected from the cannibalistic characteristics of the equipment and the process.

b) The mask material must be tough enough and resilient enough to absorb and rebound the shot without tearing off or eroding.

NOTE: 3M Scotch Brand Pressure-Sensitive Tape No. 280 is recommended by Hartzell for this application.

5) Shot Peening Equipment and Materials

a) For best shot peening results, use a suction air blast cabinet with floor-grate screening separator, return elevator air line and hopper.

b) The hardened steel shot must conform to SAE J827. It ranges in size from 0.039 inch (0.99 mm) to 0.055 inch (1.4 mm) diameter.

6) Shot Peening Process (Figure 6-7)

a) Blasting shot is stored in the hopper in the base of the air suction blast cabinet.

b) Air induced through a double-opening nozzle forms suction action in the feed hose. Shot is sucked up the line and out through the nozzle mouth in the direction of the workpiece.

c) Air flow to the nozzle can be controlled by a foot treadle or by a timer that automatically starts and stops flow of air and blasting material.

d) A counterweight system elevates and lowers the nozzle away from or toward the workpiece.

CAUTION: THE AREA OF THE WORKPIECE TO BE PEENED MUST BE PERPENDICULAR TO THE LINE OF THE BLASTING MATERIAL.

e) The workpiece must be perpendicular to the line of the shot and should be approximately 4 to 6 inches (101.6 to 152.4 mm) from the end of the nozzle opening.

f) Either the nozzle or the workpiece must be in constant, steady motion for uniform compression of the surface area.

g) Use a shield plate to block the workpiece from the blast stream when the valve is first opened. When the equipment is producing a steady flow of blast material, pull the shield aside, and direct the blast onto the surface of the part.

CAUTION: THE PEENED AREA MUST BE FULLY COVERED.

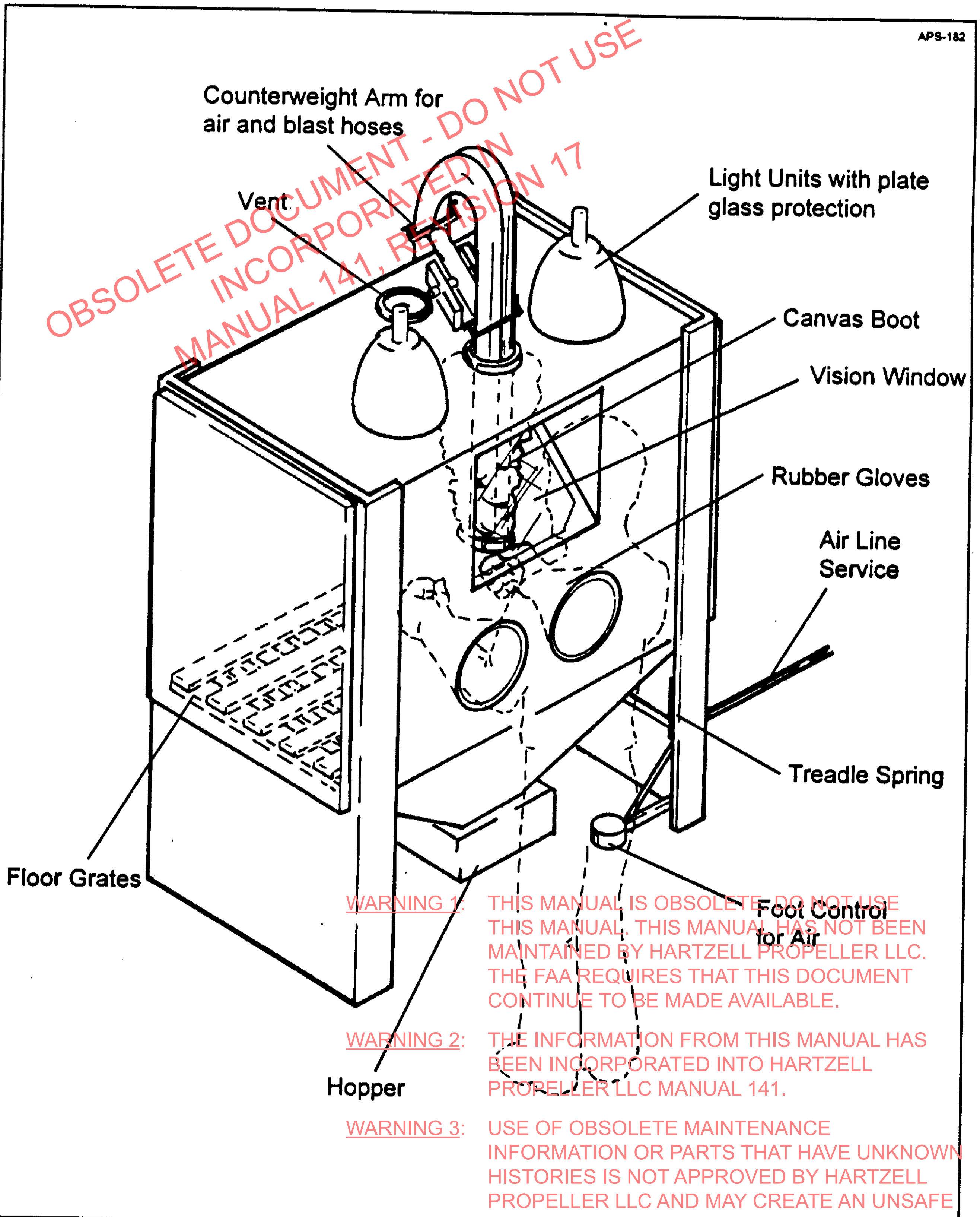
h) Small shot will produce full coverage of the peened area more rapidly than larger shot. Larger shot will produce impact depth and consequent high compression depths. In any case, full coverage is required.

i) Intensity of the blast (compression depth) is expressed as "arc height." It is determined by means of an Almen No. 2 Gauge.

7) Inspection Procedure for Shot Peening

a) An Almen No. 2 Gauge and Almen test strip should be used to inspect compressed stress areas on the surface of parts.

b) The gauging equipment consists of a holding block with four hold-down screws, a dial indicator attached to a check block, and an inserted test strip.



Suction Air Blast Cabinet for Shot Peening
Figure 6-7

c) The test strip is fastened to the holding block and put into compression on one side by the blasting operation. The gauge measures longitudinal and transverse curvature of the test strip.

NOTE: Blasting of the test strip duplicates as nearly as possible the operation to be used on the workpiece—including time, shot size, distance from nozzle opening and velocity.

d) Use an A-2 Almen test strip for shot peening work with wall thickness of 0.5 inch (12.7 mm) or less. Use a C-2 Almen test strip if wall thickness is greater than 0.5 inch (12.7 mm).

e) The amount of curvature measured by the dial indicator gauge is expressed as Arc Height.

NOTE: Curvature of the test panel should be checked before use to assure it is less than 0.001 inch (0.0254 mm).

f) Since shot peened parts cannot be inspected after the operation, the operator must run two Almen test strips—one before the peening operation and one after the peening operation.

8) Shot Peen Material and Equipment Control

a) Shot should be visually examined monthly in accordance with MIL-S-13165, Section 5.2.3. Used and undersize shot may be kept separate and rescreened later for additional use.

b) Shot size should be screen-checked weekly in accordance with MIL-S-13165.

1 Take a random sample of 50 grams of shot from the hopper.

2 Place the shot in a U.S. Standard sieve, and shake the screen until all of the undersize shot has passed onto the next size screen (or into the screen cup).

3 Weigh the material deposited on each screen. Check against specification for 50-gram sample of shot being processed.

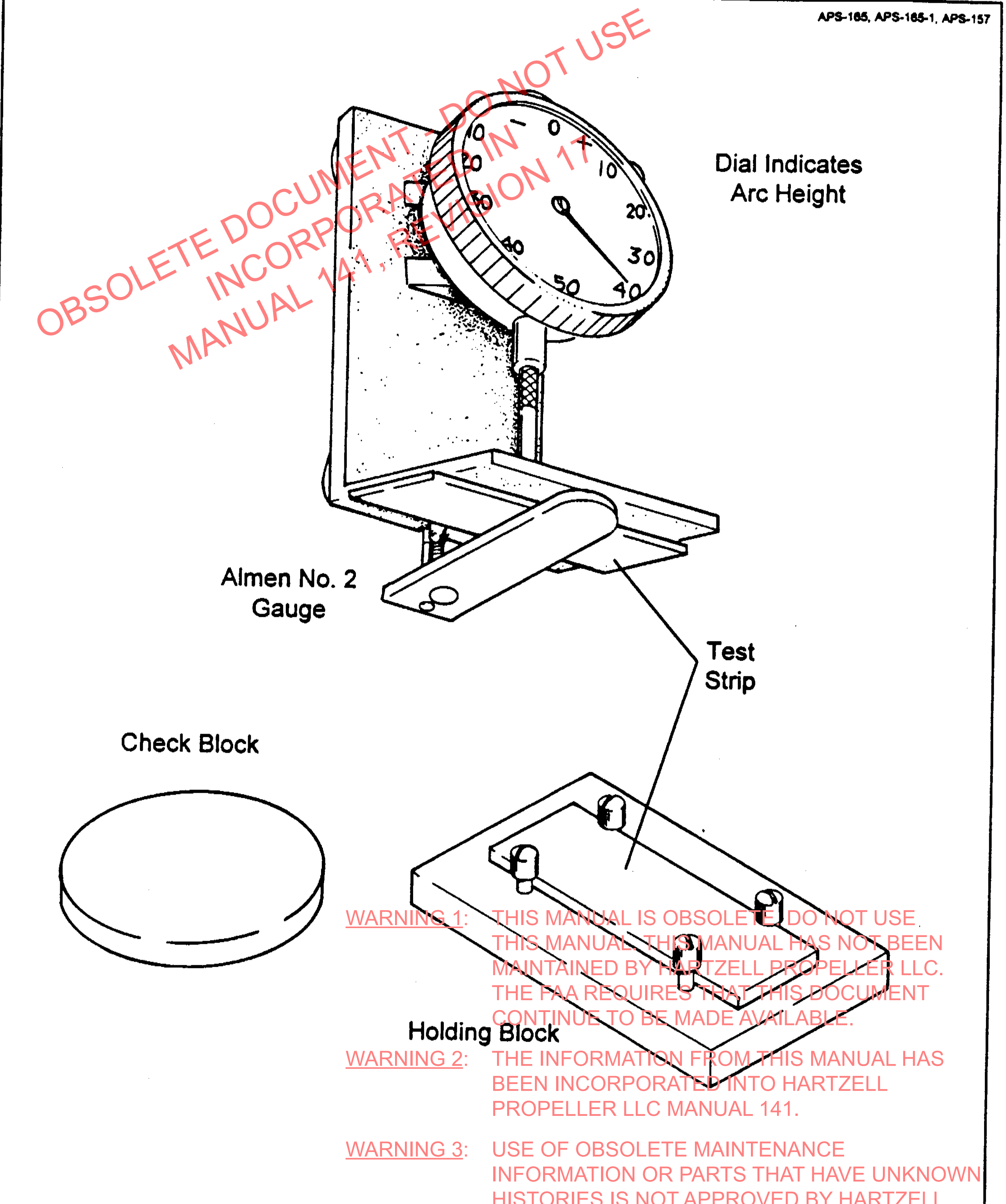
4 Maintain a log of screening results, and keep this log at the blast cabinet.

c) Check operation of air nozzles and vanes daily. Provide maintenance as necessary.

d) Check scales before each test by counterbalancing weights of approximately 50 grams. Adjust scales as necessary.

e) Gram weights should be sent to an outside source at least once every five years for calibration.

f) Visually inspect screens before each test for possible damage that would affect the test.



Gauging Equipment for Measuring Arc Height
of Shot Peened Part
Figure No. 6-8

9) Specific Shot Peening Procedures

a) Re-Shot Peening of Aluminum Hub

CAUTION: ALL ANODIC COATING MUST BE REMOVED FROM AN ALUMINUM HUB PRIOR TO RE-SHOT PEENING PROCEDURES.

1 Strip anodic coating from hub (see Specific Rework Procedures).

NOTE: Remove all traces of paint and sealant.

2 Use the following procedural controls for inside diameters (ID) and exterior surfaces of the hub:

Almen Strip	C-2
Arc Height	0.007 inch (0.178 mm) to 0.009 inch (0.229 mm)
Shot	S550

CAUTION: IMPROPER APPLICATION OF SHOT PEENING IN THE CRITICAL OUTBOARD BEARING RACE SEATING AREAS CAN CONTRIBUTE TO UNEVEN LOAD DISTRIBUTION AND CAUSE THE HUB TO CRACK.

3 As necessary, re-shot peen critical blade retention areas of hub after stripping and before re-anodizing (Figure 5-8).

C. Procedure for Stripping Anodic Coating from Aluminum Parts

CAUTION: DO NOT ALLOW AN ALUMINUM HUB TO REMAIN IN THE STRIPPING SOLUTION FOR LONGER THAN TWENTY (20) MINUTES OR THE HUB MAY BE DESTROYED.

CAUTION: REMOVE ALL ANODIC COATING FROM AN ALUMINUM PART BEFORE RE-SHOT PEENING IT. (DO NOT USE GLASS BLASTING).

WARNING: CHROMIC ACID IS POISONOUS WHEN TAKEN INTERNALLY AND DESTROYS ANIMAL AND VEGETABLE TISSUE. DO NOT WEAR COTTON CLOTHING, AND TAKE SPECIAL CARE NOT TO SPILL CHROMIC ACID ON CLOTHING OR SKIN.

1) Use the following materials in the designated concentrations for the stripping solution:

chromic acid	20 ounces (0.60 l)
phosphoric acid	48 ounces (1.42 l)
tap water	7 gallons (26.5 l)

2) Mix the materials in a tank fabricated of mild steel.

3) Heat the solution and hold it at a temperature between 190° F (87.78° C) and 200° F (93.33° C).

4) Immerse the part in the heated solution, being careful not to spill any of the solution on skin areas or clothing.

5) Time cycle for stripping action will vary from 5 to 30 minutes, depending on the temperature of the solution, the mass of the part and the thickness of the anodic coating.

6) Immerse the part in a tank of flowing demineralized water, and thoroughly rinse off the toxic chromic acid.

NOTE: As necessary, drain the chromic acid solution into a resin bed for disposal.

7) Aluminum oxide blasting is an acceptable alternate method for removing anodic coatings from aluminum parts.

NOTE: Blast pressure must not exceed 30 psi (2.11 kg/cm²).

NOTE: After stripping the anodic coating from an aluminum part—and before re-anodizing the part—use the fluorescent method for dye penetrant inspection (refer to Chapter 5).

D. Chromic Acid Anodizing Procedures

CAUTION: ALL ANODIC FILM OPERATIONS MUST BE PERFORMED AFTER ALL MACHINING AND PROCESSING OPERATIONS (EXCEPT FINAL PAINTING AND DECAL APPLICATIONS) ARE COMPLETED.

1) The chromic acid soft anodize process is approved by Hartzell for formation of a protective anodic film on aluminum metal parts to increase resistance to corrosion and abrasion and to protect the base metal from attack by foreign materials.

NOTE: Certain aluminum alloys may not accept an anodic film which will pass salt spray requirements.

2) The anodic coating should have uniform coloration and a smooth texture, free of crystalline and burned areas.

NOTE: Color can vary from light gray through silver gray to dark gray as long as it is uniform.

3) Use an anodicator to check thickness of the anodic coating after application.

NOTE: Resistance of the protective oxide coating is more important than its thickness, and the anodicator measures protective insulating value of the coating.

WARNING: ALKALINE CLEANERS NORMALLY IRRITATE THE SKIN. AVOID CONTACT WITH THEM.

4) The following materials are employed in chromic acid anodizing:

chromic acid (approximately 10% solution)

inert anodes (lead and/or steel)

demineralized water (produced automatically)

city tap water

commercial alkaline cleaners

NOTE: Sensing instruments built into the water demineralizer should indicate when the equipment requires regeneration.

5) Figure 6-9 illustrates a typical chromic acid anodizing system.

6) Chromic Acid Anodizing Process

a) Soak Cleaning

Use a tank fabricated of mild steel.

Prepare a cleaning solution for aluminum parts from one of the following commercial materials and in the designated concentration:

Taskleen D4 (Taskem, Inc.)

5 ounces (141.75 g) to 7 ounces (198.44 g) per gallon (3.785 l) of water

Spray Altrex (Wyandotte Chemical Co.)

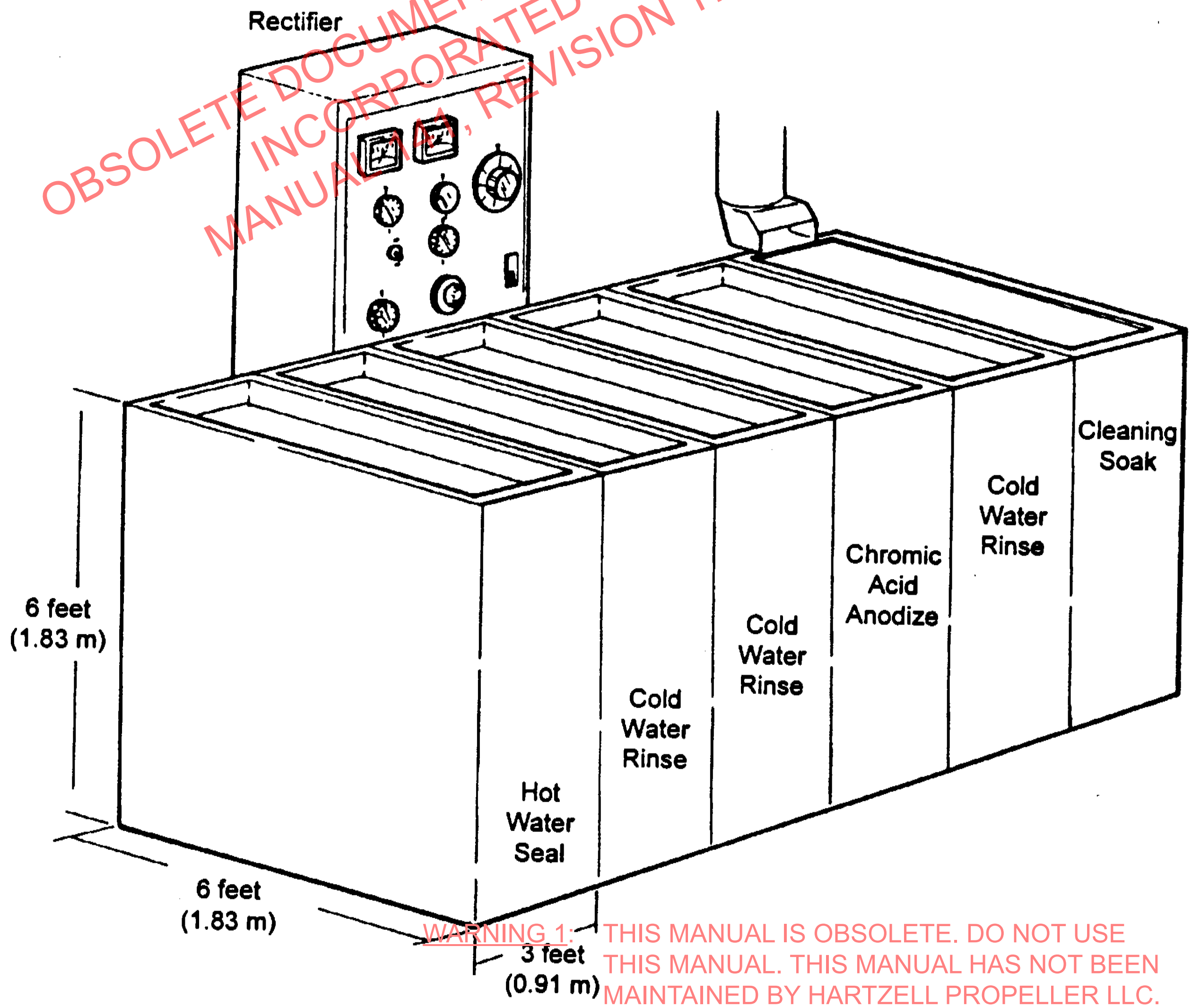
5 ounces (141.75 g) to 10 ounces (283.50 g) per gallon (3.785 l) of water

WARNING: WHEN BUILDING A NEW CHARGE IN THE CLEANER TANK, ADD LARGE AMOUNTS OF MAKE-UP WATER TO SMALL AMOUNTS OF THE ALKALINE MATERIAL TO PREVENT HEAT EXPLOSIONS.

NOTE: Check concentration of the cleaner solution regularly to assure its effectiveness.

Maintain the cleaning solution within temperature range designated, and immerse parts for the specified time period as follows:

Temperature Range	Immersion Time
Taskleen D4 150° F (65.56° C) to 160° F (71.11° C)	30 seconds to 60 seconds
Spray Altrex 160° F (71.11° C) to 190° F (87.78° C)	3 minutes to 10 minutes



Typical Chromic Acid Anodizing System
Figure 6-9

b) Cold Water Rinses

NOTE: Parts must be completely and thoroughly rinsed of the cleaning solution before they are anodized.

Two cold water rinses are required following the cleaning cycle to complete the removal of residual cleaning compound and loose soil.

Parts must be agitated up and down in the bath to assure complete rinsing.

The second cold rinse should be a constant flow of tap water with spray headers in the bottom of the tank providing additional air agitation so the operator can completely flush each part as it is raised from the solution.

There is no preset time for the rinse cycle.

c) Chromic Acid Anodize

Use a tank fabricated of mild steel. Exhaust by lip ventilation.

NOTE: DC power is carried from the rectifier to the parts in process on copper anode and cathode rails. The rails are insulated from the tank and the solution. The aluminum parts act as the anode.

Maintain accurate solution temperature of 95° F (35° C) ±4° F (2° C) by means of automatically controlled heating and cooling coils.

As necessary, use air agitation to control concentration of the solution.

Maintain current density between 1 and 6 amperes per square foot (0.093 sq m).

Fasten the parts tightly to titanium or aluminum racks that are in contact with the anode rail from which the parts are suspended in the solution.

Maintain concentration of the solution at approximately 10% to 5% of chromic acid by weight.

Parts must be kept in the solution for at least 40 minutes to attain the proper coating.

NOTE: The time cycle is approximately the same for any size of part.

d) Cold Water Rinses

Pre-rinse the thoroughly drained parts in cold city tap water.

NOTE: Parts must be thoroughly drained after the chromic acid anodize cycle before they are transferred to the cold water rinse cycle.

Final-rinse the parts in constantly recirculating industrial demineralized water.

NOTE: The final rinse tank should include a resin bed which removes chromic acid and holds toxic material for later disposal.

Recirculate the final-rinse water with a positive pump at a constant pressure between 13 gpm (49.2 lpm) and 17 gpm (64.3 lpm).

Use air agitation to assure complete removal of residual materials.

e) Follow both the Visual Inspection Procedure and the Anodicator Inspection Procedure to make sure there are no defects in the anodize surface.

f) Hot Water Seal

NOTE: Parts must be thoroughly rinsed and drained before the hot water seal cycle.

Use a tank fabricated of stainless steel. Exhaust by lip ventilation.

NOTE: All system components that are in contact with the hot seal solution must be made of stainless steel.

CAUTION: CONTROL OF THE SOLUTION TEMPERATURE IS EXTREMELY CRITICAL.

Immerse the parts in demineralized water heated to a temperature accurately maintained between 190° F (87° C) and 200° F (93° C).

NOTE: An acceptable alternate hot seal solution is: 6 ounces (0.177 l) of sodium dichromate per gallon (3.785 l) of demineralized water heated to a temperature accurately maintained between 178° F (81° C) and 182° F (83° C).

CAUTION: TIMING OF THE IMMERSION IS EXTREMELY CRITICAL.

Immersion time must be accurately controlled because the hardened anodic film will tend to become soft again if the solution temperature is too high or if the part is immersed for too long.

The anodic film is soft when the part first is immersed in the hot seal solution, and the film is hardened in about 15 minutes under normal conditions.

NOTE: Immersion time can vary between 15 and 20 minutes depending on mass and wall thickness of the part.

CAUTION: WHILE THE PARTS ARE COOLING FROM THE HOT WATER SEAL CYCLE—AND FOR THE 30 TO 60 MINUTES IMMEDIATELY FOLLOWING—THEY MUST BE HANDLED WITH CARE TO AVOID MARKING OF OR DAMAGE TO THE SEMI-HARDENED ANODIZE SURFACE.

After the hot water seal cycle, remove parts from the tank and allow them to air dry.

NOTE: An additional cold water rinse cycle is required when a sodium dichromate solution is used for the hot seal cycle.

7) Chromic Acid Anodizing Solution and Equipment Control

a) Solution Control

Check the concentration of tank solutions regularly. Maintain constant surveillance of amperage, voltage, liquid levels, temperatures and ventilation.

b) Equipment Control

Check the automatic temperature controllers on the tanks regularly using a precision laboratory thermometer.

NOTE: Always check in the same area of the tank where the sensing thermocouple is located.

Use a 260-volt meter to check the rectifier regularly.

NOTE: Have the accuracy of the volt meter checked at least once every six months.

8) Specific Chromic Acid Anodizing Procedures

a) Split-Hub Re-Anodizing Procedure

1 At overhaul, the guide bushing (68), Heli-Coil inserts (69) and K-Sert inserts (70) are removed from the split-hub unit (67).

2 Then, follow the Procedure for Stripping Anodic Coating from Aluminum Parts.

Do not allow an aluminum hub to remain in the stripping solution longer than 20 minutes.

If the hub is exposed to a temperature in excess of 200° F (93° C), it must be re-shot peened internally and externally before further rework.

3 Follow the Fluorescent Method for Dye Pentrant Inspection of the stripped hub (Figure 5-9).

If there is indication of a discontinuity, return the entire hub to the factory for evaluation.

4 Follow the Procedure for Re-Shot Peening of Aluminum Hub and Chromic Acid Anodizing Procedures.

5 Re-inspect the re-anodized hub before returning it to service using the Fluorescent Method for Dye Penetrant Inspection.

b) Bearing Clearance Check on Re-Anodized Split-Hub (Figure 6-10)

1 Install a No. AST-2870 tool in each blade retention radius of the engine-side hub-half (67).

2 Place the hub-halves together, and insert all twenty hex head hub bolts (61 and 62).

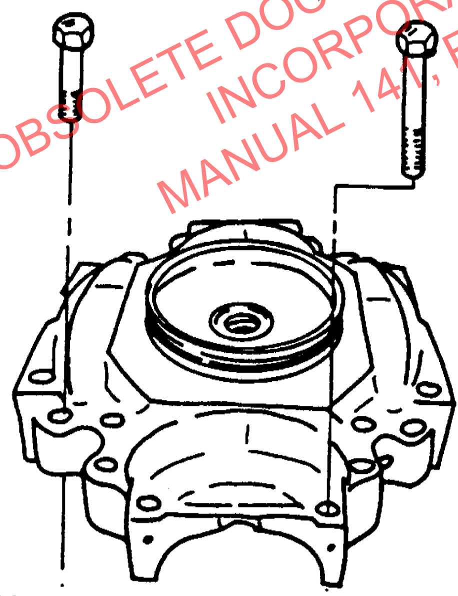
3 Add washers (63) and self-locking nuts (64).

APS-155, APS-970

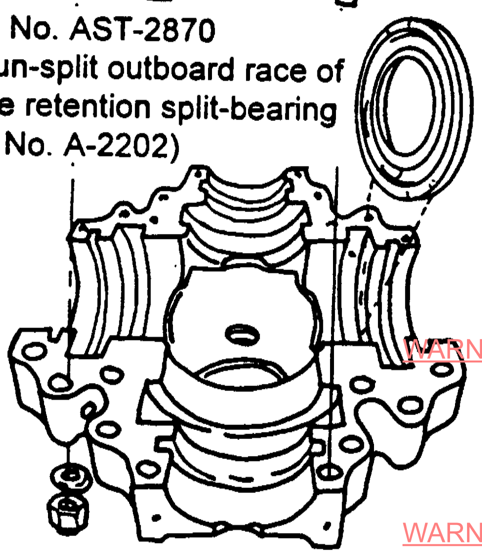
1. Install a No. AST-2870 tool in each blade retention radius.

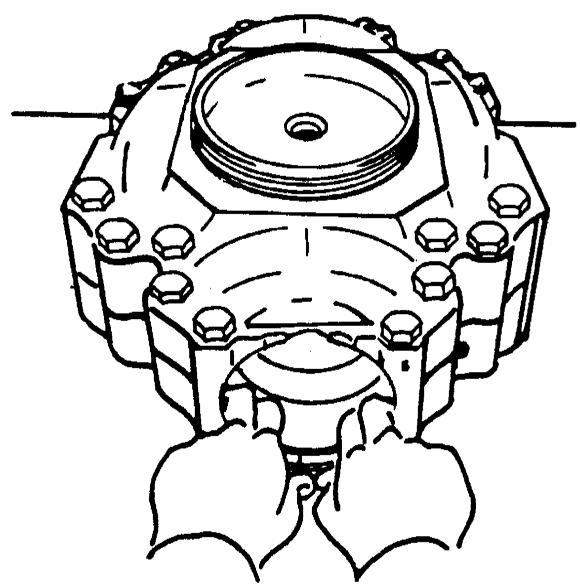
2. Use all twenty sets of hex hub bolts, washers and nuts to pull hub halves together.

   Torque to 22 lb-ft (30 N •m)



Tool No. AST-2870
(an un-split outboard race of blade retention split-bearing Part No. A-2202)





3. Pull tool forward to where it normally seats.

4. Try to rotate tool by hand in the blade retention radius.

NOTE: As necessary, add or remove material to assure proper fit at final assembly.

Using an Un-Split Outboard ("A") Race as Radius Comparitor
for Blade Retention Split-Bearing after Re-Anodizing Hub
Figure 6-10

4 Torque the nuts to 22 lb-ft (30 N•m).

5 Check the fit of each tool by pulling it forward to where it normally seats.

NOTE: If fit is proper, the tool should pull forward or push backward with little effort.

6 If the tool can be rotated by hand in the radius, it is too loose, and material must be added to build-up the radius.

7 Apply several coatings of approved "build-up" material to the hub bearing radius as necessary to restore proper fit of the tool.

8 If the tool fits too tightly in the bearing radius area of the hub, material must be removed from the hub radius.

CAUTION: DO NOT REMOVE MATERIAL FROM THE BEARING RADIUS OF THE HUB DEEPER THAN THE SHOT PEEN "PEBBLE GRAIN" SURFACE (FIGURE 5-9).

9 Polish the bearing radius area lightly with a fine-grit cloth to remove just enough material for proper fit of the tool.

10 When proper fit has been established between the tool and the blade retention split-bearing areas of the hub, the reworked hub is ready for reassembly procedures. (Refer to Split-Hub Replacement Section.)

11 As illustrated in Figure 6-11, use a round-bottomed stamp to restore the hub serial number at two locations and the model number at one location on each half of the split-hub.

E. Chemical Conversion (Cold) Coating Method

CAUTION: ANY ALUMINUM PART COATED BY A CHEMICAL CONVERSION METHOD MUST BE COVERED WITH HARTZELL POLYURETHANE PAINT IN ACCORDANCE WITH SPECIFICATIONS.

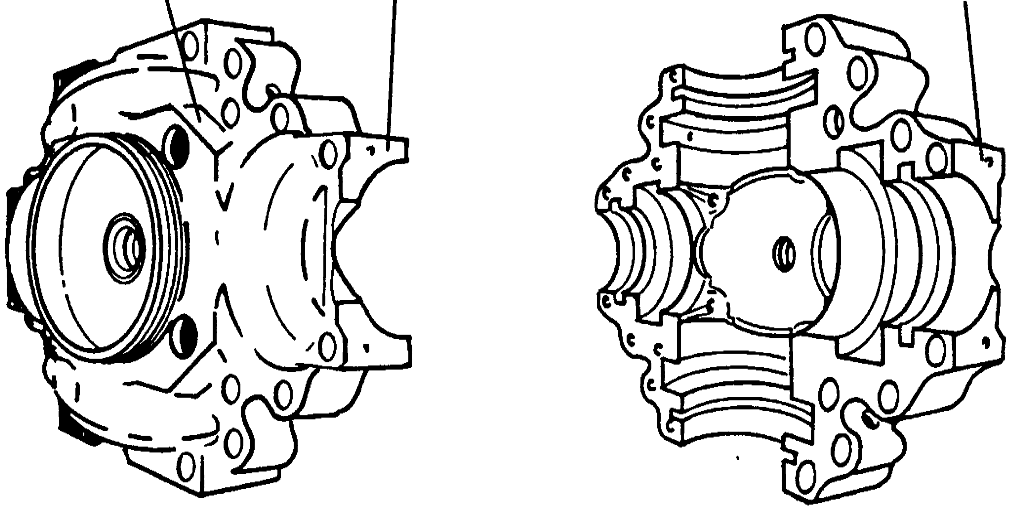
1) Chemical conversion liquids are an acceptable alternate to chromic acid anodizing for coating aluminum parts after rework.

a) Tasdip - AL, Chromicoat L25, Alodine 1201, Alodine 1200, and Alochrom 1200 are approved by Hartzell for chemical conversion (cold) coating of aluminum parts.

2) Follow the manufacturer's instructions for preparation and application of chemical conversion coating materials.

APS-006

CAUTION: STRIP ANODIC COATING FROM SPLIT HUB UNIT BEFORE BEGINNING RE-SHOT PEENING PROCEDURES.



CAUTION: USE A ROUND-BOTTOMED STAMP TO RESTORE SERIAL NUMBER AT TWO LOCATIONS ON EACH HALF OF THE SPLIT-HUB AFTER RE-ANODIZING.

Locations for Stamping Serial Number and Model Number on Reworked Split-Hub
Figure 6-11

3) Application of Polyurethane Paint on Chemical Conversion Coating

a) Materials Mix

1 part Sherwin-Williams V66V29 Polane Catalyst

6 parts Hartzell Z99AB503 Gray

3 parts Sherwin-Williams R7K69 or R7K84 Polane Reducer

Sherwin-Williams V66VB11 Accelerator as needed

NOTE: Mix the Gray paint thoroughly, and allow at least one hour of dwell time before mixing in reducer or accelerator prior to application.

NOTE: Pot life of the mix with accelerator is four (4) hours, without accelerator is 8 hours at 77° F (25° C).

b) Equipment

DeVilbiss MBC suction-feed air spray gun (or equivalent) with E tip needle and No. 30 air cap.

Apply at atomizing pressure between 40 psi (2.81 kg/cm²) and 45 psi (3.16 kg/cm²).

7-1. General Procedures for Reassembling the Propeller

A. **In preparation for reassembling and reinstalling the Hartzell propeller, make sure that all preliminary procedures have been followed.**

B. Review the following information before beginning reassembly procedures:

Chapter 1 - *Mandatory Parts Retirement Procedures*

Chapter 3 - *Special Tooling and Fixtures*

Chapter 4 - *Allowable Wear Limits Table, Figure 4-3*

Chapter 5 - *Cleaning and Inspection Procedures, including visual, magnetic particle, and dye penetrant inspections*

Chapter 6 - *Repair, Replacement and Rework Procedures, including cadmium plating, anodizing and shot peening*

Chapter 7 - *Torque Values Table, Figure 7-1*

Chapter 9 - *Reassembly when blades have been removed for shipment and for activating a propeller assembly after lengthy storage*

7-2. Specific Reassembly and Reinstallation Procedures

NOTE: As necessary during reassembly procedures, use clean, dry compressed air to clean out bits of metal and any other foreign material which may accumulate.

A. Split-Hub Unit

1) Use special tool, Figure 3-12, and install new Heli-Coil inserts (69) in engine-half of split-hub unit (67).

a) The insert has a driving "tang" for installation. The tang is notched for easy removal after installation of the insert.

b) During insertion, the special tool applies torque to the tang and reduces the diameter of the leading coil. This permits the coil to enter the tapped thread in the hub.

c) After installation, each coil of the insert expands outward with a spring-like action that anchors the insert.

2) Use special tool, Figure 3-13, and install new K-Sert inserts (70) in engine-half of the split-hub unit.

a) Each insert should be stopped at a depth between 0.010 inch (0.25 mm) and 0.030 inch (0.76 mm) below the surface of the hub unit.

b) Use the installation tool to drive in the keys, either with a hammer or with an arbor press.

TEMPORARY REVISION NO. 007

To Manual 61-10-56

This Temporary Revision is now considered a part
of Hartzell Propeller Inc. Four-Blade Lightweight Turbine Propeller Manual 156A.

NOTE: Record the incorporation of this temporary revision on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

Insert in REASSEMBLY, facing page 7-2 (Nov/92).

Reason for issue: To revise the Torque Values Table, Figure 7-1.

NOTE: See page 1 of this Temporary Revision.

CAUTION 1: TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS, UNLESS OTHERWISE STATED IN FIGURE 7-1.

CAUTION 2: TORQUE TOLERANCE IS ±10 PERCENT UNLESS OTHERWISE NOTED.

Item No.	Part Number	Description	Torque Ft-Lb	Torque In-Lb	Torque N•m
20	B-3830	Screw, Pitch Change	18 - 22	216 - 264	25 - 29
29	B-3368	Nut, Jam	---	120	13.5
38	B-474	Self Locking Nut / Piston	100	1200	136
39	D-6845	Cylinder	200 wet	2400 wet	271 wet
	D-484	Cylinder	200 wet	2400 wet	271 wet
40	D-494-( )	Pitch Change Rod	80 wet	960 wet	109 wet
45	B-468	Extension Bumper / Pitch Change Fork	---	72 - 96	8.2 - 10.8
49	B-3821	Socket Head Cap Screw	---	72	8.2
55	B-3839-16	Drilled Thin Hex Nut / Cylinder	120	1440	163
56	B-3375	Drilled Thin Hex Nut / Cylinder	165	1980	224
57	B-3841-5	Drilled Screw / Cylinder	---	41	4.6
64	A-2043-1	Self-locking Hex Nut / Hub Clamping	22	264	30
65	A-279	Lubrication Fitting	Tighten until snug		
	C-6349	Lubrication Fitting	Tighten until snug		
73	A-2070-( )	Button Head Screw / Bulkhead	---	96 - 120	10.9 - 13.5
77	B-3808-3	Self-locking Hex Nut / Pitch Change Rod	---	43 - 53	4.9 - 5.9

Torque Values Table
Figure 7-1

Item No.	Part Number	Description	Torque foot-pound	Torque inch-pound
-1	57B3339-1	B-3339-1 Bolt, Propeller Mounting	100-105 wet	
-4	368803080	AN526C1032R8 Screw, Spinner Assembly		17
-12	*AN501A10-( )	Balance Weight Screw, Balance Parts		17
-14	7919062712	NAS627-12 Bolt, 12-point	65	
-20	57B3825	B-3825 Screw, Pitch Change	16	
-29	57B3368	B-3368 Nut, Jam	10	
-38	57B0474	B-474 Nut, Self-Locking	115	
-39	57D0484	D-484 Cylinder	200	2400
-40	57D0494	D-494 Rod, Pitch Change	40	
-45	57B0468	B-468 Bumper, Fork	8-10	96-120
-47	793151966-131	MS51966-131 Set Screw, Socket	2-4	24-48
-49	57B3821	B-3821 Bolt, Hydraulic Parts	6-8	
-55	3617142316	NAS1423-16 Nut, Jam	120	
-56	57B3375	B-3375 Nut, Jam	165	1980
-57	360005050	AN501A416-5 Screw, Safety	1-5	12-60
-64	57A2043-1	A-2043-1 Nut, Self-Locking	22	
-65	57A0279	A-279 Fitting, Lubrication		40-50
-73	57B3384-3H	B-3384-3H Bolt, Spinner Mounting	8 - 10	96 - 120
-77	792190103	H10-3 Nut		40

CAUTION: TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS, EXCEPT FOR ITEM 1, PROPELLER MOUNTING BOLT, WHICH IS BASED ON THREADS WITH APPROVED LUBRICANT.

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

Torque Values Table
Figure 7-1

3) Install new guide bushing (68) in the engine-half of the split-hub unit.

   a) Use light sanding and the approved solvent to clean the bushing and its installation area in the engine-half of the hub unit.

   CAUTION: ALLOW TWELVE (12) HOURS MINIMUM TIME FOR THE ADHESIVE TO SET BEFORE RUNNING UP THE PROPELLER ON THE AIRCRAFT.

   b) Apply a liberal coating of the approved two-part epoxy adhesive to one-half the length of the bushing's outside diameter.

   NOTE: There should be enough adhesive on the bushing that an excess will be forced out of the hub when the bushing is inserted.

   c) Tap the bushing into the hub and hold the bushing firmly in place for a minimum of 45 seconds.

   d) Wipe excess adhesive from the hub surface.

4) Mount the engine-half of the hub on the rotatable fixture of the assembly table as shown in Figure 3-4.

   a) Apply a thin film of the approved lubricant to all four blade sockets in the engine-half of the hub.

   b) Apply a thin film of the approved lubricant to the O-ring grooves in the engine-half of the hub.

   c) Lubricate and install the engine-half hub O-ring (36).

B. Blade Pitch Change

1) Starting with Blade Number One, press the dowel pin (21) halfway into the pitch change knob (17).

2) Repeat this procedure for each of the other three blades.

C. Blade Preload

1) Install blade plug (26) in base of Blade Number One.

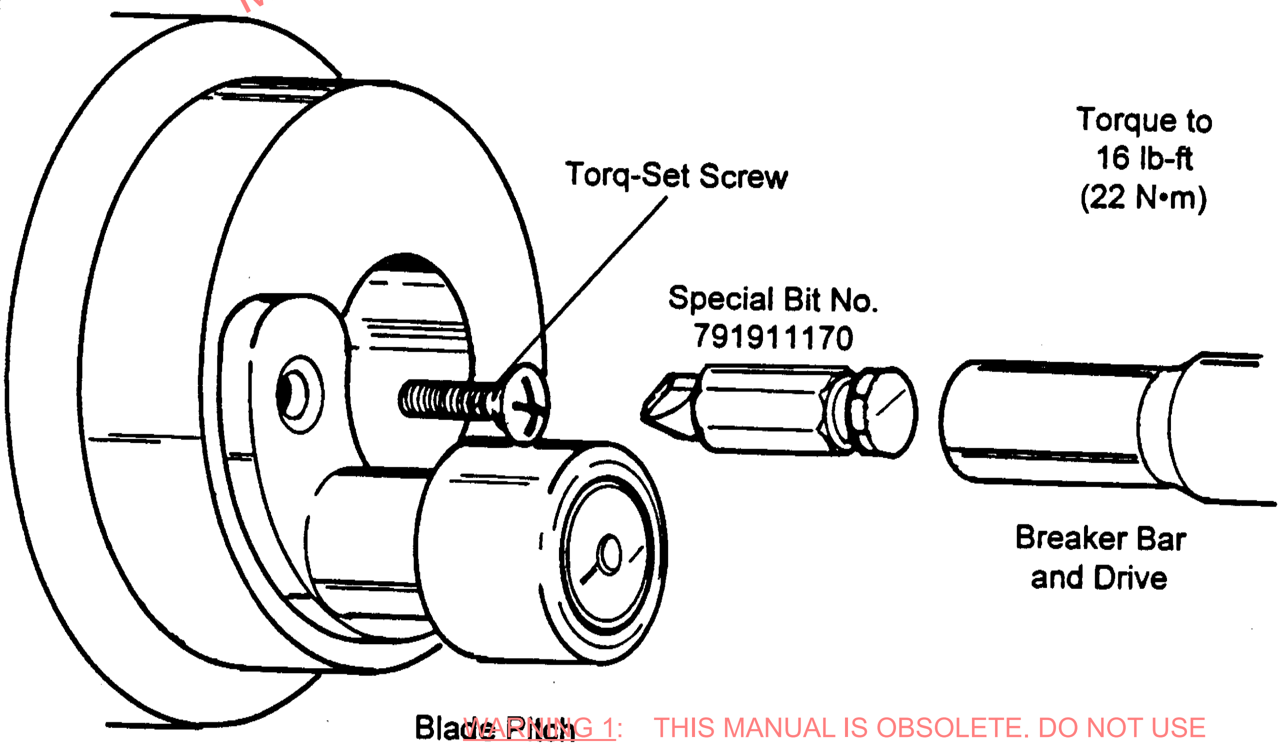
2) Insert needle roller bearing (27) and inner bearing ring (30) into base of blade.

3) Line up the mounting holes, and tap the blade pitch change unit bracket into place flush with the base of the blade.

   NOTE: Refer to pitch change unit selection data in Figure 10-4. Use alternate pitch change unit choices as necessary to bring floating pitch angle of all four blades within the specified tolerance of 0.10-degree.

4) As shown in Figure 7-2, use the special tooling (Figure 3-14) to install pitch change unit Torq-Set screw (20).

5) Torque the pitch change unit set screw to 16 lb-ft (22 N•m).



Procedure for Installing Special Torq-Set Screw
at Blade Preload Reassembly
Figure 7-2

6) Press inner bearing ring onto preload plate (28).

7) Loosely install set screw (31) and jam nut (29).

8) Repeat these procedures for the other three blades.

D. Split-Bearing Unit

1) Beginning with Blade Number One, apply approved adhesive to the inner races of the blade retention split-bearing (23), and press-fit the races into the radius of the blade base.

2) Install the bearing retention ring (25).

3) Apply sealant (72) to the shank to form a seal between the shank and the preload plate. The sealant has a self-adhesive tape on the back. Remove the protective paper and install as shown in Figure 7-3.

NOTE: The surface to which the sealant is to be applied must be clean and dry prior to installation.

Optional procedure: Adhesion of the adhesive tape on the sealant is sometimes marginal due to interaction with grease. For improved adhesion, if desired, 3M 1300L cement may be applied either directly to the blade shank or to the seal. A small amount of cement, enough to cover one side of the seal, is required. Allow approximately ten minutes for cement to cure prior to continuation of re-assembly. If 1300L cement is used, it is preferable to entirely remove the adhesive tape from the sealant.

4) Slide O-ring (22) over base of the blade.

5) Place a mound of approved lubricant on the preload plate unit (28).

6) Place ball spacer (24) around blade base, and add bearing balls.

7) Place the outer races of the split-bearing (23) on top of the balls, and use special clamp, Figure 3-8, to hold the parts together.

8) Install the blade base in its designated socket in the engine-half of the hub unit.

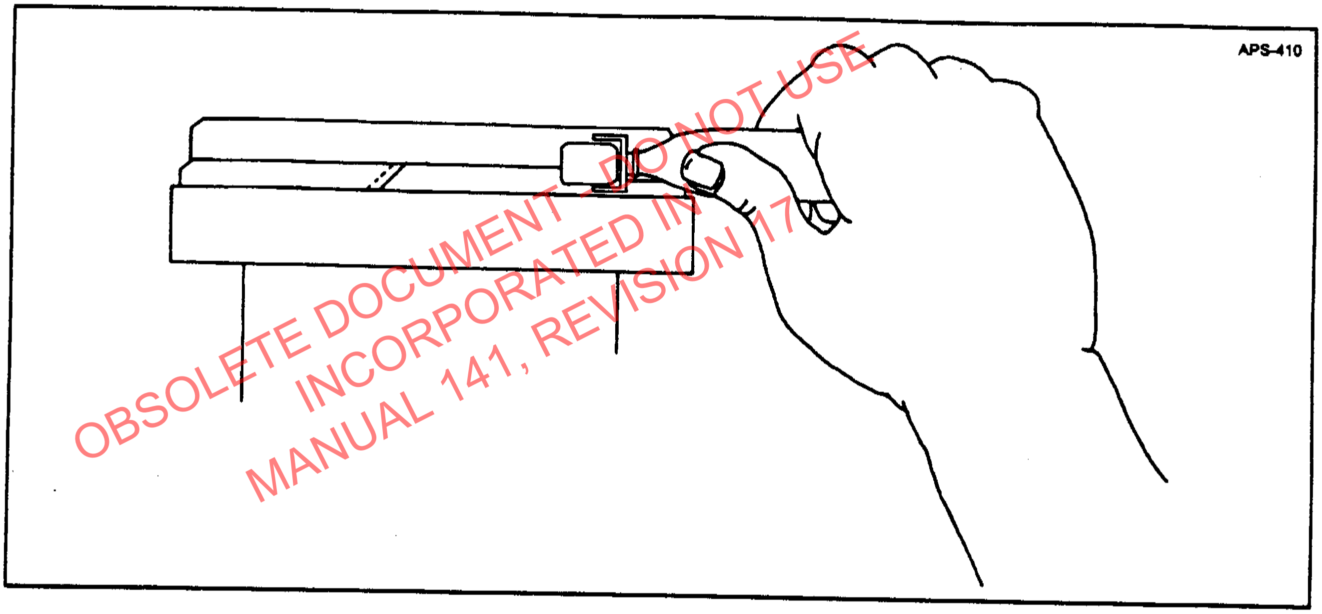
NOTE: Make sure the bearing split is at a 90-degree angle to the hub parting surface, as shown in Figure 7-4.

9) Repeat these reassembly procedures for the other three blades.

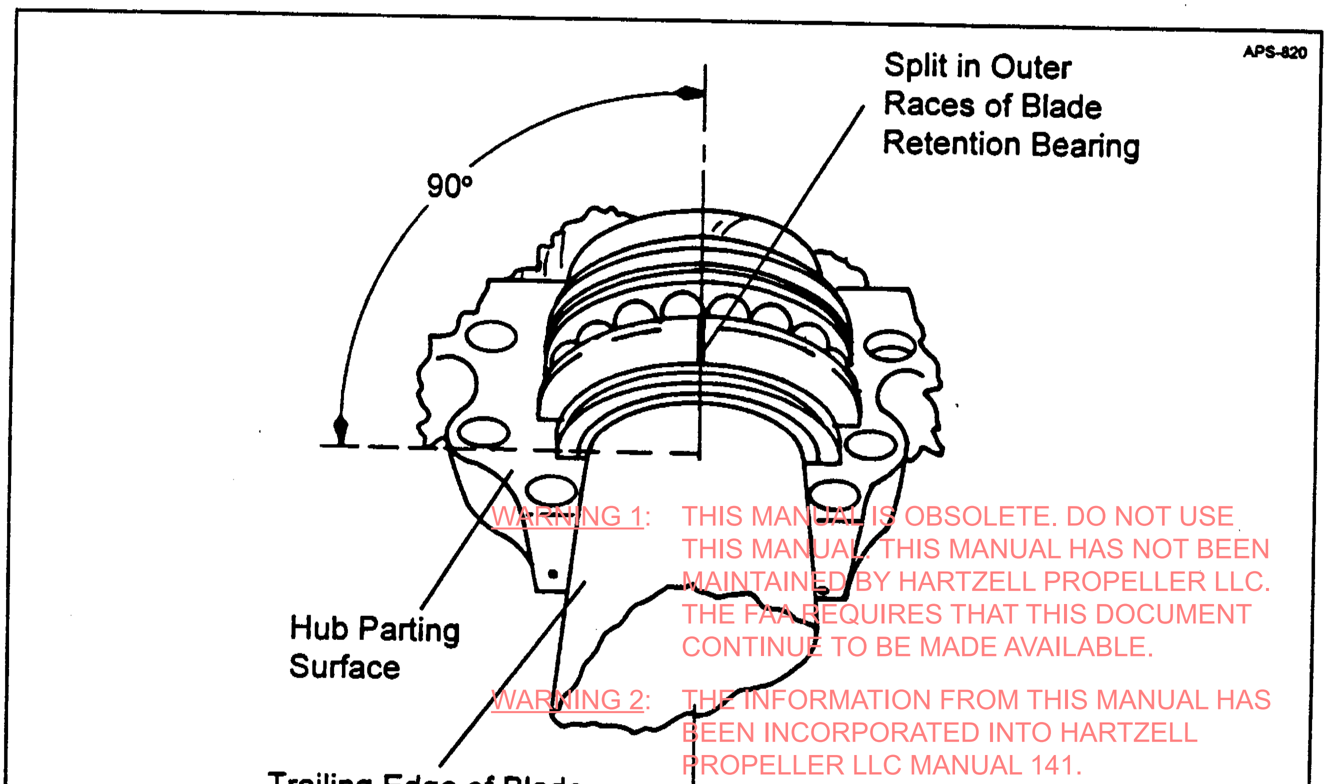
10) Install two of these three blade assemblies in their designated sockets in the engine-half of the hub unit.

NOTE: As necessary, tap the blade bases into their sockets with a soft hammer.

11) Temporarily install cylinder side hub half with the four centrally located short hexhead bolts (62), nuts (64) and washers (63). Torque the nuts as specified in Figure 7-1.



Applying Sealant to Blade Shank
Figure 7-3



NOTE: Split in outer races of blade retention bearing must be at 90° angle to the hub parting surface as shown.

Correct Positioning of Split in Blade Retention Bearing Races
Figure 7-4

Threaded Surface of Pitch Change Rod to Which Anti-Seize Compound Must be Applied Prior to Reassembly
Figure 7-5

12) Set the preload on the three blade assemblies by tightening the set screw (31) in each until the blade fits snugly into its socket. Turn the set screw 1/4 turn further into preload plate.

13) Remove the cylinder side hub half and the three blades. Install the one remaining blade in engine side hub. Repeat preload procedure for fourth blade.

14) When preload has been set on all blades, apply approved adhesive to the exposed threads of the set screw, and torque the nut (29) onto the end of the screw according to the table in Figure 7-1.

15) Remove cylinder side hub half and place two of remaining blades in cylinder side hub half.

16) Install bumpers (45) and buttons (46) on the fork (44).

17) With the three blades in full reverse position, maneuver the fork into position over the knobs of the pitch change units.

18) Reinstall the fourth blade assembly in its hub socket.

19) Apply a continuous bead of approved sealant on the parting half surface of the engine side hub half, just inboard of the hub through bolt holes, and just contacting the blade seals.

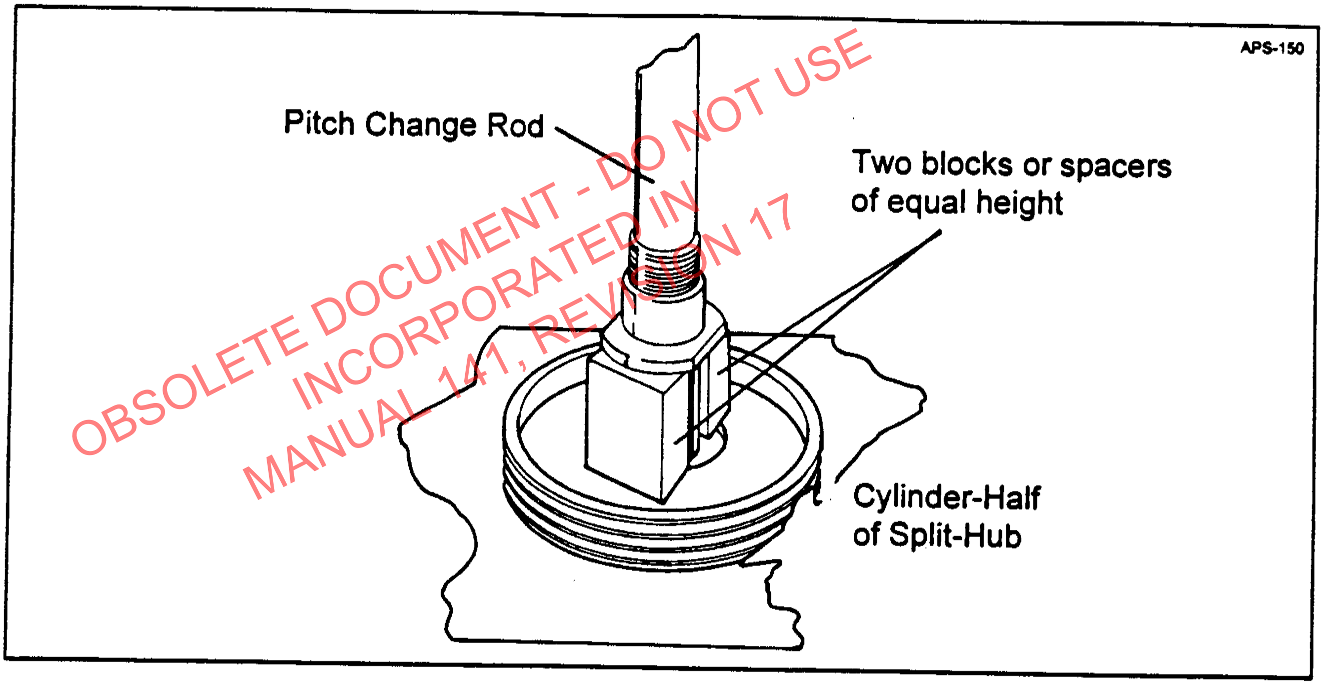
20) Reinstall the cylinder side hub half and all hub through bolts, nuts, and washers. Torque nuts (64) as specified in Figure 7-1.

E. Hydraulic System

1) Apply approved anti-seize compound to external threads on engine-end of pitch change rod (40) in the area indicated in Figure 7-5.

2) Thread the pitch change rod into center of engine-half of hub.

3) Torque pitch change rod into fork (44) to 40 lb-ft (54 N •m).



Using Blocks or Spacers to Hold Propeller in Low Pitch
for Check of Floating Pitch
Figure 7-6

F. Setting Floating Pitch Angle of Blades

NOTE: Refer to the applicable aircraft specifications manual or Hartzell Application Guide for specific blade angles required. Be sure the reference includes both the angle and the radius station.

1) As shown in Figure 7-6, place two blocks or spacers of equal height alongside the pitch change rod to hold the propeller in low pitch position for check of floating pitch position.

   NOTE: Blades must be torqued by hand toward high pitch position to assure that the cam followers are properly seated against the fork.

2) With bench-top protractor and riser fixture (Figure 3-7), check to make sure floating pitch angle for all blades is within specified tolerance of ±0.10-degree.

   NOTE: If blade-angle difference is greater than ±0.10-degree, replace pitch change unit(s) on blade(s), and recheck floating pitch until tolerance is achieved on all four blades.

   NOTE: Refer to Pitch Change Unit Selection Chart in Figure 10-4 to aid choice of replacement unit(s).

3) Torque all of these nuts to 22 lb-ft (30 N•m).

4) Use bench-top protractor and riser fixture to check angle of each blade at tip.

   NOTE: Reject any blade which does not have correct tip-angle.

G. Hydraulic System (resumed). Start Lock and Pitch Adjustment Unit

1) Start Lock

a) Turn socket set screws (47) an equal number of turns into each end of one start lock boss on the cylinder (39).

b) Insert one start lock housing (50) into a start lock cover (48).

c) Slide a high pitch stop pin (53) into the housing.

NOTE: The flat side of the pin must be in the direction of the piston lip it engages.

d) Place a start lock spring (51) inside the high pitch stop pin.

e) Compress the spring, and insert clevis pin (78). Insert small cotter pin (52) into clevis pin for retention.

CAUTION: DO NOT TIGHTEN THE START LOCK COVER CAP SCREWS AT THIS STAGE.

f) Fasten the start lock cover to the cylinder boss with four socket head cap screws (49), but do not tighten the screws until after feathering angle of blades has been set.

g) Repeat this reassembly procedure for the other start lock.

2) Lubricate and install the cylinder-half hub shoulder O-ring (33).

3) Apply a bead of approved sealant around the shoulder of the cylinder-half of the hub.

4) Lubricate and install the small piston O-ring (37).

5) Install the piston unit on pitch change rod (40).

6) Thread self-locking nut (38) onto the pitch change rod, and torque the nut according to Torque Values Table in Figure 7-1.

NOTE: Hold pitch change rod steady to prevent overtorquing into fork.

7) Lubricate and install the large piston O-ring (34) and felt dust seal (35).

NOTE: The felt dust seal must be free of fuzz.

8) Set cylinder (39) open-end-up on work table.

9) Apply anti-seize compound to the entire outer surface of each end-coil of the feathering spring (10).

10) Place the spring inside the cylinder and spring retainer (9) in the spring.

11) Apply anti-seize compound to the threads of the reverse adjustment sleeve (59), and install it through the retainer.

NOTE: Turn the reverse adjustment sleeve with a screwdriver as shown—just far enough that a wrench with crowfoot adapter can be applied to the flat surfaces on the other end of the sleeve.

Using Screwdriver to Thread Reverse Adjustment Sleeve
Through Cylinder
Figure 7-7

12) If the sleeve bushing (60) needs to be replaced, proceed as follows:

a) Use the approved cleaning medium to clean the bushing and the areas of the sleeve in which the bushings will be installed.

b) Use the approved adhesive to install the bushing.

c) Allow 24 hours drying time before grinding or boring the newly installed bushing to the specified inside diameter.

NOTE: The replacement bushing must be concentric to within 0.001 inch (0.03 mm) of the sleeve bore.

13) As shown in Figure 7-7, use a screwdriver in the slot in the reverse adjustment sleeve to thread the sleeve through the cylinder far enough that a wrench can be applied to the flat surface on the end of sleeve to pull it on through.

14) Apply approved anti-seize compound to the cylinder mounting threads on the hub and place the cylinder on the hub.

15) With special wrench (Figure 3-5), torque the cylinder to 200 lb-ft (271 N·m).

16) Install large jam nut (56) on the reverse adjustment sleeve.

17) Put inner small jam nut (55) on end of pitch change rod.

H. Counterweight Installation

Refer to the "Counterweight Clamp Installation for E11990K" in the Composite Blade Overhaul Procedures section.

I. Setting Blade Angles and Checking Blade Track

NOTE: Refer to the applicable aircraft specifications manual or Hartzell Application Guide for specific blade angles required. Be sure the reference includes both the angle and the radius station.

1) Apply 200 psi (14.05 kg/cm²) air or oil pressure to the propeller assembly.

2) Check to make sure there is no fore-and-aft movement in each blade.

NOTE: If there is fore-and-aft movement in a blade, it may indicate that the blade preload is set too loose. See the procedure described in Troubleshooting Guide, Chapter 2, to correct the problem.

3) Use a 0.25 inch (6.35 mm) diameter spacer to hold the high pitch stop pins (53) off of the start lock housings (50) while reverse angle and feathering angle are being set.

4) Refer to Figure 7-8 for station references for setting blade angles at reassembly and the appropriate blade manual for height allowance.

5) Turn the propeller assembly on the rotatable fixture of the assembly table, and recheck the height at the tip of each blade with a height gauge, as shown in Figure 7-9.

J. Setting Reverse Angle of Blades

1) With the propeller still pressurized, check reverse angle of each blade at appropriate station reference, using bench-top protractor and riser fixture (Figure 3-7).

2) If reverse blade angle is not correct, relieve pressure from the propeller, turn the reverse adjustment sleeve either clockwise to increase pitch or counterclockwise to decrease pitch.

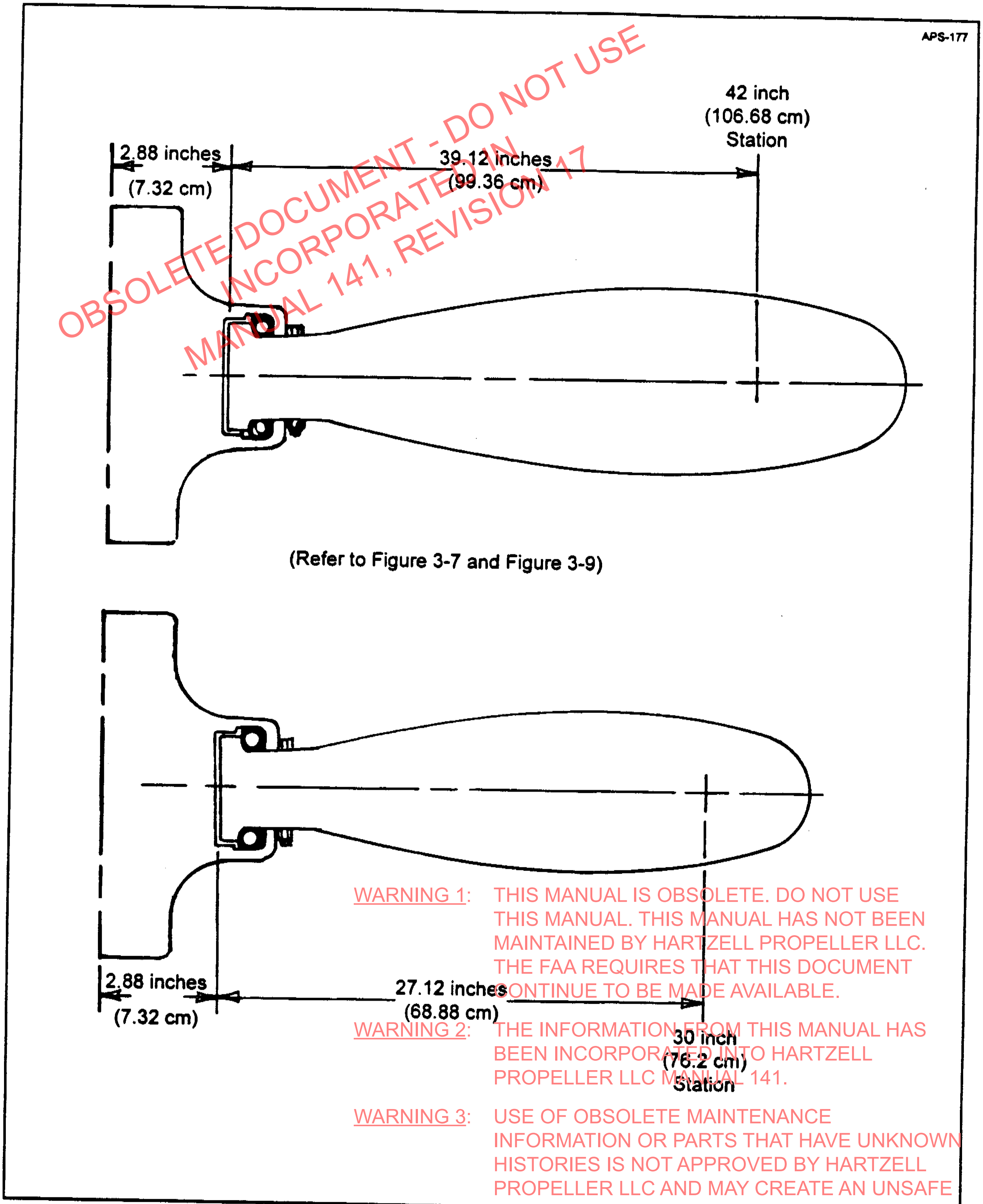
NOTE: One full turn of the sleeve equals approximately five degrees (5°).

3) After correction, repressurize the propeller, and recheck the reverse angle.

4) When correct reverse angle has been established in all four blades, tighten large jam nut (56), and torque it to 165 lb-ft (224 N •m).

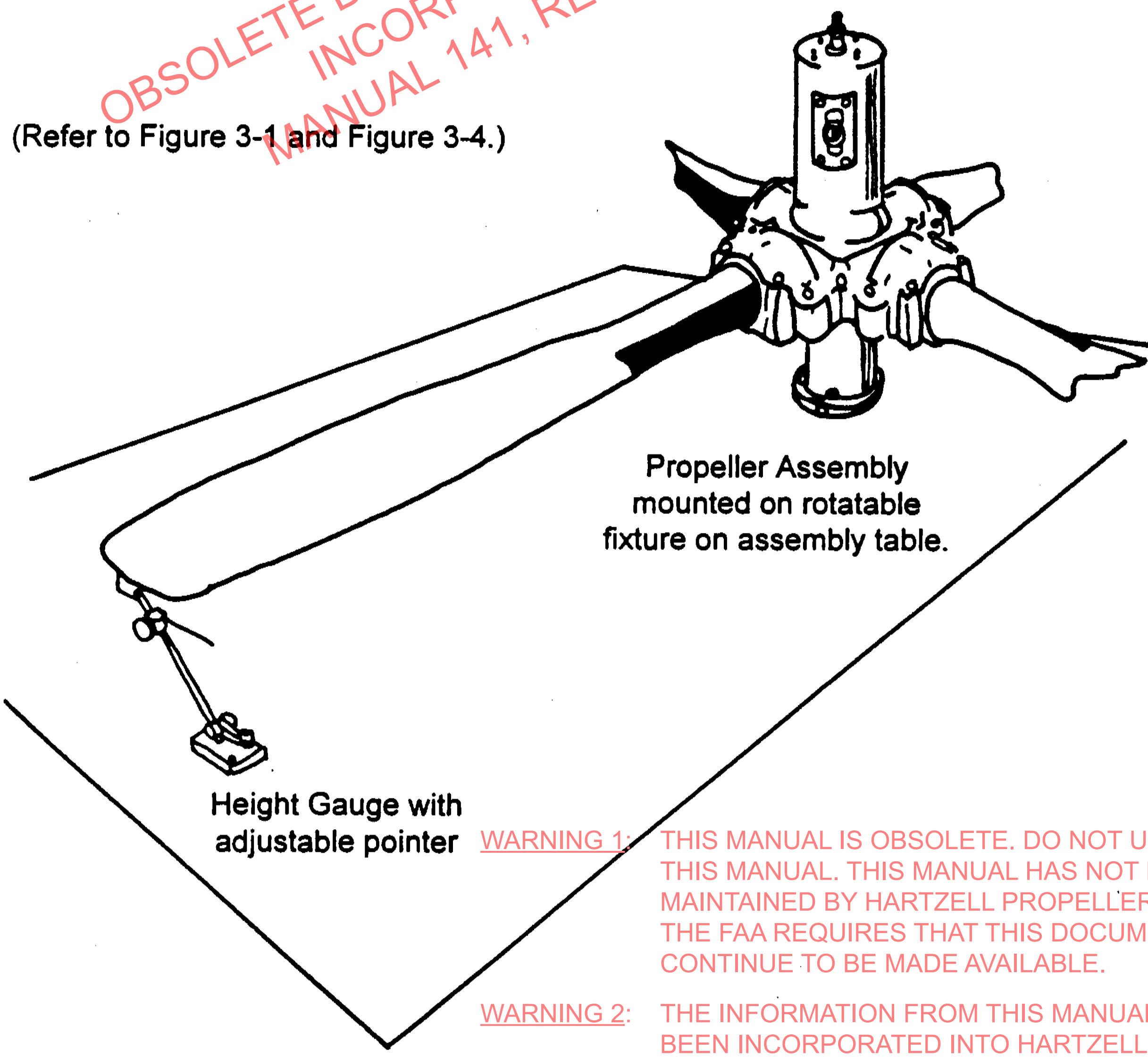
5) Install safety screw (57) and washer (58) in one of the holes provided in cylinder (39).

6) Wire large jam nut and safety screw for safety with 0.032 inch (0.813 mm) minimum diameter stainless steel safety wire.



Station References for Setting Blade Angles at Reassembly
Figure 7-8

(Refer to Figure 3-1 and Figure 3-4.)



Using Height Gauge with Adjustable Pointer
to Check Blade Track
Figure 7-9

K. Setting Feathering Angle of Blades

1) Release all air (or oil) pressure from the propeller.

2) With bench-top protractor and riser fixture (Figure 3-7), check the feathering angle of Blade Number One at the appropriate reference station.

3) If blade feathering angle is not correct, apply enough pressure to the propeller to move the pitch change rod out of the cylinder for accessibility.

CAUTION: INNER SMALL JAM NUT MUST CONTACT THE SHOULDER OF THE REVERSE ADJUSTMENT SLEEVE TO HOLD THE BLADES IN CORRECT FEATHERING POSITION.

4) Adjust the feathering angle by turning inner small jam nut (55) on the pitch change rod (40) either clockwise to decrease angle or counterclockwise to increase angle.

NOTE: One full turn of the small jam nut equals approximately five degrees (5°).

5) When correct feathering angle is established for all four blades, add outer small jam nut (55), and jam it against the inner small jam nut.

6) Wire the two small jam nuts for safety with 0.032 inch (0.81 mm) minimum diameter stainless steel safety wire.

7) Remove the spacers used to hold the high pitch stop pins off the start lock housings while reverse and feathering blade angles were being set.

8) Start Lock Reassembly (resumed)

a) Use the socket head cap screws (47) to adjust one start lock housing (50) as necessary to obtain the starting angle specified in the composite blade section in the back of this manual.

b) When the correct starting pitch has been set, tighten the four socket head cap screws (49).

c) Repeat steps a) and b) on the second start lock.

d) Wire the cap screws for safety with 0.032 inch (0.81 mm) minimum diameter stainless steel wire. Use a front-to-back "S" pattern.

L. Engine-Side Bulkhead Unit Installation

1) If the propeller is equipped with a de-icer system, use buttonhead socket cap screws inserted through the engine-side bulkhead unit (6) to fasten the slip ring to the engine-half of the split-hub.

NOTE: Follow reinstallation instructions in the applicable manufacturer's manual.

2) Torque the buttonhead socket cap screws to between 70 and 100 lb-in (11 and 14 N•m).

3) Safety the buttonhead socket cap screws to each other with 0.032 inch (0.81 mm) minimum diameter stainless steel wire.

7-3. Final Inspection of the Reassembled Propeller

Use Form No. AICO-141, Assembly and Inspection Check-Off Record (Figure 7-10) as a check-list for final inspection of the reassembled propeller.

7-4. Decal Replacements

A. All CAUTION decals, informational decals and identification decals on the propeller assembly must be replaced after overhaul or major repair.

B. The following decals are affected (Figure 7-11):

1) POM on piston

2) A-1025 on piston

3) CAU-112 on blade base

4) CAU-113 on blade base

5) REM-922 near lubrication fitting

6) A-1026 on cylinder

7) A-3594 on hub-half close to lubrication fitting

8) A-4900 on cylinder

C. Refer to the composite blade section in the back of this manual for blade decal replacement instructions.

D. Follow Propeller Balancing Procedures as necessary.

1) If applicable, apply Warning Decal Part No. A-2803 to engine-side bulkhead (Figure 8-2).

Hartzell Constant Speed Propeller
Assembly Inspection Check-off Record
Reversing and Feathering Propeller

MODEL HC-D4N-5	Assembly Serial No.
Customer	Factory No.
Order No. New	Repair Experimental
Hub Assembly No. D-471	Blade Angles
	Reverse Pitch ° Start Lock °
BLADES Design No.	Feather Angle ° (Checked by Assembler)
Ser. No. & & &	Track Friction
Cur. Design C472 -	Built By: Insp. By:
Hub Bolts Torqued at 22 ft. lbs.	
Gap Between Halves Max. .0015	Functional Test 0 to 200 lbs.
PISTON C482	Bulkhead S/N Cylinder S/N
PR902-48-2 "O" Ring	Difference Between Blades in Floating Pitch
B1843-3 Dust Seal	42" Sta. 48" Sta.
C482 Piston Unit Pinned	Deicer Slip Ring Ass'y No. Ser. No.
BALANCE Greased By:	Deicer Unit Installed Yes No.
Slugs Per Blade (1) (2)	Deicer Platter Runout -
(3) (4)	(4) NAS1351-3H6P Screws Safetied
	(2) NAS1423-16 Jam Nuts Safetied
REMARKS	(8) 1652B Zerks & "B" Lubricaps Installed
	INSTALLATION PARTS
	(8) B3339-1 Bolts (1) 909-8 "O" Ring
	(8) A2048-1 Washers (1) B439 Adj. Screw
	F.A.A. Designee
	Inspector
	Date

** For Repairs Only! Complies with all Hartzell Service Bulletins through AD & Bulletin

** This propeller has been repaired in accordance with FAR Part 43 or in accordance with manufacturer's approved data on file with the Federal Aviation Agency and is classed as a minor repair. This sheet should be attached to your log book in lieu of a log book entry in compliance with requirements of FAR Part 43.

** Not applicable if assembly is new.

Propeller Assembly Inspection Check-Off Form AICO-141
Figure 7-10

Remove other fittings to avoid blowing out gasket and "O" ring seal. Fill with grease here.
PART NO. REM-922

Decal No. REM-922
on each Hub-Half
close to lubrication
fitting

PLEASE READ
HARTZELL
propeller owner's manual
FOR INSTALLATION INSTRUCTIONS
POM

Decal No. POM
on Piston Unit

NOTE: See Figure 7-12 for standard locations of replacement decals.

CAUTION
DO NOT
PUSH OR PULL AIRCRAFT USING PROPELLER BLADES.
CAU-112

Decal No. CAU-112
on Blade Base

TORQUE B-3339-1 MOUNTING BOLTS
100 to 105 FT. LBS.
LUBRICATED THREADS
[Per Applicable Installation Instruction]
A-1025

Decal No. A-1025
on Piston Unit

CAUTION
DO NOT USE BLADE PADDLES IN DE-ICE BOOT AREA. PLACE PADDLES IN THICKEST AREA BEYOND DE-ICE BOOT.
CAU.113

Decal No. CAU-113
on Blade Base

PROPELLER S/N ____________
LUBRICATED WITH ____________
THIS GREASE MUST BE USED ON ALL SUBSEQUENT LUBRICATIONS.
DECAL NO. A-3594

Decal No. A-3594 on Hub-Half
close to lubrication fitting

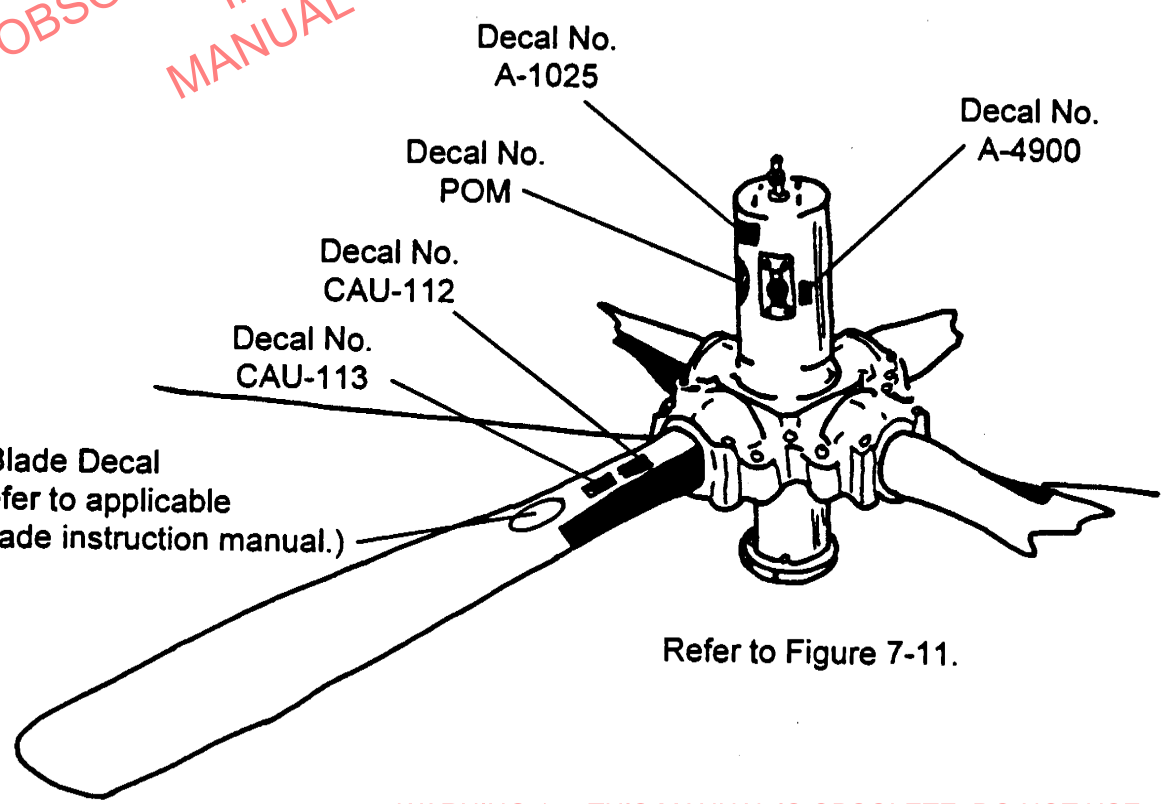
DANGER
SPRING RETAINED BY CYLINDER.
TO AVOID INJURY,
USE PROPER DISASSEMBLY TOOLS TO ASSURE SAFE REMOVAL OF CYLINDER FROM HUB.
A-1026

Decal No. A-1026
on Cylinder

Caution - DO NOT release automatic high pitch stop pins without proper control.

Decal No. A-4900
on cylinder

Replacement Decals for Four-Blade Lightweight
Turbine Propeller Assembly
Figure 7-11



Standard Locations for Replacement Decals
on Four-Blade Lightweight Turbine Propeller
Figure 7-12

7-5. Reinstalling the Propeller Assembly on the Aircraft Engine

A. With a suitable crane hoist and sling, carefully move the propeller assembly up to the mounting flange on the aircraft engine.

NOTE: Follow the applicable manufacturer's instructions for reinstallation of de-icer system.

1) Make sure the propeller hub flange and engine flange are clean and flat.

2) Line up the mounting holes in the propeller hub flange with the mounting holes in the engine flange.

3) Install the specified oil seal on the engine flange.

CAUTION: USE ONLY PROPELLER MOUNTING BOLT PART NUMBER B-3347.

CAUTION: REPLACE ALL PROPELLER MOUNTING BOLTS AND WASHERS AT OVERHAUL. MOUNTING BOLTS AND WASHERS MAY BE RE-USED ONLY WHEN THE PROPELLER ASSEMBLY IS BEING REIN-STALLED AFTER HAVING BEEN REMOVED BETWEEN OVER-HAULS.

4) Apply approved anti-seize compound to the threaded surfaces of the eight propeller mounting bolts (1).

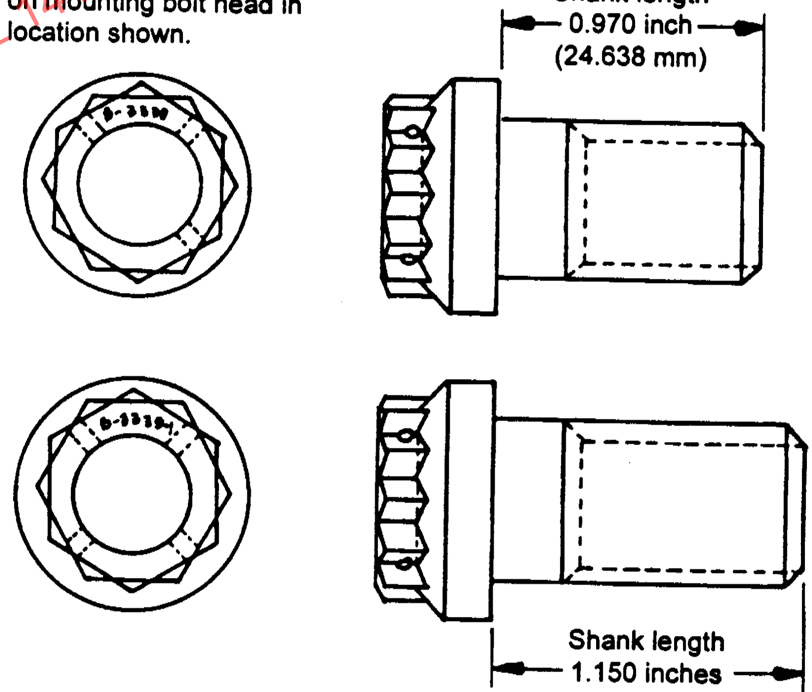
NOTE: Mounting Bolt Kit Number A-2338 (available from the factory) includes the mounting bolts, washers, anti-seize compound and replacement decal required for this installation.

5) Install the mounting bolts with washers (2) through the engine flange and into the propeller hub flange.

NOTE: Any version of mounting bolt washer part number A-2048-2 may be used (or re-used) with the B-3347 mounting bolt. The five versions of washer A-2048-2 which have been produced to date can be identified visually by characteristics shown in Figure 7-14.

6) Use wrench with special adapter (Figure 3-2) to torque all mounting bolts in sequences and steps shown in Figure 7-15.

7) Safety all mounting bolts in an airworthy manner with 0.032 inch (0.81 mm) minimum diameter stainless steel wire.

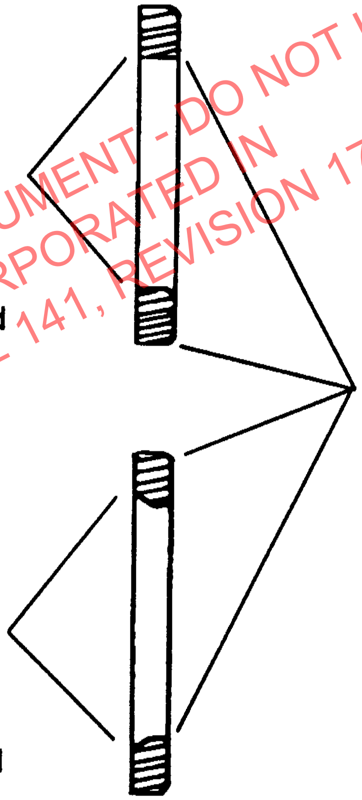


NOTE: B-3339-1 is used with HC-(D, E)4(N, P)-3 propeller.

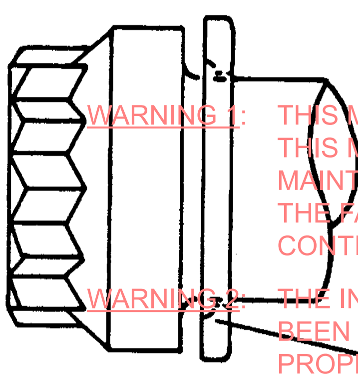
B-3347 is used with HC-E4A-3 propeller.

B-3347 shank length is 1.400 inches (3.556 cm).

Identification of Propeller Mounting Bolts
Figure 7-13



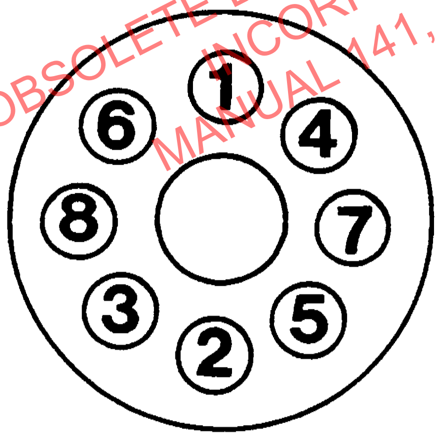
NOTE: Size of chamfer varies from washer to washer. This condition is acceptable.



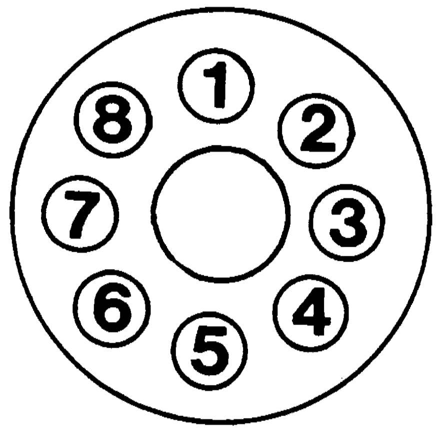
Various Versions and Installation Procedure,
Stamped Washer No. A-2048-2
Figure 7-14

APS-272

HC-E4P-5 Propeller



SEQUENCE A



SEQUENCE B

SEQUENCE A

Step 1 - Torque all bolts to 40 lb-ft (54 N •m)

Step 2 - Torque all bolts to 80 lb-ft (108 N •m)

SEQUENCE B

Step 1 - Torque all bolts to between 100 lb-ft (136 N •m) and 105 lb-ft (142 N •m)

Diagram of Torquing Procedures for Propeller Mounting Bolts
Figure 7-15

7-6. Spinner Reassembly (Refer to Figure 7-16 in addition to Figure 10-2)

CAUTION: THE SPINNER DOME MUST PRESS FIRMLY AGAINST THE END OF THE ENGINE-SIDE BULKHEAD UNIT.

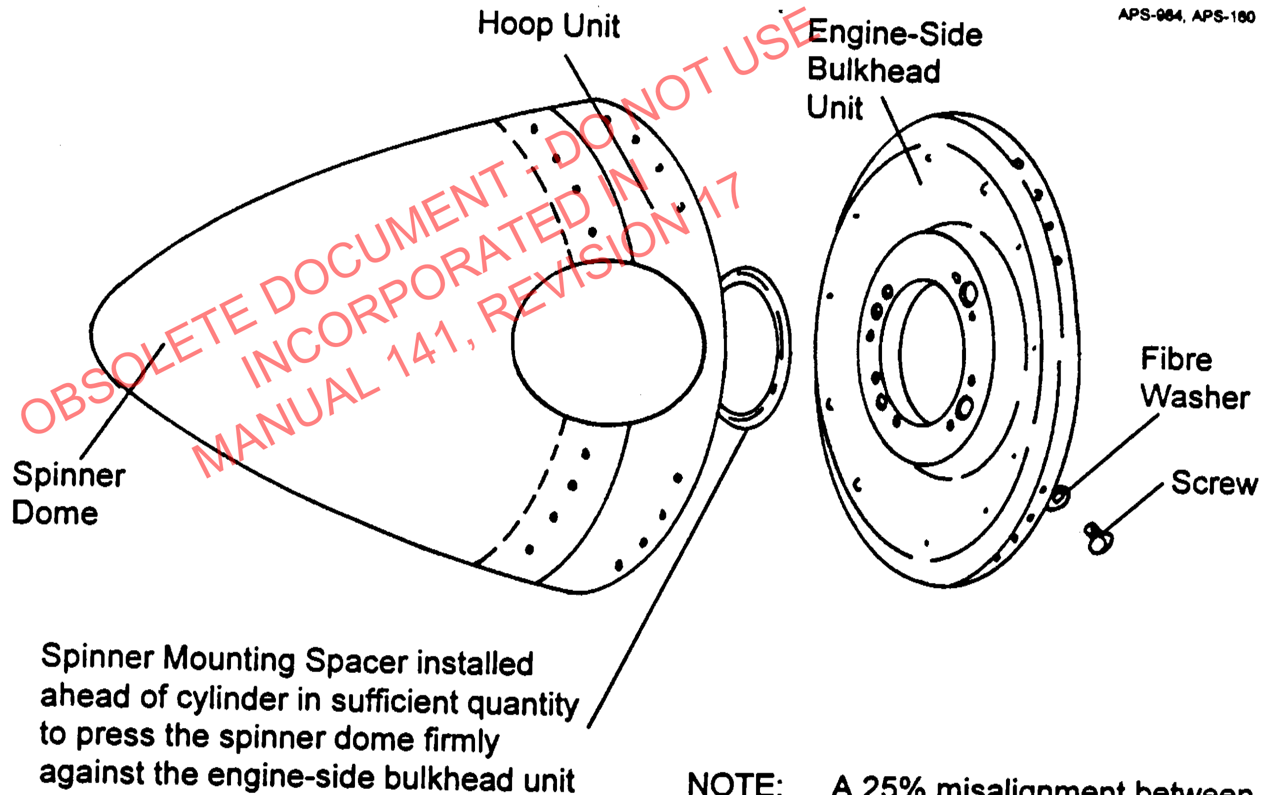
A. Carefully slide the spinner dome (7) over the reassembled propeller, and press on the dome to check for adequate tension between it and the engine-side bulkhead unit.

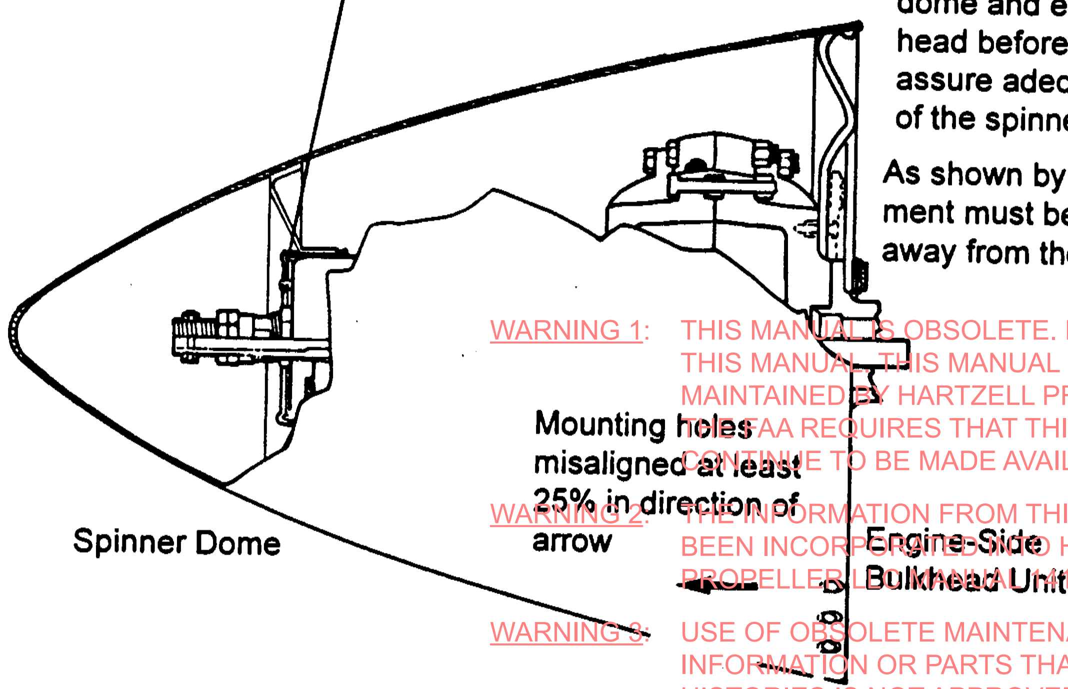
NOTE: There is adequate preloading in the fit between dome and engine-side bulkhead when at least 25% of the area of a mounting hole in the dome is misaligned with its matching hole in the outer circumference of the bulkhead in the direction away from the bulkhead.

B. As necessary to increase preloading, install spinner mounting washers (8) over inner flange of the hoop unit (79) until the spinner dome is pressed firmly against the engine-side bulkhead unit.

C. Use new fibre washers (5) and screws (4) to re-attach the spinner dome to the outer circumference of the engine-side bulkhead unit.

Reassembly and reinstallation of the propeller is now complete.





<u>NOTE</u>: A 25% misalignment between mounting holes in spinner dome and engine-side bulkhead before assembly will assure adequate preloading of the spinner dome.

As shown by arrow, misalignment must be in direction away from the bulkhead.

Spinner Reassembly Procedure
Figure 7-18

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WARNING 2: THE INFORMATION FROM THIS MANUAL HAS BEEN INCORPORATED INTO HARTZELL PROPELLER LLC MANUAL 141.

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8-1. Static Balancing Procedures

CAUTION: COMPLETE THE INSPECTION PROCEDURES DETAILED IN THE COMPOSITE BLADE SECTION IN THE BACK OF THIS MANUAL BEFORE ATTEMPTING TO STATICALLY BALANCE THE BLADE AND HUB ASSEMBLIES.

CAUTION: STATICALLY BALANCE THE PROPELLER BEFORE ADDING LUBRICANT TO THE HUB UNIT. RECHECK BALANCE AFTER ADDING LUBRICANT.

NOTE: The outboard surface of a counterweight clamp half is the preferred location for static balance weights.

NOTE: Although one balance weight may be added on the surface of the blade socket shoulder of the hub unit, weight attachment is difficult because of restricted access to the area.

A. As shown in Figure 8-1, balance the propeller statically by adding balance weights (11) to the outboard surfaces of the counterweight clamp halves and/or by adding no more than one balance weight (12) on each blade socket shoulder of the hub.

NOTE: Balance the propeller with the blade angle set in a position between low and high pitch.

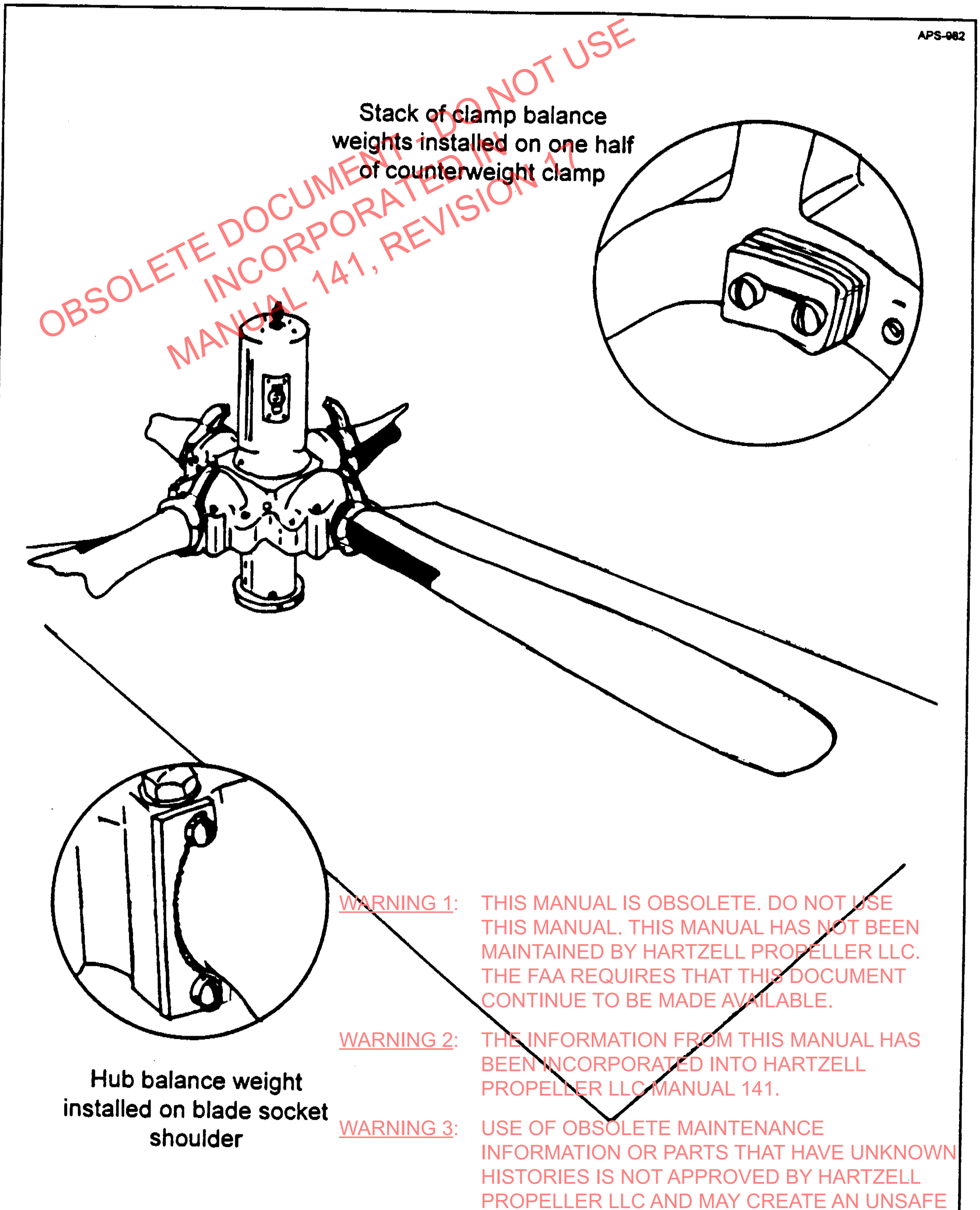
B. Use a Micropoise, Marvel, Knife-edge, or equivalent balancing system to determine which blade assembly is heaviest.

CAUTION: ADD COUNTERWEIGHT CLAMP BALANCE WEIGHTS ON OUTBOARD SURFACES IF POSSIBLE. A MAXIMUM OF 16 CLAMP BALANCE WEIGHTS MAY BE INSTALLED ON EACH COUNTERWEIGHT CLAMP IN TWO STACKS OF FOUR WEIGHTS EACH ON EACH CLAMP HALF.

CAUTION: ADD HUB BALANCE WEIGHTS ON THE LEAD-SIDE ONLY OF THE BLADE SOCKET SHOULDER, AND NO MORE THAN ONE WEIGHT IS PERMITTED ON ANY SHOULDER.

C. When the heaviest blade assembly has been determined, add counterweight clamp balance weights to the opposing blade clamps or hub balance weights to the opposing socket shoulders as necessary until correct static balance is achieved.

CAUTION: BALANCE WEIGHT SCREWS MUST EXTEND AT LEAST 0.3125 INCH (7.94 MM) INTO THE COUNTERWEIGHT CLAMP-HALF.



Balance Weight Installations
Figure 8-1

D. Select balance weight screws (12) that are long enough to extend through the balance weight(s) and into the counterweight clamp, or into the hub socket shoulder, at least 0.3125 inch (7.9375 mm). Refer to the chart in Figure 10-3.

E. After enough balance weights have been attached to the counterweight clamps and/or split-hub unit to bring the propeller into static balance, lubricate the blade retention bearings in accordance with approved procedures.

F. If necessary, add approved Classification I lubricant to bring the propeller back into balance after balance weights have been attached.

G. Correct static balance is achieved when a single balance weight changes the propeller balance in any direction.

CAUTION: DEFLECT THE SAFETY WIRE AWAY FROM THE BLADE BASE SO THERE WILL BE NO CONTACT BETWEEN THE BLADE AND THE WIRE.

H. When correct static balance has been achieved, wire the balance weight attaching screws for safety with 0.032 inch (0.81 mm) minimum diameter stainless steel wire according to MIL SPEC MS33540.

1) If necessary, pull the safety wire away from the blade base to assure there will be no contact between the blade and the wire (Figure 8-1).

a) If there is a preference for insulating the safety wire from the blade base, slide a plastic tube over the wire. This step is not mandatory.

8-2. Inspection Procedures Prior to Dynamic Balancing

A. Perform the following visual inspections before dynamically balancing the propeller assembly after it has been reinstalled on the aircraft engine.

NOTE: The first run-up of a new or just-overhauled propeller assembly probably will leave a small amount of grease on the blades and inner surface of the spinner dome.

1) Use the approved solvent to completely remove any grease on blades or inner surface of spinner dome resulting from first run-up or subsequent run-ups of the propeller.

2) Visually check each propeller blade for evidence of grease leakage (Figure 1-5).

3) Visually inspect the inner surface of the spinner dome for evidence of grease leakage.

4) When it has been determined that no grease leakage is occurring, add lubricant to the propeller assembly as necessary in accordance with the Approved Lubrication Procedures.

CAUTION

THIS PROPELLER HAS BEEN DYNAMICALLY BALANCED.
Location of Static Balance Weights May Have Been Altered.
A-2803

Caution Decal Part No. A-2803
for Dynamically Balanced Propeller
Figure 8-2

8-3. Dynamic Balancing Procedures

A. Dynamic balancing of the Hartzell Four-Blade Lightweight Turbine Propeller is permitted provided an accurate measuring system is used and weight is redistributed in an airworthy manner.

NOTE: Follow instruction of the balancing system manufacturer.

B. The amount of balance weight which is redistributed must not exceed the amount specified for static balance of the propeller.

CAUTION: DYNAMIC BALANCING WEIGHTS MUST NOT EXCEED ONE OUNCE (28.349 G) TOTAL IN ANY ONE LOCATION ON THE BULKHEAD.

C. Dynamic balancing weights may be attached either to the engine-side bulkhead unit (6) or to the split-hub unit (67).

NOTE: If dynamic balance weights are later removed from the bulkhead unit, the propeller returns to its original static balance condition.

CAUTION: DYNAMIC BALANCE WEIGHTS MUST BE INSTALLED IN AN AIRWORTHY MANNER AND IN LOCATIONS WHERE THEY DO NOT INTERFERE WITH ANY ENGINE PARTS WHEN THE PROPELLER ROTATES.

D. Decal No. A-2803, Figure 8-2, must be applied to the engine-side bulkhead unit of a Hartzell propeller which has been dynamically balanced.

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9-1. Reassembly Procedures when Blades Have Been Removed for Shipment

CAUTION: A PROPELLER SHIPPED WITH BLADES REMOVED MUST BE REASSEMBLED IN A FACILITY APPROVED BY HARTZELL.

A. Propellers which are disassembled for shipment will have identifying numbers temporarily placed on various components. They indicate the position of these components relative to each other and to other components. It is necessary to properly orient the components as labeled to ensure proper assembly.

B. In some cases, all blades are removed from the propeller after assembly at the factory to facilitate shipment.

1) The propeller has been fully assembled and balanced at the factory before blade removal and shipment.

2) Before starting reassembly, it may be desirable to review the following:

a) Chapter 1 - *Approved Lubrication Procedures and Lubricants*

b) Chapter 2 - *Troubleshooting Guide*

c) Chapter 3 - *Tooling and Fixtures*

d) Chapter 4 - *Disassembly Procedures*

e) Chapter 5 - *Cleaning and Inspection Procedures*

f) Chapter 7 - *Torque Values Table, Figure 7-1, Reassembly, Setting Blade Pitch, and Checking Blade Track and Floating Pitch*

CAUTION: BLADE PITCH ANGLES MUST BE SET IN ACCORDANCE WITH SPECIFICATIONS IN THE APPROPRIATE AIRCRAFT MANUAL OR HARTZELL APPLICATION GUIDE. BE SURE REFERENCE INCLUDES BOTH THE ANGLE AND THE RADIUS STATION.

5) It should not be necessary to reset blade pitch or to re-balance the propeller after reassembly. If it is, follow the prescribed procedures for Setting Blade Pitch and/or Propeller Balancing Procedures.

9-2. Preparing a Propeller Assembly for Lengthy Storage

CAUTION: IF A PROPELLER ASSEMBLY WILL NOT BE INSTALLED WITHIN ONE YEAR AFTER IT IS SHIPPED FROM THE FACTORY, THE PROPELLER MUST BE STORED IN A MANNER WHICH PROVIDES SUFFICIENT PROTECTION AGAINST PHYSICAL DAMAGE AND AGAINST DAMAGE FROM EXTREMES IN TEMPERATURE OR HUMIDITY.

A. If a propeller assembly will not be activated within six months of shipment from the Hartzell factory, store the propeller in a sturdy, dry container.

NOTE: As necessary, add a dehydrating agent.

9-3. Activating a Propeller Assembly after Lengthy Storage

A. Refer to Service Letter 61( ) on recommended overhaul periods and service life limits to determine whether or not a propeller assembly has been stored for a longer period of time than is allowed.

B. A propeller assembly being placed in service after lengthy storage must comply with all applicable FAA Airworthiness Directives as well as the applicable Hartzell Service Letters, Bulletins, Instructions and Advisory notices.

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CONTENTS

FIGURES

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1. Introduction

A. General

(1) This Illustrated Parts List contains all of the current configurations for the specified propellers manufactured by Hartzell Propeller Inc. and supersedes any prints that may have previously been supplied for part and assembly information. The parts lists contained within the Illustrated Parts List are to be used for verifying the configuration of propeller models and ordering parts.

CAUTION: FIGURES IN THE ILLUSTRATED PARTS LIST ARE TO BE USED FOR IDENTIFYING PARTS AND SHOULD NOT BE USED AS A MAINTENANCE REFERENCE FOR ASSEMBLY.

(2) Figures are for reference only. The figures provide general views of parts. For ease of illustration, typical views of some parts were created and shown in multiple figures. For this reason, illustrated parts may not exactly reflect parts contained in some propeller assemblies.

B. Using the Illustrated Parts List

(1) Every effort has been made to include all of the propellers and configurations manufactured by Hartzell Propeller Inc. If an overhaul facility has questions about a propeller configuration as stated in the Illustrated Parts List, contact the Hartzell Propeller Product Support Department.

(2) Basic Propeller Parts: Refers to all of the propeller components that may be unique to a particular propeller model.

C. Propeller Assemblies Configured with a De-Ice System

The Illustrated Parts List assumes the propeller assembly is not configured with a de-ice system. For de-ice part information, refer to the BF Goodrich Replacement Parts List, the BF Goodrich general arrangement drawing for the applicable de-ice kit, or the airframe manufacturer's maintenance manual.

2. The Illustrated Parts List

A. Detailed Parts List

The Detailed Parts List consists of the Figure/Item Number, Part Number, Description, Configuration Change Code, Effectivity Code and Units Per Assembly. Space is reserved for the Airline Stock Number. The following is an explanation of each column.

(1) Fig/Item Number

(a) Figure Number refers to the illustration where items appear. Item Numbers are assigned in broken sequence to allow the insertion of subsequent additional parts. Items listed but not illustrated are identified by a dash to the left of the item number.

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

1 A part may have an alternate, or may be superseded, replaced, or obsoleted by another part. For example, the felt dust seal (A-863) that is item 170 was superseded by the felt dust seal (B-1843) that is item 170A.

2 An Illustrated Parts List may contain multiple configurations. Effectivity codes are used to distinguish different part numbers within the same list. For example, one configuration may use a cylinder (D-6845) that is item 39, yet another configuration uses a cylinder (D-484) that is item 39A. Effectivity codes are very important in the determination of parts in a given configuration.

(2) Part Number

Use the Hartzell part number when ordering the part from Hartzell or a Hartzell approved distributor. Digits of Hartzell Part Numbers have no significance other than to identify a part.

(3) Airline Stock Number

Space is reserved for the Airline Stock Number.

(4) Description

This column identifies the item. The relationship of parts to the assembly are indicated by the use of indentations. This column may also contain vendor CAGE codes, as applicable. Information regarding part alternative, supersedure, replacement, or obsolescence may also be found in this column. Refer to Revisions, below, for further information regarding alternate, superseded, replaced, or obsoleted parts.

(5) Units Per Assembly (UPA)

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

(6) Overhaul (O/H)

Designates the parts that require replacement at overhaul. A "Y" will identify which parts are replaced at overhaul.

B. Revisions

(1) Alternate

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

(2) Supersedure

Part changes are identified by the terms “SUPERSEDES ITEM _____” or “SUPERSEDED BY ITEM _____” in the Description column. Superseded items are considered airworthy for continued flight and existing stock of superseded parts may be used for maintenance and/or repair. Superseded parts may no longer be available, and the new part number must be used when ordering/stocking new parts.

(3) Replacement

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

(4) Obsolescence

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

(5) Service Documents and Airworthiness Directives

(a) In the event of modification or rework of an existing part, the supersedure, replacement, or obsolescence of a part, or the addition of parts installed by a Service Bulletin (SB) or Service Letter (SL), the SB or SL number will appear in the Description column as “SB_____”, or "SL_____” after the description.

(b) When a SB has a relationship to an Airworthiness Directive (AD), the AD will be shown in parentheses after the SB number as SB_____ (AD_____).

C. Vendors

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

(2) Some O-rings, fasteners, and hardware manufactured in accordance with established industry specifications (certain AN, MS, NAS items) are acceptable for use in Hartzell products without additional standards imposed by Hartzell. Refer to Manual 202A (61-01-01), Vendor Cross Reference Chapter, for a listing of part number interchangeability.

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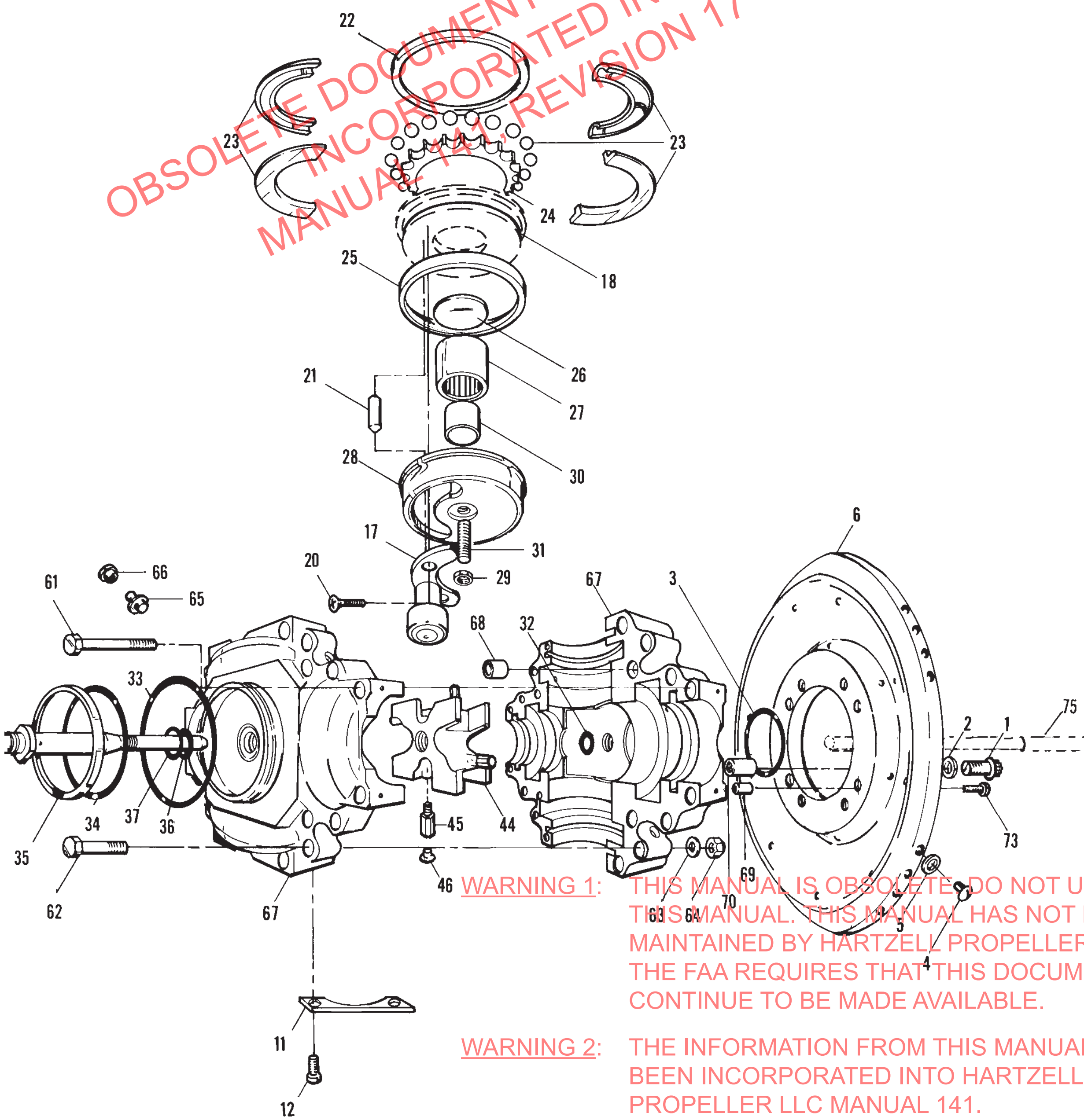
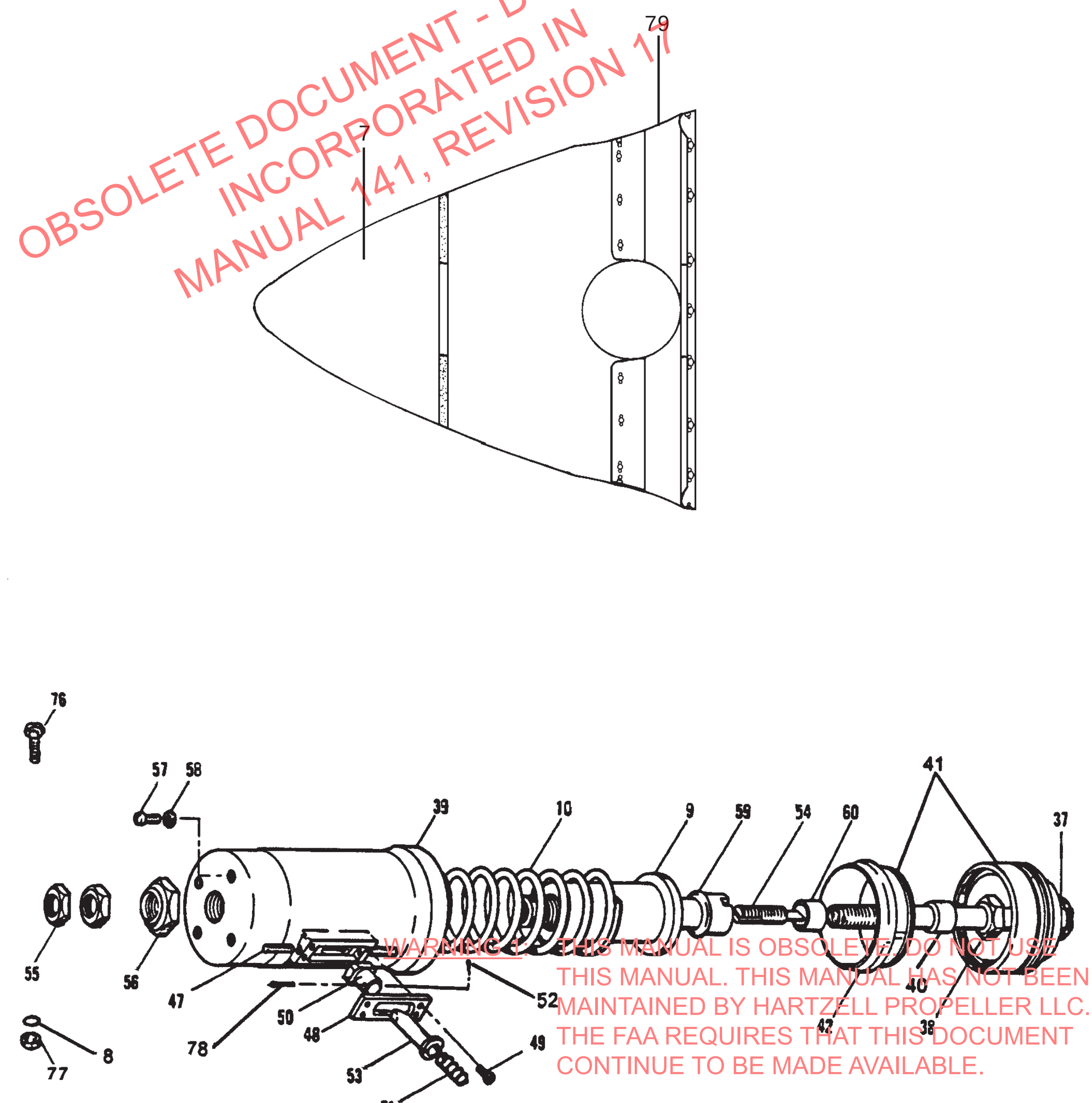
BPS 563

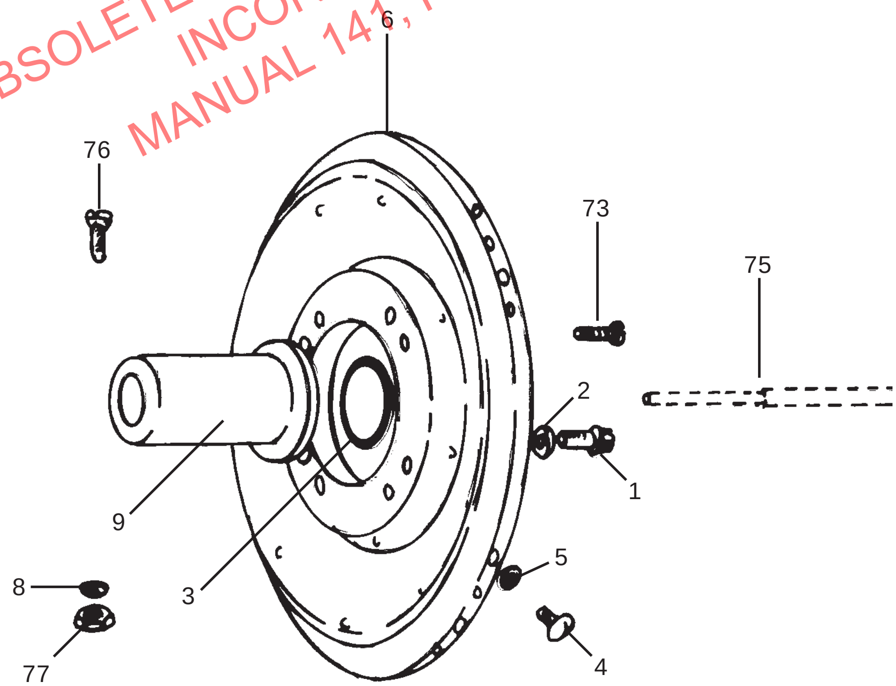


HC-E4P-5 and HC-E4P-5E Propeller Assembly
Figure 10-1A

APS 1022



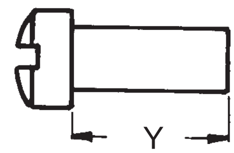
HC-E4P-5 and HC-E4P-5E Propeller Assembly
Figure 10-1B

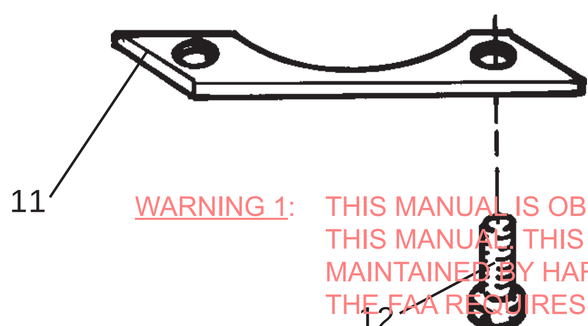


Propeller Mounting Parts, Spinner Assembly, and Feathering Unit
Figure 10-2

APS 096
APS 172

BALANCE WEIGHT SCREW SELECTION - ITEM 12		
Part Number	Thread Length Dimension Y	
	inch	mm
B-3840-6	0.375	9.53
B-3840-7	0.438	11.11
B-3840-8	0.500	12.70
B-3840-10	0.625	15.88
B-3840-12	0.750	19.05

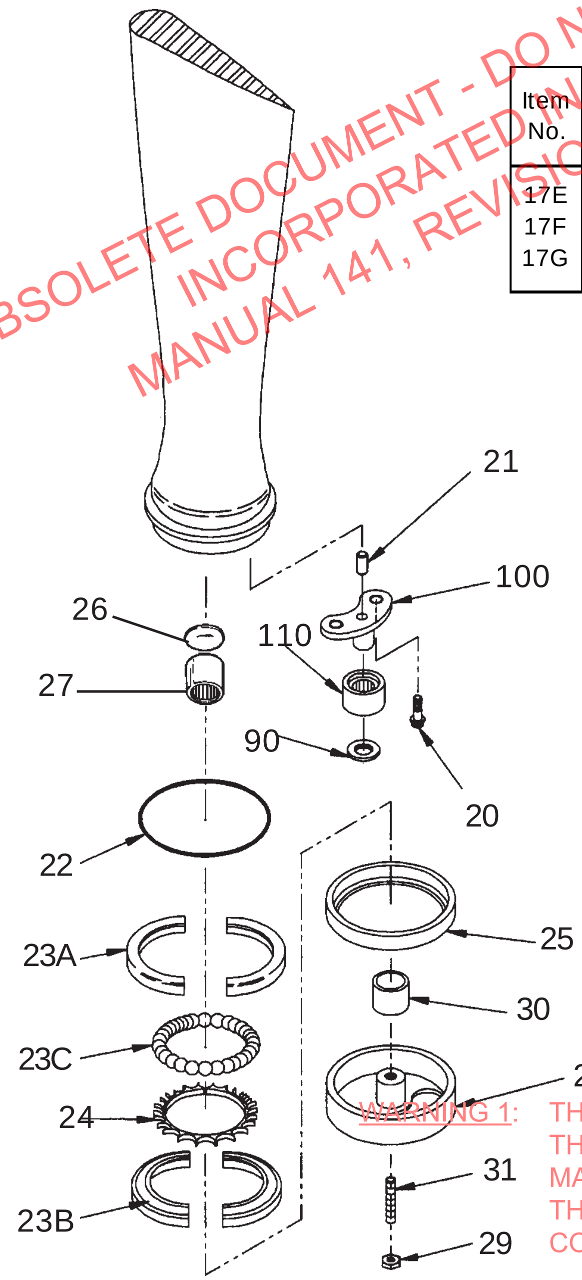




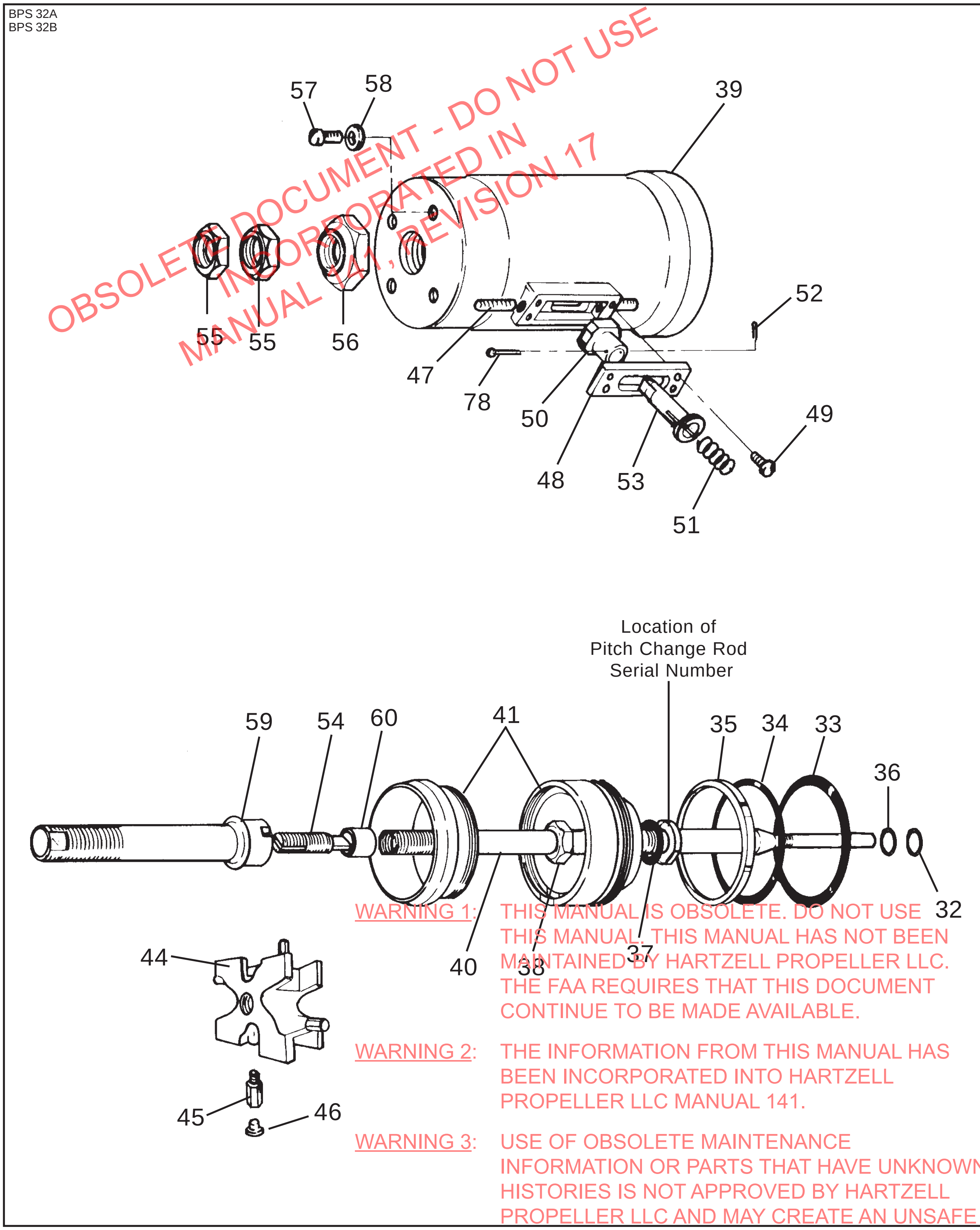
Balance Unit
Figure 10-3

W10535A

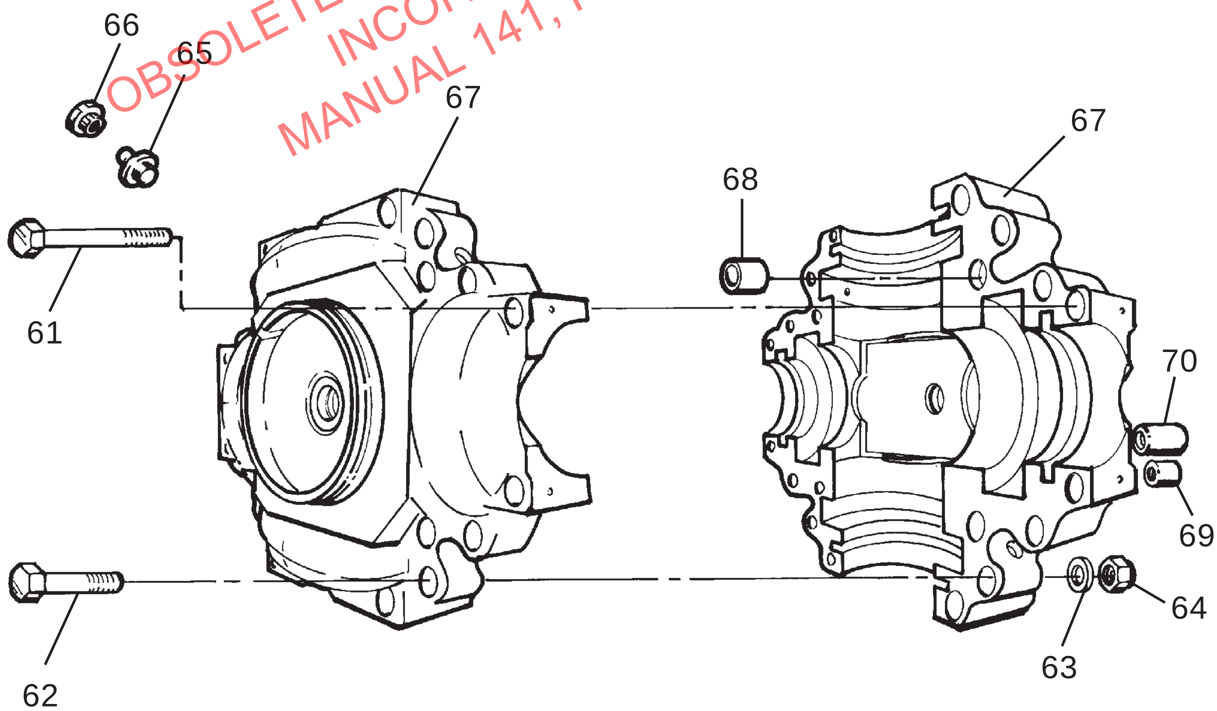
Item No.	Part Number	Change of Blade Angle for tractor installation
17E	B-6257-1	- 0.3 degrees
17F	B-6257-2	0.0 degrees
17G	B-6257-3	+ 0.3 degrees



Blade Bearing System
Figure 10-4



Hydraulic System, Start Lock Assembly and Pitch Change Unit
Figure 10-5



Split-Hub Unit
Figure 10-6

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-1A						
10-1B	HC-E4P-5, -5B		**PROPELLER ASSEMBLY**			
10-2			**PROPELLER MOUNTING PARTS**			
1	B-3347		• BOLT, MOUNTING, 12 POINT		8	Y
2	A-2048-2		• WASHER, MOUNTING		8	Y
3	C-3317-230		• O-RING		1	Y
			SPINNER ASSEMBLY			
			NOTE 1: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 2: REFER TO HARTZELL COMPOSITE SPINNER MAINTENANCE MANUAL 148 (61-16-48).			
-120	D-5362		• COMPOSITE SPINNER ASSEMBLY		1	
4	B-3867-272		• • SCREW		32	Y
5	B-3860-10L		• • WASHER		32	Y
6	D-5364		• • BULKHEAD UNIT, COMPOSITE		1	
-121	D-5453		• • • BULKHEAD		RF	
-122	B-3858-3		• • • NUTPLATE		16	
-123	B-3878-3-4		• • • RIVET		32	
7	D-5363		• • DOME UNIT		1	
-124	D-5434		• • • FORWARD BULKHEAD, COMPOSITE		1	
79	D-5433		• • HOOP UNIT		1	
-125	B-3858-3		• • • NUTPLATE		8	
-126	B-3878-3-4		• • • RIVET		32	
-127	B-6768		• • RETAINER, FORWARD, SPRING		1	
			DE-ICER PARTS			
-128	79312-67-595-1		• DE-ICER KIT		1	
-130	7931-4E-2661-1		• SLIP RING ASSEMBLY (GOODRICH CORPORATION)		1	
73	A-2070-10		• CAPSCREW, SOCKET, BUTTONHEAD		8	Y

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-2			**BETA CONTROL PARTS**			
8	B-3851-0363		• WASHER		1	Y
76	B-3383-15		• BOLT		1	Y
77	B-3808-3		• NUT		1	Y
			FEATHERING PARTS			
9	B-442		• GUIDE, SPRING, PLASTIC	-5	1	Y
9A	B-6761		• GUIDE, SPRING, PLASTIC	-5E	1	Y
10	C-447		• SPRING, FEATHER REPLACED BY ITEM 10A		1	
10A	C-6760		• SPRING, COMPRESSION, FEATHERING REPLACES ITEM 10		1	
75	SEE NOTE		• ENGINE BETA ROD NOTE: SEE APPLICABLE MANUFACTURER'S MANUAL		1	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5	HC-E4P-5		
-5E	HC-E4P-5E		

-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-3			**BALANCE UNIT**			
-11	A-2424		• BALANCE WEIGHT		AR	
12	B-3840-( ) SEE NOTE 1		• SCREW, BALANCE WEIGHT		AR	Y
			NOTE 1: REFER TO FIGURE 10-3 FOR THREAD LENGTH DIMENSION Y			
			COUNTERWEIGHT ASSEMBLY			
			NOTE 2: SEE COMPOSITE BLADE SECTION ILLUSTRATED PARTS LIST IN THE BACK OF THIS MANUAL.			
-18	E11990K		**BLADE ASSEMBLY**		4	
			NOTE 3: SEE COMPOSITE BLADE SECTION ILLUSTRATED PARTS LIST IN THE BACK OF THIS MANUAL.			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

-ITEM NOT ILLUSTRATED

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-4			BLADE BEARING SYSTEM			
-17	B-463-( )		• BLADE PITCH CHANGE KNOB ASSEMBLY REPLACED BY ITEM 17D		4	
-17A	B-464-1		• • BLADE PITCH CHANGE KNOB REPLACED BY ITEM 17E		4	
-17B	B-464-2		• • BLADE PITCH CHANGE KNOB REPLACED BY ITEM 17F			
-17C	B-464-3		• • BLADE PITCH CHANGE KNOB REPLACED BY ITEM 17G		4	
17D	B-6258-( )		• BLADE PITCH CHANGE KNOB ASSEMBLY REPLACES ITEM 17		4	
-17E	B-6257-1		• • BLADE PITCH CHANGE KNOB REPLACES ITEM 17A		4	
-17F	B-6257-2		• • BLADE PITCH CHANGE KNOB REPLACES ITEM 17B		4	
-17G	B-6257-3		• • BLADE PITCH CHANGE KNOB REPLACES ITEM 17C		4	
90	B-475		• • • KNOB UNIT RETAINING WASHER		4	Y
100	B-465-( )		• • • BLADE PITCH CHANGE BRACKET SUPERSEDED BY ITEM 100A		4	
100A	C-6253-( )		• • • BLADE PITCH CHANGE KNOB BRACKET SUPERSEDES ITEM 100		4	
110	B-6545		• • • CAM FOLLOWER		4	Y
20	B-3825		• • SCREW REPLACED BY ITEM 20A (PRE HC-SB-61-216)		8	
20A	B-3830		• • BOLT, 12 POINT REPLACES ITEM 20 (POST HC-SB-61-216)		8	Y
21	B-6260		• • • HEADLESS STRAIGHT PIN		4	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

-ITEM NOT ILLUSTRATED

TEMPORARY REVISION NO. 009

To Manual 61-10-56

This Temporary Revision is now considered a part of Hartzell Propeller Inc. Instruction Manual for Series HC-E4P-5( )/E11990K Manual 156A.

NOTE: Record the incorporation of this temporary revision on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

Remove Temporary Revision TR-008.

Insert this Temporary Revision in the ILLUSTRATED PARTS LIST chapter with this transmittal page facing page 10-18 (Rev. 1 Apr/03).

Temporary Revision TR-009 replaces Temporary Revision TR-008 in its entirety.

NOTE: Record the removal of TR-008 on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

Reason for issue: To add new preload plate part numbers, correct hub part numbers, make the D-484 cylinder a propeller critical part, incorporate HC-SL-61-354, and other minor changes to the Illustrated Parts List.

NOTE: See page 1 of this Temporary Revision.

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FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-6		HC-E4P-5, HC-E4P-5E PROPELLER ASSEMBLY PARTS				
67	D-389-1	• PCP:HUB UNIT REPLACED BY ITEM 67A		-5	1	PCP
67A	D-389-3	• PCP:HUB UNIT REPLACES ITEM 67		-5	1	PCP
67C	E-6771	• PCP:HUB UNIT, HC-E4(N,P)-(2,5)		-5E	1	
68	A-2249	• • HUB BUSHING, GUIDE		1	Y	
69	B-6142	• • INSERT, 1/4-28, CRES, COILED		8	Y	
70	B-1234	• • INSERT, 9/16-18, CRES, STAKED		8	Y	
-180	A-6153-137	• • RING, RETAINING, EXTERNAL SPIRAL		1	Y	
-181	A-6153-162	• • RING, RETAINING, EXTERNAL SPIRAL		1	Y	
-182	B-5952	• • HUB BUSHING, ROD		1		
-183	B-6108	• • HUB BUSHING, ROD		1		
-184	C-3317-026-2	• • O-RING		1	Y	
-185	C-3317-135-2	• • O-RING		1	Y	
61	A-2431	• • BOLT, 3/8-24, HEX HEAD		1		
62	A-2432	• • BOLT, 3/8-24, HEX HEAD		1		
63	B-3834-0632	• • WASHER		20	Y	
64	A-2043-1	• • NUT, 3/8-24, SELF-LOCKING		20	Y	
65	A-279	• FITTING, LUBRICATION REPLACED BY ITEMS 65A AND 101		8	Y	
65A	A-279	• FITTING, LUBRICATION REPLACES ITEM 65 IN ENGINE-SIDE OF HUB		4	Y	
65B	C-6349	• FITTING, LUBRICATION, 45° (POST HC-SL-61-187) ALTERNATE FOR ITEM 65A		4	Y	
-101	106545	• PLUG, LUBRICATION (POST HC-SL-61-354) REPLACES ITEM 65 IN CYLINDER-SIDE OF HUB		4	Y	
66	B-6544	• CAP, FITTING, LUBRICATION USED WITH ITEMS 65, 65A, AND 65B		4	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-5		**HC-E4P-5, HC-E4P-5E PROPELLER ASSEMBLY PARTS**				
		PITCH CHANGE PARTS				
-160	C-635	• FORK, FOUR BLADE - ASSEMBLY		1		
44	D-495	• • FORK, FOUR BLADE REPLACED BY ITEM 44A		1		
44A	D-495-1	• • FORK, FOUR BLADE REPLACES ITEM 44		1		
44B	D-495-2	• • FORK, FOUR BLADE ALTERNATE FOR ITEM 44A		1		
45	B-468	• • EXTENSION, BUMPER		4		
46	A-3256	• • BUMPER, FORK		4	Y	
10-5		**BETA CONTROL PARTS**				
47	B-6639-131	• SCREW, SET		4	Y	
48	B-446	• COVER, HOUSING, START LOCK		4		
49	B-3821	• SCREW, 10-32, CAP		8	Y	
50	B-444-1	• HOUSING, START LOCK		2		
51	B-331	• SPRING, COMPRESSION		2	Y	
52	B-3838-1	• COTTER PIN		2	Y	
53	A-2620-1	• PIN, START LOCK		2		
54	B-439	• SCREW, BETA ADJUST		2		
55	B-3839-16	• PCP: NUT, HEX, THIN, DRILLED		2		PCP
56	B-3375	• PCP: NUT, 1 3/8-12, HEX, THIN, DRILLED		2		PCP
57	B-3841-5	• SCREW, 1/4-28, FILLISTER HEAD		1	Y	
58	B-3837-0463	• WASHER, CORROSION RESISTANT		1	Y	
-170	B-476	• SLEEVE UNIT REPLACED BY ITEM 170A		1		
-170A	B-6758	• PCP: SLEEVE, PITCH ADJUST-UNIT REPLACES ITEM 170		1		PCP
59	C-438	• • SLEEVE, REVERSE ADJUST REPLACED BY ITEM 59A		1		
59A	C-6759	• • PCP: SLEEVE, REVERSE ADJUST REPLACES ITEM 59 ONLY AVAILABLE AS PART OF ITEM 170A		1		PCP
60	A-441	• • BUSHING, SLEEVE		1		
78	B-2877	• CLEVIS PIN, 3/32		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-5		**HC-E4P-5, HC-E4P-5E PROPELLER ASSEMBLY PARTS**				
		HYDRAULIC SYSTEM				
32	C-3317-211-2	• O-RING, BUSHING TO PITCH CHANGE ROD		1	Y	
33	C-3317-251	• O-RING, HUB, CYLINDER HALF	-5	1	Y	
33A	C-3317-354	• O-RING, HUB, CYLINDER HALF	-5E	1	Y	
34	C-3317-426-2	• O-RING, PISTON, LARGE		1	Y	
35	B-1843	• SEAL, FELT, DUST		1	Y	
36	C-3317-213-2	• O-RING, BUSHING TO PITCH CHANGE ROD		1	Y	
37	C-3317-217	• O-RING, PISTON, SMALL		1	Y	
38	B-474	• NUT, 1 1/8-12, HEX, SELF-LOCKING		1	Y	
39	D-484	• PCP: CYLINDER	-5	1		PCP
39A	D-6845	• CYLINDER	-5E	1		
40	D-494	• PCP: PITCH CHANGE ROD SUPERSEDED BY ITEM 40A		1		PCP
40A	D-494-1	• PCP: ROD, PITCH CHANGE SUPERSEDES ITEM 40		1		PCP
41	C-497	• PISTON UNIT		1		
150	C-492	• • PISTON		1		
151	B-493	• • RING, PISTON, START LOCK		1		
152	A-637	• • SPRING PIN REPLACED BY ITEM 152A		OBS		
152A	B-3842-0250	• • SPRING PIN, 3/32", CRES REPLACES ITEM 152		8	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5	HC-E4P-5		
-5E	HC-E4P-5E		

- ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	DESCRIPTION	EFF CODE	UPA	O/H	PCP
10-4		**HC-E4P-5, HC-E4P-5E PROPELLER ASSEMBLY PARTS**				
		BLADE BEARING SYSTEM (CONTINUED)				
22	C-3317-340	• O-RING SUPERSEDED BY ITEM 22A PRE HC-SL-61-301		4	Y	
22A	C-3317-340-8	• O-RING SUPERSEDES ITEM 22 POST HC-SL-61-301		4	Y	
23	C-792	• BLADE RETENTION BEARING		2		
23A	C-792-A	• • RACE, HUB-SIDE		4		
23B	C-792-B	• • RACE, BLADE-SIDE		4		
23C	B-6144-1	• • BEARING BALL, 3/8 INCH DIA		132	Y	
-23D	B-6144-1-1500	• • BEARING BALL, 3/8 INCH DIA (BOX OF 1500)		RF		
24	B-793	• BALL SPACER		4	Y	
25	B-1041	• RING, RETAINING, BEARING, REPLACED BY ITEM 25A		4		
25A	B-7071	• BEARING RETAINING RING, REPLACES ITEM 25		4		
-26	A-665	• BLADE PLUG		4		
-27	A-1271	• BEARING, NEEDLE, CLOSED END		4	Y	
28	C-6259	• PRELOAD PLATE ASSEMBLY REPLACED BY ITEM 28D PRE HC-SB-61-289 AND HC-SB-61-309				
28A	C-659	• • PRELOAD PLATE REPLACED BY ITEM 28B AND 28C PRE SB 185		4		
28B	C-6172	• • PRELOAD PLATE REPLACES ITEM 28A POST SB 185 REPLACED BY ITEM 28C PRE HC-SB-61-216		4		
28C	C-6255	• • PRELOAD PLATE REPLACES ITEM 28A REPLACES ITEM 28B POST HC-SB-61-216		4		
29	B-3368	• • NUT, 5/16-24, HEX, THIN		4	Y	
30	A-1272	• • RACE, INNER BEARING REPLACED POST HC-SB-61-216		OBS		
31	A-3204-1	• • SCREW, SET, 5/16-24 REPLACED BY ITEM 31A PRE HC-SB-61-225		4		
31A	A-3204-2	• • SCREW, SET, 5/16-24 REPLACES ITEM 31 POST HC-SB-61-225		4	Y	
28D	100641-1	• PRELOAD PLATE ASSEMBLY REPLACES ITEM 28 POST HC-SB-61-289 AND HC-SB-61-309		4		
29A	B-3368	• • NUT, 5/16-24, HEX, THIN		4	Y	
31B	B-7019-2	• • SCREW, SET, 5/16-24		4	Y	
140	B-3838-3-2	• COTTER, PIN		8	Y	
72	B-1925	• GORTEX HUB SEAL		OBS		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-4			**BLADE BEARING SYSTEM (CONTINUED)**			
22	C-3317-340		• O-RING		4	Y
23	C-792		• BLADE RETENTION BEARING		2	
23A	C-792-A		• • BLADE RETENTION BEARING, BLADE SIDE		4	
23B	C-792-B		• • BLADE RETENTION BEARING, HUB SIDE		4	
23C	B-6144-1		• BEARING BALL, 3/8 INCH		132	Y
-23D	B-6144-1-1500		• BEARING BALL, 3/8 INCH (BOX OF 1500)		RF	
24	B-793		• BALL SPACER FOR 3/8 INCH BALLS		4	Y
25	B-1041		• BEARING RETAINING RING		4	
-26	A-665		• BLADE PLUG		4	Y
-27	A-1271		• BEARING, NEEDLE CLOSED END		4	Y
28	C-6259		• PRELOAD PLATE ASSEMBLY			
28A	C-659		• • PRELOAD PLATE REPLACED BY ITEM 28B AND 28C (PRE SB 185)		4	
28B	C-6172		• • PRELOAD PLATE REPLACES ITEM 28A (POST SB 185) REPLACED BY ITEM 28C (PRE HC-SB-61-216)		4	
28C	C-6255		• • PRELOAD PLATE REPLACES ITEM 28A REPLACES ITEM 28B (POST HC-SB-61-216)		4	
29	B-3368		• • • THIN HEX NUT		4	Y
30	A-1272		• • • BEARING INNER RING (REPLACED POST HC-SB-61-216)		OBS	
31	A-3204-1		• • • SET SCREW REPLACED BY ITEM 31A (PRE HC-SB-61-225)		4	
31A	A-3204-2		• • • SET SCREW REPLACES ITEM 31 (POST HC-SB-61-225)		4	Y
140	B-3838-3-2		• COTTER, PIN		8	Y
72	B-1925		• GORTEX HUB SEAL		OBS	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-5			HYDRAULIC SYSTEM			
32	C-3317-211-2		• O-RING, HUB, CYLINDER HALF		1	Y
33	C-3317-251		• O-RING, HUB, CYLINDER HALF	-5	1	Y
34	C-3317-426-2		• O-RING, PISTON, LARGE		1	Y
35	B-1843		• SEAL, FELT, DUST		1	Y
36	C-3317-213-2		• O-RING, HUB, ENGINE HALF		1	Y
37	C-3317-217-2		• O-RING, PISTON, SMALL		1	Y
38	B-474		• NUT, HEX, SELF-LOCKING		1	Y
39	D-6845		• CYLINDER	-5	1	
39A	D-484		• CYLINDER	-5E	1	
40	D-494		• • PITCH CHANGE ROD SUPERSEDED BY ITEM 40A		1	
40A	D-494-1		• • ROD, PITCH CHANGE SUPERSEDES ITEM 40		1	
41	C-497		• PISTON UNIT		1	
150	C-492		• • PISTON		1	
151	B-493		• • RING, PISTON, START LOCK		1	
152	A-637		• • SPRING PIN REPLACED BY ITEM 152A		OBS	
152A	B-3842-0500		• • SPRING PIN REPLACES ITEM 152		8	Y

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5	HC-E4P-5		
-5E	HC-E4P-5E		

-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-5			PITCH CHANGE PARTS			
-160	C-635		• FORK, FOUR BLADE - ASSEMBLY		1	
44	D-495		• • FORK REPLACED BY ITEM 44A		1	
44A	D-495-2		• • FORK REPLACES ITEM 44		1	
45	B-468		• • EXTENTION, BUMPER		4	
46	A-3256		• • BUMPER, FORK		4	Y
10-5			BETA CONTROL PARTS			
47	B-6639-131		• SET SCREW		4	Y
48	B-446		• COVER, HOUSING, START LOCK		4	
49	B-3821		• SCREW, CAP		8	Y
50	B-444-1		• HOUSING, START LOCK		2	
51	B-331		• SPRING, COMPRESSION		2	Y
52	B-3838-1		• COTTER PIN		2	Y
53	A-2620-1		• PIN, START LOCK		2	
54	B-439		• SCREW, BETA ADJUST		2	
55	B-3839-16		• NUT, HEX, THIN, DRILLED		2	
56	B-3375		• NUT, HEX, THIN, DRILLED		2	
57	B-3841-5		• SCREW, FILLISTER HEAD		1	Y
58	B-3837-0463		• WASHER		1	Y
-170	B-476		• SLEEVE UNIT REPLACED BY ITEM 170A		1	
-170A	B-6758		• SLEEVE PITCH ADJUST - UNIT REPLACES ITEM 170		1	
59	C-438		• • SLEEVE, REVERSE ADJUST REPLACED BY ITEM 59A		1	
59A	C-6759		• • SLEEVE, REVERSE ADJUST REPLACES ITEM 59		1	
60	A-441		• • BUSHING, SLEEVE		1	Y
78	B-2877		• • CLEVIS PIN		2	Y

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-6						
67	D-389-1		• HUB UNIT REPLACED BY ITEM 67A	-5	1	
67A	D-389-3		• HUB UNIT REPLACES ITEM 67	-5	1	
67C	E-6711		• HUB UNIT	-5E	1	
68	A-2249		• • HUB BUSHING GUIDE		1	Y
69	B-6142		• • INSERT, CRES, COILED		8	Y
70	B-1234		• • INSERT, CRES, STAKED		8	Y
-180	A-6153-137		• • RING, RETAINING, EXTERNAL SPIRAL		1	Y
-181	A-6153-162		• • RING, RETAINING, EXTERNAL SPIRAL		1	Y
-182	B-5952		• • HUB BUSHING, ROD		1	
-183	B-6108		• • HUB BUSHING, ROD		1	
-184	C-3317-026-2		• • O-RING		1	Y
-185	C-3317-135-2		• • O-RING		1	Y
61	A-2431		• • BOLT, HEX HEAD		1	
62	A-2432		• • BOLT, HEX HEAD		1	
63	B-3834-0632		• • WASHER		20	Y
64	A-2043-1		• • NUT, SELF-LOCKING		20	Y
65	A-279		• • FITTING, LUBRICATION		8	Y
65A	C-6349		• • FITTING, LUBRICATION (ALTERNATE) (POST HC-SL-61-187)		4	Y
			NOTE: THE C-6349 LUBRICATION FITTINGS MAY BE USED IN PLACE OF THE FOUR A-279 LUBRICATION FITTINGS ON THE ENGINE-SIDE HUB HALF ONLY, PER HC-SB-61-235.			
66	B-6544		• • CAP, FITTING, LUBRICATION		8	Y

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL
-5	HC-E4P-5		
-5E	HC-E4P-5E		

-ITEM NOT ILLUSTRATED

Composite Blade Section

To keep the revision process efficient, the following section is a copy of Composite Propeller Blade Manual 135D (currently rev. 1) in its entirety, except for those forms at the end of Chapter 5 which do not pertain to blade model E11990K. Please disregard any text or reference to blade models other than E11990K.

NOTE: To maintain control of personnel and facilities performing counterweight procedures for E11990K, the procedures are not provided in the composite blade section, but in the propeller assembly section at the beginning of this manual.

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Table of Contents

List of Illustrations

1-1. Introduction

A. This manual is arranged differently from past editions and must be used as such. Following is a list of chapters and a statement of purpose for each to clarify how this manual is arranged.

Chapter 2 - states personnel, facility and tooling requirements along with various kits and consumable materials.

Chapter 3 - the most important chapter of this manual to determine correct repair of damage. Refer to Paragraph 3-1 (General) and Figure 3-1 for instructions.

This chapter defines the limits of damage for determining the condition of a blade, airworthy or unairworthy.

Chapter 4 - outlines inspection procedures and intervals.

Chapter 5 - lists overhaul procedures. "Travelers" for specific blade models are found at the end of this chapter and must be used as a guideline for correct procedures and sequence to be performed for a specific blade model. Random "flipping through pages" will result in confusion.

Chapter 6 - gives dimensional limits for minor repair (which determines *who may perform the repair*). Also gives minor repair procedures.

Chapter 7 - gives dimensional limits for major repair (which determines *who may perform the repair*). Also gives major repair procedures.

Chapter 8 - contains procedures for de-icer boot application.

Chapter 9 - contains finish procedures for each blade model.

Chapter 10 - illustrated parts list and how to use them.

B. Composite blades must be inspected, maintained and repaired in accordance with procedures specified in this manual. Consult the applicable Hartzell propeller assembly manual and propeller owner's manuals for additional information regarding specific disassembly, inspection, repair, maintenance, and reassembly procedures.

C. This manual is NOT laid out sequentially in steps of the overhaul process. The sequence is provided in the traveler. However, differing blade conditions as well as individual shop requirements may dictate a need for variation in the sequence of blade overhaul. Although the sequence of events is not mandatory and may be rearranged to fit individual shop requirements, it is essential that ALL of the steps of the overhaul process be completed during overhaul.

<u>CAUTION</u>: DO NOT ATTEMPT IN THE FIELD ANY REPAIR, REPLACEMENT OR OVERHAUL PROCEDURE WHICH IS NOT SPECIFICALLY AUTHORIZED BY HARTZELL PROPELLER INC. OR WHICH IS NOT SPECIFICALLY REFERRED TO IN THIS MANUAL.

D. This manual covers only the composite propeller blade and assumes that the blade has been removed from the propeller assembly (except for minor repairs which can often be accomplished on the aircraft). Coverage includes minor repairs, major repairs, and overhaul. Coverage of major repairs is somewhat limited in that some major repairs either must be returned to the factory for repair or require consultation with the factory for individual evaluation/repair.

E. It is important to note that this manual is not the sole document required in order to perform propeller overhaul. Other Hartzell manuals referenced in the text, such as Propeller Instruction Manuals, provide essential information. Consult the applicable Hartzell publications such as those listed below for additional information regarding specific recommendations and procedures:

<u>Service Advisory 54</u> *(details Plastic Media Blasting)*

<u>Service Letter 61</u> *(contains overhaul intervals)*

<u>Propeller Owner's Manuals</u> *(various manual numbers)*

<u>Propeller Instruction Manuals</u> *(various manual numbers, include overhaul and part list information)*

<u>Hartzell Specifications SR202</u> *(includes manufacturing standards: de-icer boot installation, parts identification, blade painting, balancing, etc.)*

Consult the applicable manufacturer's manual for de-icer system instructions

F. This instruction manual is written in the format specified by A.T.A. Specification No. 100. It is assumed that persons using this manual have sufficient training for following instructions and procedures to accomplish the work properly.

G. Hartzell Propeller Inc. regularly schedules factory training classes specifically related to the composite blade. Participation is strongly recommended, and in some cases, required.

H. For Hartzell service literature and revisions, contact:

Hartzell Propeller Inc.
Product Support Department
One Propeller Place
Piqua, Ohio 45356 U.S.A.

Telephone: 513.778.4200
Telex: 4332032 HRTZLP
Fax: 513.778.4391

1-2. General Description

A. The Hartzell Composite Blade is composed of a metal blade shank retention section into which is molded a low-density foam core that supports built-up layers of composite laminate (Figure 1-1).

B. An erosion shield of electroformed nickel or stainless steel is incorporated into the fabrication to protect the blade leading edge from impact damage. Erosion shields are adhesively bonded to blades. The LM10585 blade was introduced with a stainless steel erosion shield. All other blades (as well as recent production LM10585) use a nickel erosion shield.

C. Some designs incorporate a stainless steel wire mesh into the fabrication to inhibit erosion in blade tip areas.

D. Other designs incorporate a non-structural blade cuff of low-density foam which is molded to the blade and covered with composite material (Figure 1-2).

E. Filament windings of composite material provide blade retention of the blade material to the internal metal plug. The composite laminates which are an integral component of the blade also provide a retention load path directly under the clamp in steel hubs (or bearing in aluminum hubs) for blade retention (Figures 1-3 and 1-4).

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

G. The composite blade is balanced in the horizontal plane during production by the addition of lead wool to a centrally located balance tube in the metal blade shank (which may protrude into the blade's foam core).

H. A finish covering of polyurethane paint protects the entire blade from erosion as well as ultraviolet damage. Aircraft that require de-icing protection use an external de-icer boot except for the A10460E blade which was introduced with an internal heating element in lieu of boots. Standard de-icer boots for this model are an option.

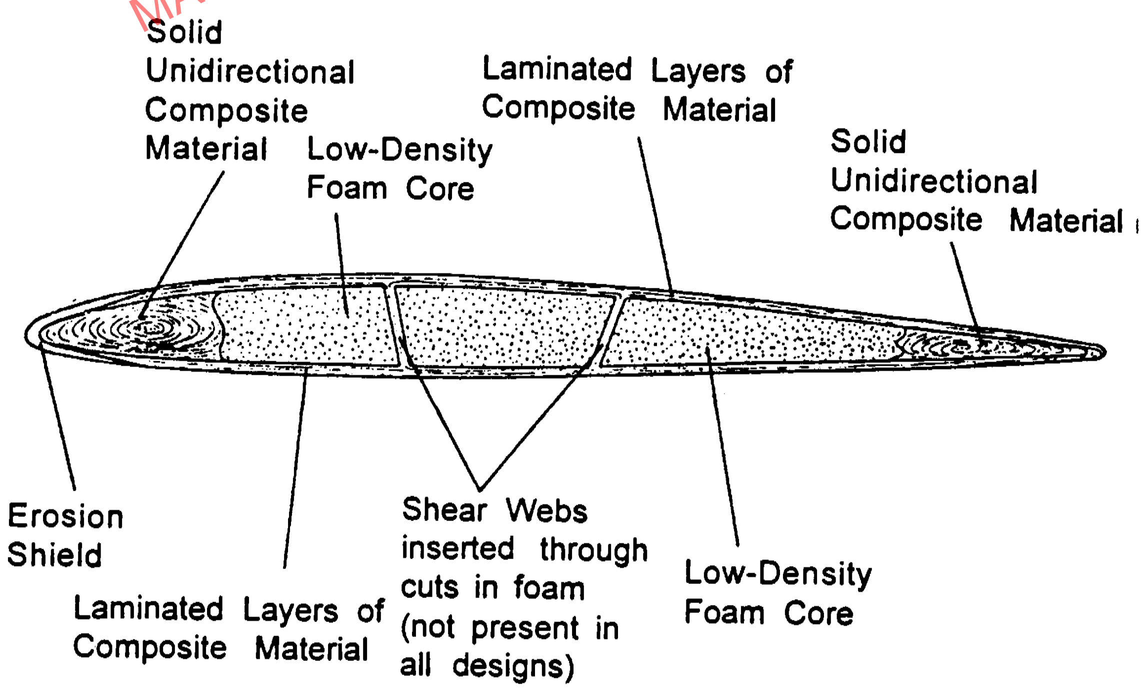
1-3. Blade Model Designation (Figure 1-5)

Hartzell uses a model designation to identify specific propeller and blade assemblies. Example: HC-B4MN-5 ( )/LM10585B+4. A slash mark separates the propeller and blade designations. The propeller model designation is the impression stamped on the propeller hub. The blade designation is the impression stamped on the butt end (internal) as well as ink stamped on the camber side (external) of the blade.

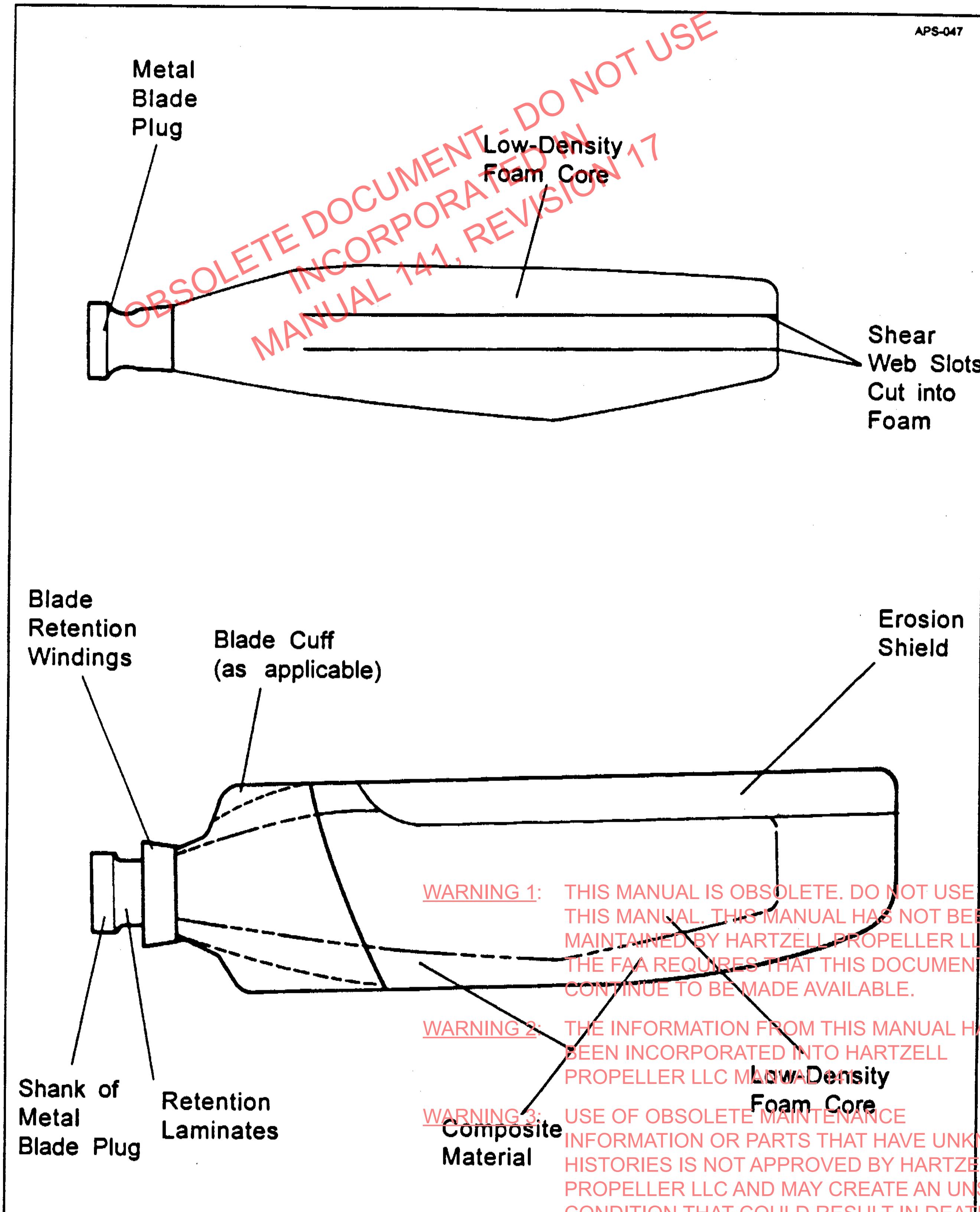
1-4. Blade Shank Designs

Hartzell blades are often referred to as "A shank", "M shank", etc. For most blades, the shank type is identified in the prefix letters of the blade model designation, such as B7466. It is useful to understand the basic differences between shank types (ref. Figure 1-5).

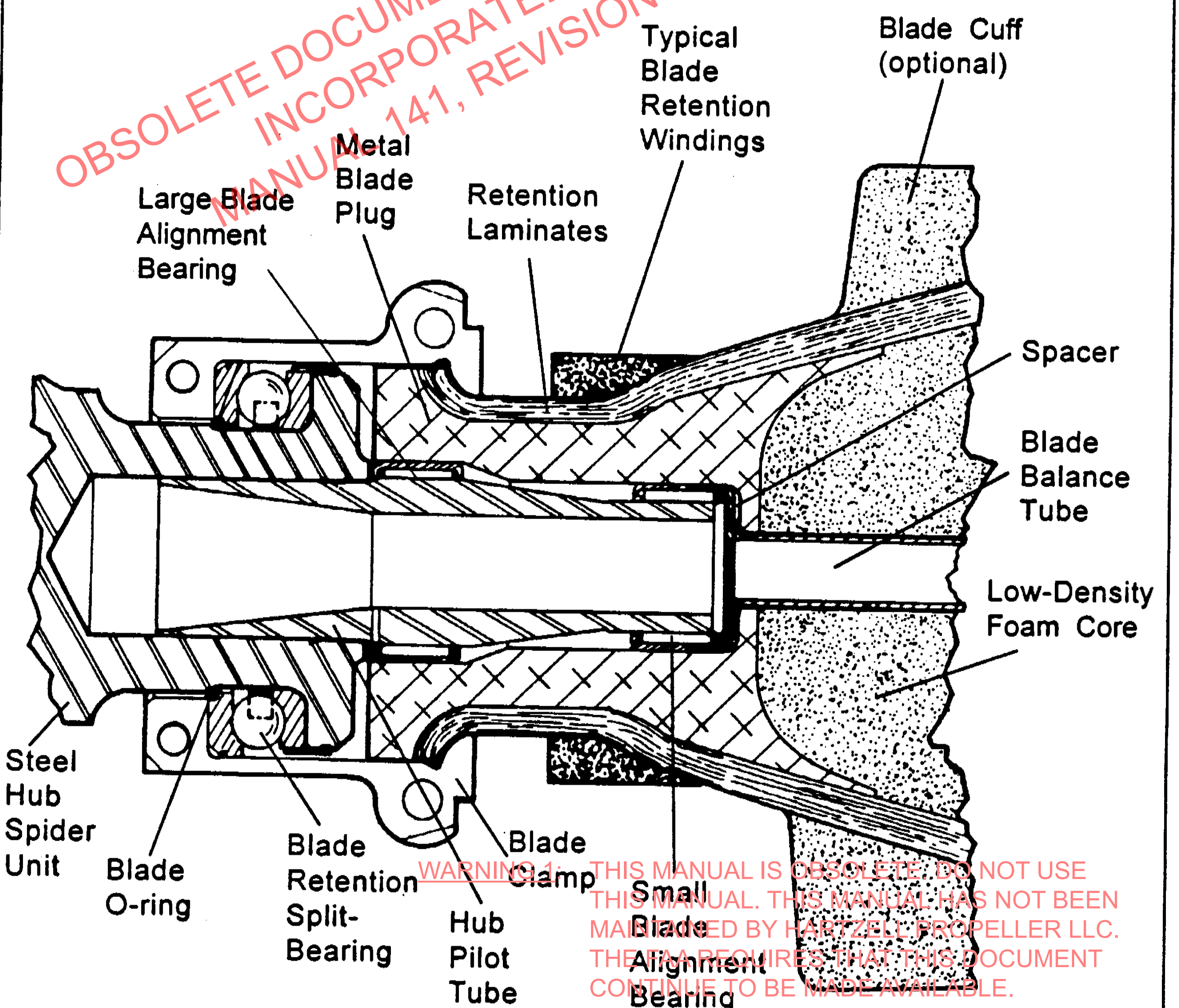
CPS-051



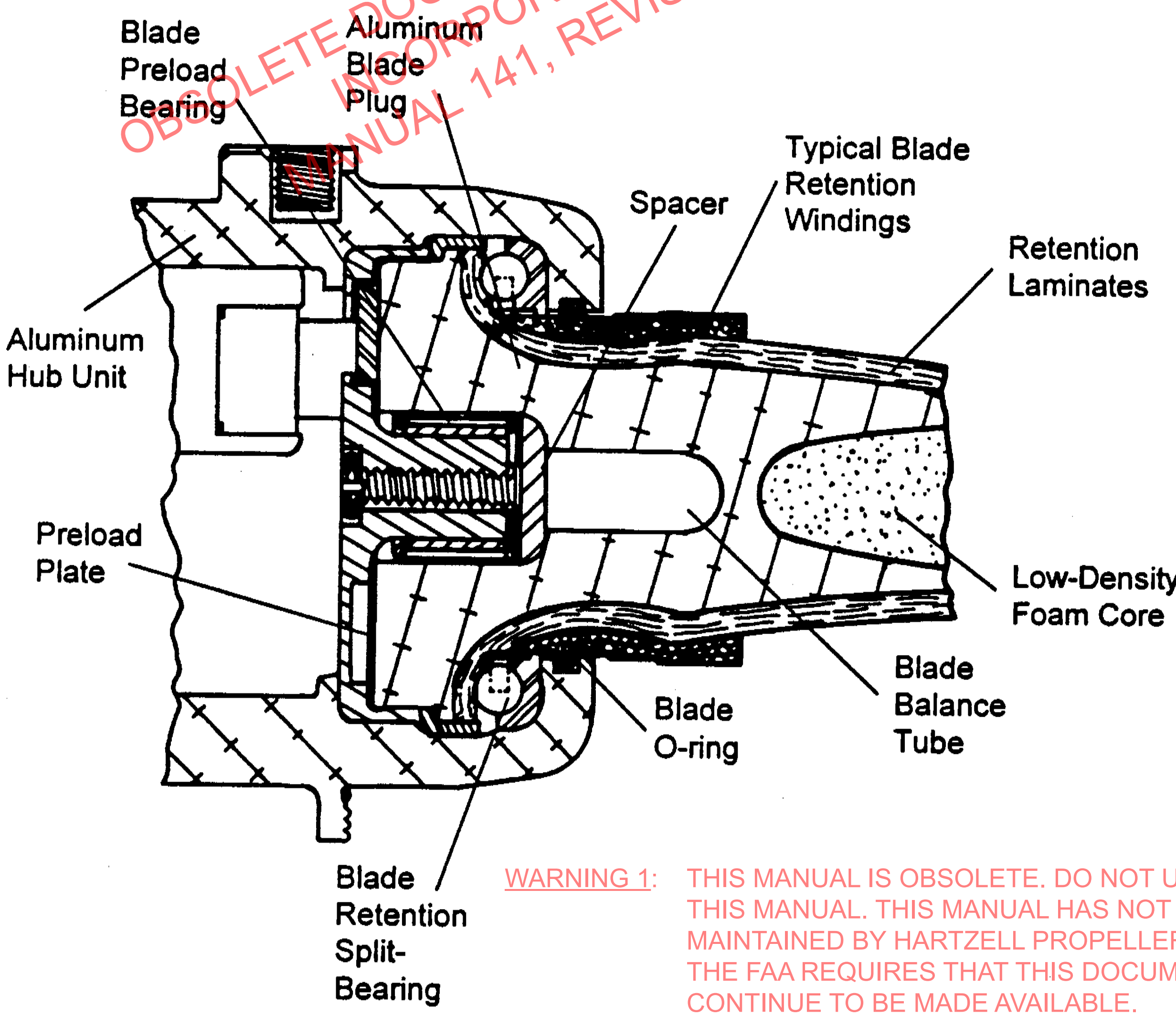
Section of Typical Hartzell Composite Blade
Figure 1-1



Basic Components of the Composite Blade
Figure 1-2



Composite Blade Retention System for Steel Hub
Figure 1-3



Composite Blade Retention System for Aluminum Hub
Figure 1-4

Typical Composite Blade Model Number

L M - 1 0 5 8 5 A K + 4

CHANGE FROM BASIC PROPELLER DIAMETER (inches plus or minus)

TYPE OF DE-ICER BOOT
- K external, foil element
- B external, wire element
- E internal element
- EK internal and external (only external is working)

MINOR MODIFICATIONS
e.g. Cuff Shape

ENGINEERING DESIGNATION for DESIGN CHARACTERISTICS

INITIAL DESIGN DIAMETER (inches)
(Not necessarily the actual propeller dia.)

BLADE RETENTION SYSTEM

<u>A shank</u>: used with aluminum hub 6 blade propeller, has bolt-on pitch change knob, and counterweight attached to a clamp at the blade shank.

<u>B shank</u>: used with aluminum hub "compact" propellers, has retention and pitch change knob similar to Y shank aluminum blades.

<u>E shank</u>: three different types

<u>M shank</u>: used with steel hub propellers, shank is similar to M shank aluminum blades, counterweights are attached to steel hub clamps.

<u>NOTE</u>: There are aluminum blades that may use the same prefix letter designations, such as M10282. There are no model designation letters which clearly indicate whether a blade is composite or aluminum.

DIRECTION OF ROTATION (L = Lefthand Blade)

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

Model Designation System
Figure 1-5

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2-1. General

Specific facilities, tools and materials are required for acceptable field repair and overhaul of Hartzell Composite Blades. Repair of airworthy damage may be performed in the field in accordance with this manual. Overhaul and repair of unairworthy damage are to be performed by a Hartzell approved propeller repair station.

2-2. Facility Requirements for Major Repair and Overhaul

If damage to a composite blade is determined to be of unairworthy degree, the blade must often be returned to the factory for repair or replacement. In some unairworthy damage cases, the composite blade may be taken to a designated repair facility for repair. The facility must be approved for major repairs and overhaul by Hartzell. Contact Hartzell product support department for guidance.

The standard facility equipment are listed in Figure 2-1. Tool Kit A-2334 (Figure 2-2) is available for basic start-up of a new facility.

2-3. Personnel Requirements

A. Factory training is mandatory for all personnel performing major repairs and/or overhaul. All persons who receive factory training will be provided with a certificate after completion of training, which must be made available for review at the facility. A copy of all certificates is kept on file at the factory.

Training must be received at least once every two years, with intermediate classes occurring as the need arises. Contact the Hartzell Product Support Department for class dates, arrangements, etc.:

Hartzell Propeller Inc.
Product Support Department
One Propeller Place
Piqua, Ohio 45356 U.S.A.
Telephone: 513.778.4200
Telex: 4332032 HRTZLP

B. Personnel approved for major repair/overhaul (certificate holders) must be listed as such in the agencies' repair station manual.

C. It is recommended for personnel performing minor repair attend factory training.

2-4. Tooling

Figures 2-1 through 2-11 list and illustrate the special tools and kits that are necessary to perform minor and major repairs as well as overhauls.

NOTE: Be sure to have proper ventilation for your facil-

Metric Equivalency

0.002 in	=	0.05 mm
24.0 in	=	60.96 cm
72.0 in	=	182.88 cm
1.5 ft	=	0.0522 m
2.0 ft	=	0.6096 m
3.0 ft	=	0.9144 m
4.0 ft	=	1.2192 m
5.0 ft	=	1.5240 m
6.0 ft	=	1.8288 m
7.0 ft	=	2.1336 m

Work Bench with fixture and vise 6 ft x 2 ft
Grind Bench 7 ft x 2 ft
Paint Booth
Tool Cart (Optional) 3 ft x 2 ft
Blade Truck 4 ft x 1.5 ft
Inspection Bench Tool Steel: 24 inches wide, 72 inches long machined one side flat within 0.002 inch over entire surface anchored with lag screws at four corners of built-up timber structure

Standard Facility Equipment for
Composite Blade Overhaul/Major Repair
Figure 2-1

Part Number	Description	Quantity/Size
796514021	1402B-1 Vacuum Pump (Duoseal)	1
79651417A	1417A Filter	1
79656547A	6 x 547 Timer, 12-hour	2
79651407K	1407K-20 Oil, Vacuum (Duoseal)	3 gallons
7965640702	YA-6407-02 Hose, Vacuum	6 ea. 10 feet
79651009A	1009A Vacuum Gage 4.5 in	2
7965639221	YA-6392-21 Fitting, Vacuum	1

Metric Equivalency

3 gal	=	11.355 l
10 ft	=	3.048 m

Tool Kit A-2334 to Prepare Facilities
for Erosion Shield Replacement
Figure 2-2

2-5. Sample Program

A. Erosion Shield Replacement

Initially, four (4) "samples" of a particular blade type must be submitted and approved for the facility to become approved for erosion shield replacement. One (1) of the four (4) samples must be completely refinished. For subsequent designs, only one (1) sample needs to be submitted. Kit no. DST-3000 (Figure 2-8), which contains unairworthy erosion shields, is available for this purpose and sample blades are available from the factory.

B. Overhaul Sample

One sample of any blade type must be submitted to evaluate overhaul and refinish methods. This is required for the facility to be approved for composite blade overhaul. A sample blade for this purpose will be provided upon request from the factory.

Ref No.	Part No.	Description	Application	Hartzell Supplied Only
1	796514021	1402B-1 Vacuum Pump (Duoseal)	Erosion shield replacement	
2	79651417A	1417A Filter	Erosion shield replacement	
3	79658547A	6 x 547 Timer, 12-hour	Erosion shield replacement	
4	79651009A	1009A Vacuum Gauge (4.5 in.)	Erosion shield replacement	
5	7965639221	YA-6392-21 Vacuum Fitting	Erosion shield replacement	
*, **6	N/A	Vibratory Sander (8 in dual acting)	Various surface preparation procedures	
*, **7	N/A	Electric Hand Drill	Lead wool removal	
*, **8	N/A	Air Pressure Feed Spray System	Apply anti-static paint or lightning guard paint	
*, **9	N/A	Utility Knife	Various procedures	
*, **10	N/A	Scissors (Heavy Duty)	Cut fiberglass material	
*, **11	N/A	Nylon Hand Rollers	De-icer boot installation	
*, **12	N/A	"C" Clamps and Plates, plastic or wood (assorted)	Apply pressure to a repaired area	
*, **13	N/A	Paint Roller (3 in)	Apply paint primer filler	
*, **14	N/A	Pressure Pot Gun	Apply anti-static paint	
*, **15	N/A	Binks Mach 1 HVLP Spray Gun or Binks Model 7 Gun with Agit Cup	Apply lightning guard	
**16	N/A	Full Radiused-tip Drill Bit, 47/64 in. dia.	Drill lead wool out of balance tube	
**17	N/A	39/64 in Drill Bit	Drill lead wool out of balance tube	
**18	982209215	Pen Light	Verify lead removal	
**19	N/A	Spherical Bottom Punch, 47/64 in. dia.	Drive lead wool into balance tube	
**20	57BST2949	BST-2949 Bearing Puller for M Shanks	Pull small blade alignment bearing (Figure 2-2)	✓
**21	57BST2950	BST-2950 Bearing Puller for M Shanks	Pull large blade alignment bearing (Figure 2-3)	✓
**22	57BST2951	BST-2951 Bearing Puller for A, B and E Shanks	Pull alignment bearing (Figure 2-4)	✓
**23	57A1891	A-1891 Hub Spider Pilot Tube	Check blade bearing fit on M shanks	✓
**24	N/A	Appropriate Pre-load Plate for A, B and E Shanks	Check blade bearing fit on A, B and E shanks	✓
**25	N/A	Propane Torch	Remove adhesively bonded erosion shield	
**26	N/A	Long, Thin Metal Rod	Determine if balance tube contains lead	
**27	N/A	Putty Knife	Help pry off erosion shield	
**28	N/A	Plastic Scraper	Remove gasket sealant from shank	
**29	N/A	Wooden or Plastic Stick	Remove grease from bearing bore	
**30	N/A	Air Nozzle with 12 inch extension	Blow remaining lead from balance tube and blade bore	
**31	N/A	Vacuum Tube - 1/2 inch CPVC 30 inch long, caps on both ends with a hole in one cap, 3/16 inch holes, 4 to 5 inches apart	Erosion shield application	

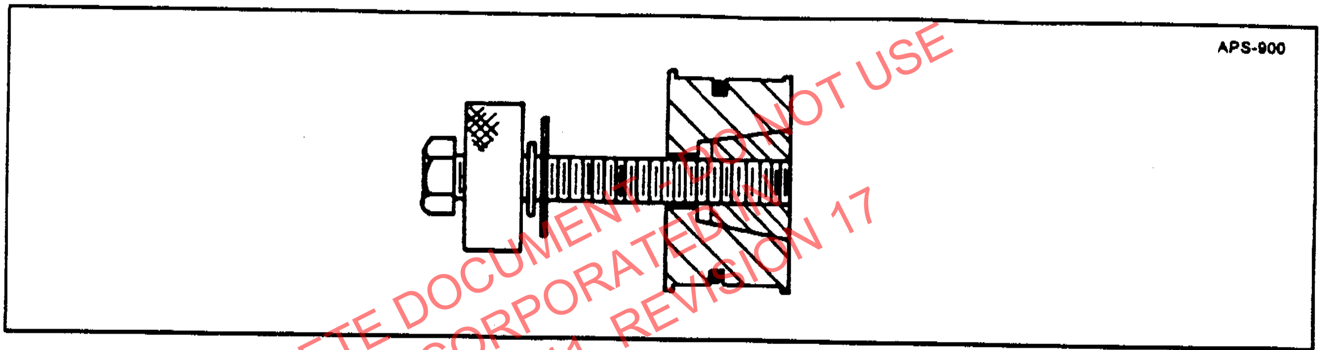
*used in Minor Repair
**used in Major Repair

Tools and Equipment
Figure 2-3

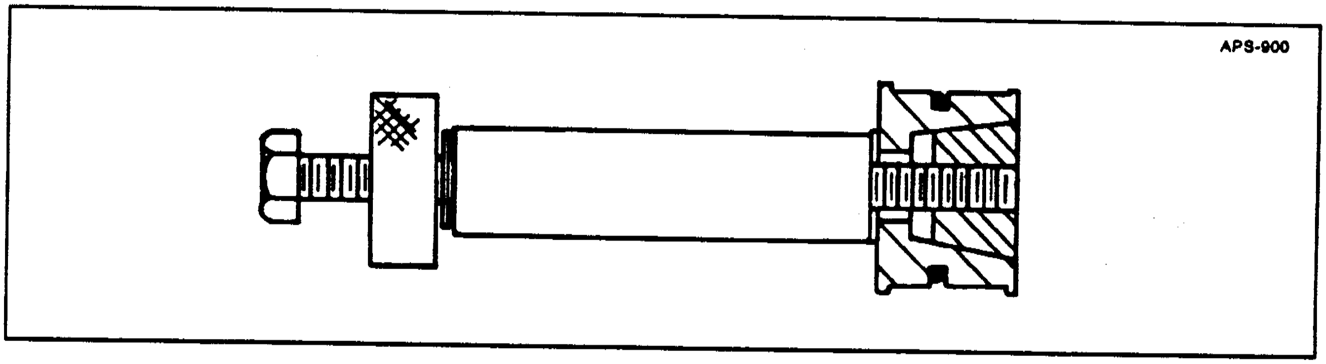
Ref No.	Part No.	Description	Application	Hartzell Supplied Only
*32	N/A	Plastic Wedge	Lift erosion shield up for cleaning	
*33	N/A	Wooden or Plastic Plate, 0.25 in. thick, 3 in. wide, 6 in. long	Clamping erosion shield repair	
*34	N/A	Drill Bit, 0.109 in.	Stainless steel erosion shield repair	
*35	N/A	Tap, 6-32	Stainless steel erosion shield repair	
*36	N/A	Countersink, 0.500 in., 90°	Stainless steel erosion shield repair	
*37	N/A	Dove-tail Cutter	Stainless steel erosion shield repair	
**38	N/A	BGT-3445 Counterweight Guage for A10460 blade	Measure distance between counterweight and blade butt	✓
**39	N/A	Megger	Resistance check of internal de-icer boot	
**40	N/A	49/64 in. reamer	Balance Tube Replacement	
**41	N/A	0.75 in. drill bit	Balance Tube Replacement	
**42	N/A	Ohm Meter	Resistance check of internal de-icer boot	
**43		BST-3008-1 Template for 42 in. station on M10877	Dimensional inspection	✓
**44		BST-3008-2 Template for 52 in. station on M10877	Dimensional inspection	✓
**45		BST-3009-1 Template for 42 in. station on E10950	Dimensional inspection	✓
**46		BST-3009-2 Template for 51 in. station on E10950	Dimensional inspection	✓
**47		BST-3010-1 Template for 42 in. station on E11990	Dimensional inspection	✓
**48		BST-3010-2 Template for 54 in. station on E11990	Dimensional inspection	✓
**49		BST-3007-1 Template for 42 in. station on LM10585	Dimensional inspection	✓
**50		BST-3007-2 Template for 48 in. station on LM10585	Dimensional inspection	✓
**51		BST-3006-1 Template for 30 in. station on A10460	Dimensional inspection	✓
**52		BST-3006-2 Template for 48 in. station on A10460	Dimensional inspection	✓
**53		BST-3005-1 Template for 29.75 in. station on M10083	Dimensional inspection	✓
**54		BST-3005-2 Template for 47.25 in. station on M10083	Dimensional inspection	✓
**55		BST-3004-1 Template for 30 in. station on B7421	Dimensional inspection	✓
**56		BST-3004-2 Template for 34 in. station on B7421	Dimensional inspection	✓
**57		BST-3004-3 Template for 30 in. station on B7466	Dimensional inspection	✓
**58		BST-3004-4 Template for 36 in. station on B7466	Dimensional inspection	✓
**60	N/A	Meg-Chek Model 2026D (or equivalent)	Megger inspection for A10460E	
**61	N/A	Hy-Pot Model 4040 AI AC (or equivalent)	Megger inspection for A10460E	

*used in Minor Repair
**used in Major Repair

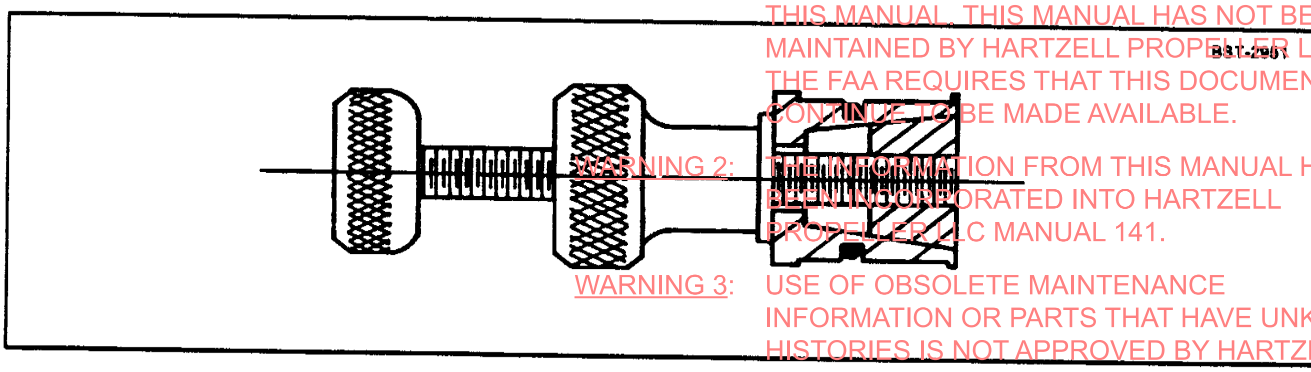
Tools and Equipment
Figure 2-3a



Special Tool (BST-2949) to Pull
Large Alignment Bearing on M Shank Blades
Figure 2-4



Special Tool (BST-2950) to Pull
Small Alignment Bearing on M Shank Blades



Special Tool (BST-2951) to Pull
Alignment Bearing on A, B and E Shank Blades
Figure 2-6

Part No.	Nomenclature	A-2333 LM10585AN+4	-1 M10877	-2 M10083	-3 B7421	-4 A10460E	-5 B7466	-6 E11990	-7 E10950
57D5003	D-5003 Erosion Shield	—	4	—	—	—	—	—	—
57D5013	D-5013 Erosion Shield	—	—	3	—	—	—	—	—
57D5019	D-5019 Erosion Shield	4	—	—	—	—	—	—	—
57D5059	D-5059 Erosion Shield	—	—	—	—	6	—	—	—
57D5066	D-5066 Erosion Shield	—	—	—	—	—	2	—	—
57D5069	D-5069 Erosion Shield	—	—	—	2	—	—	—	—
57D5072	D-5072 Erosion Shield	—	—	—	—	—	—	4	—
57D5133	D-5133 Erosion Shield	—	—	—	—	—	—	—	4
020200241	#241 Fiberglass Fabric 6 in wide	12 ea 38 in	16 ea 52 in	12 ea 50 in	8 ea 42 in	24 ea 54 in	8 ea 42 in	4 ea 54 in	16 ea 52 in
022209330	EA9330 Adhesive	1 qt	1 qt	1 qt	1 qt	2 qt	1 qt	1 qt	1qt
991500016	Vacuum Bag, 16 in wide	4 ea 52 in	4 ea 54 in	3 ea 52 in	2 ea 42 in	6 ea 54 in	2 ea 42 in	4 ea 56 in	4 ea 54 in
RS200	A-595 Vacuum Bag Sealant Tape *coils*	1	1	1	1	2	1	1	1
020200800	HS 800 Nylon Release Film 18 in wide	4 ea 40 in	4 ea 54 in	3 ea 54 in	— —	6 ea 54 in	— —	4 ea 56 in	4 ea 54 in
0204000S2	S2 Fiberglass Roving	—	88 ft	66 ft	—	—	—	—	—

Metric Equivalency

1 qt	=	0.946 l
2 qt	=	1.893 l
6.0 in	=	15.24 cm
16.0 in	=	40.64 cm
18.0 in	=	45.72 cm
38.0 in	=	96.52 cm
40.0 in	=	101.60 cm
42.0 in	=	106.68 cm
50.0 in	=	127.00 cm
52.0 in	=	132.08 cm
54.0 in	=	137.16 cm
56.0 in	=	142.24 cm
66.0 ft	=	20.12 m
88.0 ft	=	26.82 m

A-2333-( ) Erosion Shield Replacement Kits
Figure 2-7

Part No.	Nomenclature	A-2333 LM10585AN+4	-1 M10877	-2 M10083	-3 B7421	-4 A10460E	-5 B7466	-6 E11990	-7 E10950
57DST5003	DST-5003 Erosion Shield	—	4	—	—	—	—	—	—
57DST5013	DST-5013 Erosion Shield	—	—	3	—	—	—	—	—
57DST5019	DST-5019 Erosion Shield	4	—	—	—	—	—	—	—
57DST5059	DST-5059 Erosion Shield	—	—	—	—	6	—	—	—
	DST-5066 Erosion Shield	—	—	—	—	—	2	—	—
57DST5069	DST-5069 Erosion Shield	—	—	—	2	—	—	—	—
	DST-5072 Erosion Shield	—	—	—	—	—	—	4	—
	DST-5133 Erosion Shield	—	—	—	—	—	—	—	4
020200241	#241 Fiberglass Fabric 6 in wide	12 ea 38 in	16 ea 52 in	12 ea 50 in	8 ea 42 in	24 ea 54 in	8 ea 42 in	4 ea 54 in	16 ea 52 in
022209330	EA9330 Adhesive	1 qt	1 qt	1 qt	1 qt	2 qt	1 qt	1 qt	1qt
991500016	Vacuum Bag, 16 in wide	4 ea 52 in	4 ea 54 in	3 ea 52 in	2 ea 42 in	6 ea 54 in	2 ea 42 in	4 ea 56 in	4 ea 54 in
RS200	A-595 Vacuum Bag Sealant Tape *coils*	1	1	1	1	2	1	1	1
020200800	HS 800 Nylon Release Film 18 in wide	4 ea 40 in	4 ea 54 in	3 ea 54 in	— —	6 ea 54 in	— —	4 ea 56 in	4 ea 54 in
0204000S2	S2 Fiberglass Roving	—	88 ft	66 ft	—	—	—	—	—

Metric Equivalency

1 qt	=	0.946 l
2 qt	=	1.893 l
6.0 in	=	15.24 cm
16.0 in	=	40.64 cm
18.0 in	=	45.72 cm
38.0 in	=	96.52 cm
40.0 in	=	101.60 cm
42.0 in	=	106.68 cm
50.0 in	=	127.00 cm
52.0 in	=	132.08 cm
54.0 in	=	137.16 cm
56.0 in	=	142.24 cm
66.0 ft	=	20.12 m
88.0 ft	=	26.82 m

DST-3000-( ) Erosion Shield Replacement Kits
for Samples
Figure 2-8

Part No.	Nomenclature	CST-2988 LM10585AN+4	-1 M10877	-2 M10083	-3 B7421	-4 A10460E	-5 B7466	-6 E11990	-7 E10950
57BST2970	BST-2970 Erosion Shield Bonding Clamp	—	4	—	—	—	—	—	—
57BST2971	BST-2971 Erosion Shield Bonding Clamp	—	—	3	—	—	—	—	—
57BST2972	BST-2972 Erosion Shield Bonding Clamp	4	—	—	—	—	—	—	—
57BST2973	BST-2973 Erosion Shield Bonding Clamp	—	—	—	—	6	—	—	—
57BST2974	BST-2974 Erosion Shield Bonding Clamp	—	—	—	2	—	—	—	—
	BST-2977 Erosion Shield Bonding Clamp	—	—	—	—	—	—	4	—
	BST-2979 Erosion Shield Bonding Clamp	—	—	—	—	—	2	—	—
	BST-3023 Erosion Shield Bonding Clamp	—	—	—	—	—	—	—	4
57BST2962	BST-2962 Fit-Check Tool	—	—	—	—	1	—	—	—
57BST2954	BST-2954 Fit-Check Tool	—	—	1	—	—	—	—	—
57BST2955	BST-2955 Fit-Check Tool	—	1	—	—	—	—	—	—
57BST2956	BST-2956 Fit-Check Tool	1	—	—	—	—	—	—	—
	BST-2975 Fit-Check Tool	—	—	—	1	—	—	—	—
	BST-2976 Fit-Check Tool	—	—	—	—	—	1	—	—
	BST-2978 Fit-Check Tool	—	—	—	—	—	—	1	—
	BST-3022 Fit-Check Tool	—	—	—	—	—	—	—	1

CST-2988 Erosion Shield Replacement Tool Kits
Figure 2-9

2-6. Material Requirements

A. Materials such as adhesives, primers, etc. must be stored in clean and dry areas, in airtight containers, out of direct sunlight, with storage temperatures of 70° F (21° C) desired. Shelf life, as indicated on containers, can be drastically shortened if these conditions are not met.

B. If applicable, shelf life will be noted on containers when received, with effective dates noted. *Materials which have exceeded the noted shelf life must not be used.*

C. Only the materials specified in this manual are acceptable for use.

D. Consumable materials are listed in Figure 2-10( ).

E. Contents of Complete Repair/Paint Kits are listed in Figure 2-11.

F. Flash Points and Shelf Life for Most Used Consumables are listed in Figure 2-12.

2-7. Application Equipment for Finish Procedures

A. Apply polane paints, wash primer and anti-static paint with a suction-feed DeVilbiss MBC air spray gun with E-tip needle and No. 30 air cap (or with equivalent equipment) at an atomizing pressure between 40 psi (2.8 kg/cm²) and 45 psi (3.2 kg/cm²).

CAUTION: APPLY LIGHTNING GUARD PAINT ONLY WITH AN AIR-PRESSURE FEED SPRAY SYSTEM. AN AGITATION SYSTEM IS REQUIRED TO KEEP THE COPPER SUSPENDED IN THE SOLUTION.

B. Apply lightning guard paint with a standard air-pressure feed system at air pressure of approximately 40 psi (2.8 kg/cm²).

2-8. Kits

Kits are available to provide all the necessary materials for the appropriate application. Individual items may also be ordered separately.

Ref No.	Part No.	Description	Application	Hartzell Supplied Only
1	79651407K	1407K-20 Vacuum Oil (Duoseal)	Erosion shield replacement	
2	7965640702	YA-6407-02 Vacuum Hose	Erosion shield replacement	
3	993705662	30cc Disposable Commercial Syringe with needle between 0.030 and 0.050 in O.D.	Work adhesive into debond/delamination area	
4	N/A	Brush (1 in.)	Apply external boot adhesive; misc. applications	
5	N/A	Plastic Container	Mix composite materials (resin, hardener, etc.)	
6	N/A	Protective Gloves (Vinyl or Latex)	Protect skin from irritation	
7	990000900	Cheesecloth (clean), grade 90	Wipe down blades prior to painting	
8	990500801	3M EC801	Filler for: de-icer boot lead strap minor cracks in metal erosion shield cracks in uncuffed areas between blade cuff and primary retention windings Cure Time: tack-free 24 hrs.; full cure 7 days	
9	990500800	3M 800	Alternate for 3M 801, except allow 1300L adhesive to dry for 8 hours before use Cure Time: 10 to 15 minutes	
10	990501300	3M 1300L	Bond external de-icer boot to blade *Extremely Flammable* Cure Time: to tack something 8 min.; full cure 3 days	
11	990600A05 9906MEK05 9912000DA	Acetone Methyl-Ethyl-Ketone (MEK) *Denatured Alcohol Hysol	Wash any surface area of blade or cuff which has been sanded or cleaned out with a pick or brush prior to repair Wipe blade surface prior to installation of de-icer boot Clean shank and bearing bore Evaporation Time: 5 minutes	
12	#5 - 991000505 #6 - 991000605	Aeroshell 5, 6, 22 Royco 22C	Release agent on blade retention radius (ref. Hartzell Service Advisory 17A)	
13	991200EA or 990490100	Ethyl Acetate	Wipe unglazed (back) surface of the de-icer boot and strap prior to application of adhesive	
14	57A2328-21	A-2328-21 (Hysol EA9330)	Bond nickel erosion shield to blade All composite blade repairs Pot Life: 60 minutes at 77 °F, 100 gram mass Minimum Cure Time: 12 hours at 77 °F or 2 hours at 140 °F	✓
15	57A2328-16	A-2328-16 (Hysol EA9430)	Composite blade repairs except debonds and delaminations; winding application Pot Life: 40 minutes at 77 °F, 250 gram mass Minumum Cure Time: 4 hours at 77 °F before use	✓
16	991200151	Hysol 0151	On inner races of retention split-bearing to fill voids between bearing and blade retention radius	
17	N/A	Plastic Media	Paint removal [usage is limited due to necessity to protect composite materials - ref. Hartzell Service Advisory 54( )]	
18				
19	020700225	RAM 225 Epoxy Release	Release agent for counterweight I.D.	

Consumable Materials
Figure 2-10

Ref No.	Part No.	Description	Application	Hartzell Supplied Only
20	022209309	Hysol EA9309.3NA	Adhesive for counterweight clamp halves Secure blade balance tubes during installation **Pot Life: 35 minutes at 77°F, 450 gram mass** **Cure Time: 12 hours at 70°F or 2 hours at 140° ±10°F**	✓
21	990509222-41	Locktite 222	Thread locking compound for counterweight bolts	
22	991200700	700 Lacquer Thinner, or equivalent	Clean blade	
23	N/A	Stoddard Solvent 111 Tri-Chlor Ethane	Remove grease from blade bore	
24	991208514	MIL-C-8514 Wash Primer	Finsh procedure, erosion shield only	
25	991200T54	T-54 Wash Primer Reducer	Finsh procedure, mixed with MIL-C-8514	
26	99120AC01	120AC-5 Acid Diluent	Finsh procedure, mixed with MIL-C-8514	
27	9912D6123	D61-A-23 Primer Filler	Finish procedure	
28	991266V27	V66V27 Primer Catalyst	Finsh procedure, mixed with D61-A-23	
29	9912E65A4	E65-A-4 Primer Sealer	Finsh procedure	
30	991266V29	V66V29 Polane Catalyst	Finsh procedure, for all polane paint, except D61-A-23	
31	991266VB11	V66VB11 Accelerator	Finsh procedure, for all polane paint, except D-61-A-23 **Pot Life: 4 hours**	
32	9912R7K69	R7K69 Polane Reducer	Finsh procedure, for all polane paint, except D-61-A-23	
33	9912BB510	Z99BB510 Black Polane	Finsh procedure	
34	9912AB503	Z99AB503 Gray Polane	Finsh procedure	
35	991201973-1	Z98-1973 Gray Metallic Polane	Finsh procedure	
36	9912WB612	Z99WB612 White Polane	Finsh procedure	
37	991200104	528-J-104 "P" Static Coating	Finsh procedure	
38	991200119	910-J-119 "P" Static Curing	Finsh procedure, for 528-J-104	
39	99128574B	599SA-A8574-1A Lightning Guard Copper	Finsh procedure	
40	99128574A	599SA-A8574-1AB Lightning Guard Hardener	Finsh procedure	
41	990500450	Toluol	Finsh procedure	
42	020200241	#241 Fiberglass Fabric	Erosion shield application; airworthy repair	✓
43	N/A	258-B Tongue Depressors	Mixing tool	
44	020200200	Nylon Release Film	Erosion shield application	
45	991500016	Vacuum Bag (16 in. tube, 4 in. thick, poly butylene or equivalent)	Erosion shield application	
46	N/A	Sand Paper (no courser than 60 grit)	Various surface preparation procedures	
47	991900008S	Scotch Brite Pad	Lightly polish bearing bore	
48	022000098 022000087	86/87 Resin	For winding application **Cure Time: minimum 12 hours at 77°F or 2 hours at 140° ±10°F**	
49	990500776	3M EC776 Fuel Resistant Sealant	For balance tube replacement **Cure Time: 10 minutes at 77°F**	
50	N/A	Grease Pencil	Misc. markings on blade surface	

Consumable Materials Cont.
Figure 2-10a

Ref No.	Part No.	Description	Application	Hartzell Supplied Only
51	991500200	Sealant Tape	Erosion shield application	
52	N/A	Machine Screws, 6-32 x 0.375 in S.S. Ph. Head	Stainless steel erosion shield repair	
53	N/A	Rivets	Stainless steel erosion shield repair	
54	N/A	Sand paper, 60 to 80 grit	Blade cuff repair	
55	020200242	#242 Fiberglass Cloth	Repairs	✓
56	020200029	Milled Fibers	Minor repairs	
57	N/A	Pick	Removal of loose paint	
58	N/A	Teflon Bleeder Cloth	Major repair of crushed blade trailing edge	
59	N/A	Polyester Absorbent Cloth	Major repair of crushed blade trailing edge	
60	N/A	Silicon Carbide, 150-grit	Refinishing	
61	N/A	Sandpaper, 400-grit	Refinishing	
62	N/A	Crown Kleer-Kote 6004 Acrylic Spray	Protect decals	
63	N/A	240 Emery Cloth	Apply delrin seal ring to specific blade	
64	99150425-1	Aluminum Foil Tape No. 425 (1 inch square)	Finish procedure for E11990	
65	N/A	Sandpaper, 140 grit or finer	Finish procedure for E11990	
66	N/A	1/4 inch Fine Line Tape	Mask for finish procedure	
67	N/A	Zinc Chromate Primer	Corroded cadmium-plated screw repair	
68	990514250	Devcon 5 minute epoxy (1 to 1 mix)	Delrin seal ring application	
69	N/A	White Opaque Ink	Blade identification stamp	
70	N/A	Black Opaque Ink	Blade identification stamp	
71	990580495	Locktite 495	Minor blemish correction	
72	N/A	Talc Powder	Minor blemish correction	
73	N/A	Lacquer Spray	Spray decals and stamp	
74	N/A	1/2 inch Masking Tape	Delrin seal ring application	
75	N/A	1 1/2 inch Masking Tape	Delrin seal ring application	
76	N/A	Mil-P-814 Wash Primer	Painting of blade pilot bore	
77	N/A	Tempilaq (or equivalent)	Megger inspection of A10460E	

Consumable Materials Cont.

Figure 2-10b

Repair Kit Number	A-2328	-1	-3	-8	-9	-11	-12	-13	-14	-15	-18	-19	-22	-23
Description	M10677 Blade	LM10686 Blade	M10083 Blade	Lightning Guard	Minor Repair	White Paint Tip	Primer Filler	Anti-Static	Metallic Gray	Primer Sealer	Black Polane Paint	Gray Polane Paint	A-10460 E-11990 B-7468 E-10950 Blades	B-7421 Blade
D61A23 Primer Filler	32	32	32	—	16	—	32	—	—	—	—	—	32	32
V66V27 Catalyst	4	4	4	—	4	—	4	—	—	—	—	—	4	4
E66A4 Sealer	32	32	32	—	—	—	—	—	—	32	—	—	32	32
V66V29 Catalyst	32	32	16	—	—	8	—	—	8	4	8	8	16	16
V66VB11 Accelerator	4	4	4	—	—	4	—	—	4	4	4	4	4	4
EA9430 Epoxy Resin Pt. A	16	16	16	—	16	—	—	—	—	—	—	—	16	16
EA9430 Epoxy Hardner Pt. B	4	4	4	—	4	—	—	—	—	—	—	—	4	4
820200028 Milled Fibers	10	10	10	—	10	—	—	—	—	—	—	—	10	10
Fiberglass Stripe (2 in x 2 in)	2 ea	2 ea	2 ea	—	2 ea	—	—	—	—	—	—	—	2 ea	2 ea
Z99WB612 White Polane	16	16	16	—	—	32	—	—	—	—	—	—	16	16
RZK69 Reducer	64	64	1 qt 8 oz	—	—	16	—	—	16	16	16	16	1 qt 8 oz	64
3M EC800 Sealant	1 ea	1 ea	—	—	—	—	—	—	—	—	—	—	—	—
Z99BB610 Black Polane	32	32	32	—	—	—	—	—	—	—	32	—	32	32
79980-1/8x2 Station Decal	8 ea	8 ea	8 ea	—	—	—	—	—	—	—	—	—	8 ea	8 ea
Z99-1973 Metallic Gray	32	—	—	—	—	—	—	—	32	—	—	—	—	—
A-6741-8 Lightning Guard	—	—	32	32	—	—	—	—	—	—	—	—	—	—
A6574-A Lightning Guard	—	—	4	4	—	—	—	—	—	—	—	—	—	—
828-J-104 "F" Static Coating	16	—	—	—	—	—	—	16	—	—	—	—	16	16
910-J-115 "F" Static Curing Solution	16	—	—	—	—	—	—	16	—	—	—	—	16	16
Z99AB603 Gray Polane	—	32	—	—	—	—	—	—	—	—	—	32	—	32
MIL-C-8514 Wash Primer	16	16	16	—	—	—	—	—	—	—	—	—	16	16
T-51 Reducer	16	16	16	—	—	—	—	—	—	—	—	—	16	16
120AC08 Acid Diluent	4	4	4	—	—	—	—	—	—	—	—	—	4	4
9?600456 Toluol	—	—	32	32	—	—	—	—	—	—	—	—	—	—
A-1692 Comp. Blade Decal	8 ea	8 ea	8 ea	—	—	—	—	—	—	—	—	—	8 ea	8 ea
CAU-112 Blade Decal	8 ea	8 ea	8 ea	—	—	—	—	—	—	—	—	—	8 ea	8 ea
Blade Decal (oval)	8 ea	8 ea	8 ea	—	—	—	—	—	—	—	—	—	8 ea	8 ea

Note: There are also kits available that contain parts A and B of adhesive only, A-2328-16 for EA9430, and A-2328-21 for EA9330. EA9330 is useable anywhere and is essential for erosion shield replacement. EA9430 is useable everywhere except for erosion shield replacement.

Composite Blade Repair/Paint Kits (A-2328)
Figure 2-11

Part Number	Nomenclature	Manufacturer	Flashpoint °F	Flashpoint °C	Shelf Life months*
1300L	Adhesive	3M	14	-10	6 DOS
EC 801	Sealant	3M			5 DOS
MIL-C-8514	Wash Primer	Randolph	72	22	36 DOM
T-54	Reducer	Randolph	63	17	N/A
120AC05	Acid Diluent	Randolph	63	17	N/A
D61-A-23	Spray Fill	Sherwin-Williams	80	27	36 DOM
V66V27	Catalyst	Sherwin-Williams	120	49	12 DOM
E65-A-4	Primer Sealer	Sherwin-Williams	50	10	24 DOM
V66V29	Catalyst	Sherwin-Williams	95	35	24 DOM
V66VB11	Accelerator	Sherwin-Williams	74	23	12 DOM
R7K69	Reducer	Sherwin-Williams	35	17	24 DOM
Z99BB510	Black	Sherwin-Williams	51	11	24 DOM
Z99AB503	Polane Gray	Sherwin-Williams	49	9	24 DOM
Z98-1973	Polane Metallic Gray	Sherwin-Williams	41	5	24 DOM
Z99WB612	Polane White	Sherwin-Williams	41	5	24 DOM
528-J-104	"P" Static Coating	DeSoto	39	4	12 DOR
910-J-119	"P" Static Curing	DeSoto	38	3	12 DOR
599SA-A8574-1pt A	Lightning Guard Hardener	Spraylat	107.6	21	6 DOM
599SA-A8574-1 pt B	Lightning Guard Copper	Spraylat	70	42	6 DOM
990600450	Toluol		45	7	N/A
1407K-20	Vacuum Oil	Duoseal	450	232	60 DOR
EA9330 pt A	Adhesive	Hysol	200	93	12 DOS
EA9330B pt B	Adhesive	Hysol	212	100	12 DOS
EA9430A & B	Adhesive	Hysol	300	149	12DOM
800	Sealant	3M	+20	-7	5 DOM
EA9309.3NA	Adhesive	Hysol pt A	>300	>149	12 DOS
		pt B	<300	<149	12 DOS

DOM = Date of Manufacture
DOS = Date of Shipment from Manufacturer
DOR = Date of Receipt at Hartzell Propeller Inc.

*Normal Conditions Unopened

NOTE: "Flash Point" means the minimum temperature at which a substance gives off flammable vapors which, in contact with spark or flame, will ignite.

Flashpoint and Shelf Life
for Most Used Consumables
Figure 2-12

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Manual 156A (Composite Blade Section) - Damage Definitions and Descriptions

This manual is arranged differently from past editions regarding damage and repair definitions. Please do not confuse past practices with those outlined in this manual. To eliminate confusion with past editions, the terms "minor damage" and "major damage" are no longer used, being replaced with "airworthy damage" and "unairworthy damage".

3-1. General

A. This manual is arranged differently from past editions regarding damage and repair definitions. Please do not confuse past practices with those outlined in this manual. To eliminate confusion with past editions, the terms "minor damage" and "major damage" are no longer used, being replaced with "airworthy damage" and "unairworthy damage".

B. This manual is arranged such that damage and repair are treated separately. This gives the operators and repair facilities greater clarification and freedom in dealing with composite blade damage.

1) Chapter 3 defines airworthy and unairworthy damage. Chapter 6 describes minor repair and Chapter 7 describes major repair.

2) The type of repair is not dictated by the type of damage received. For example, a blade with airworthy damage may require a major repair or vice versa.

C. Upon inspection of a composite propeller blade, an operator should first determine the type of damage: airworthy or unairworthy. (Limits are in this chapter.) Figure 3-1 illustrates the determination of repair.

1) If the damage is determined to be airworthy, the aircraft may continue in service. However, the operator should make arrangements to have repairs performed as soon as practical.

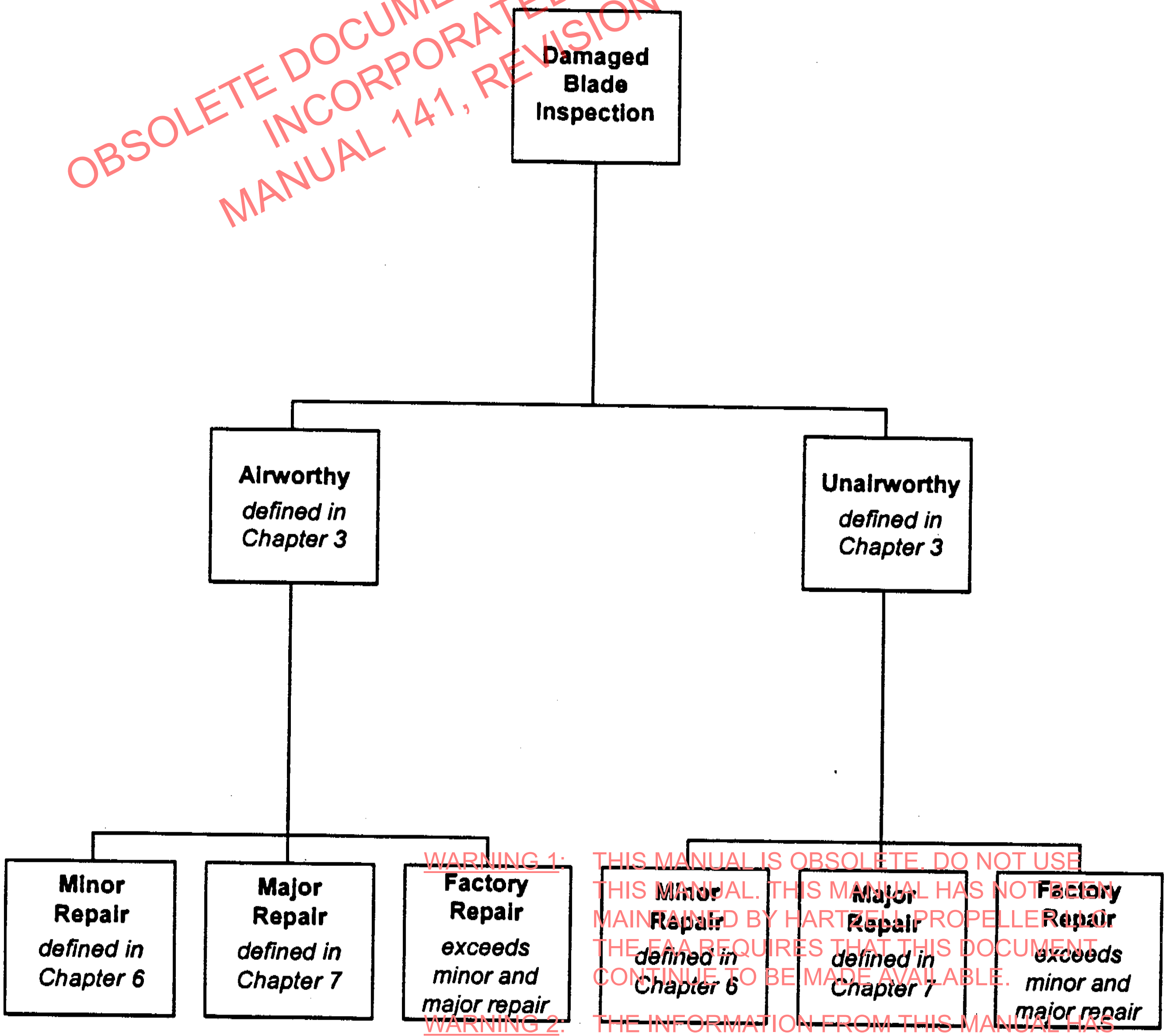
2) If the damage is determined to be unairworthy, the propeller blade should not be used until a repair is performed.

D. Next, the operator should determine if the repair falls into the category of minor or major. Limits for each repair are in Chapter 6 or 7.

1) If the repair is minor, a qualified mechanic (see qualifications in Chapter 2) may repair the damage.

2) If the repair is major, the operator should make arrangements to have the damage repaired at an approved facility.

E. Due to the infinite types of damage possible, not all types of damage that can be considered airworthy are covered in this manual. If there is any doubt as to airworthiness of the blade, contact Hartzell (address located on page 1-3).



Determination of Repair Flow Chart
Figure 3-1

3-2. Definitions

Terms used in this manual with reference to damage of the composite blade are defined as follows:

1) Corrosion - gradual wearing away or deterioration due to chemical action.
2) Crack - irregularly shaped separation within a material, usually visible as a narrow opening at the surface.
3) Debond - separation of the metal erosion shield from the composite blade material.
4) Delamination - internal separation of the layers of composite material.
5) Depression - surface area where the material has been compressed but not removed.
6) Distortion - alteration of the original shape or size of a component.
7) Erosion - gradual wearing away or deterioration due to action of the elements.
8) Exposure - leaving material open to action of the elements.
9) Gouge - surface area where material has been removed.
10) Impact Damage - occurs when the propeller blade or hub assembly strikes or is struck by an object, either in-flight or on the ground.
11) Nick/Scratch - removal of paint and possibly a small amount of composite material not exceeding one (1) layer [approximately 0.010 inch (0.254 mm)].
12) Overspeed Damage - occurs when the propeller hub assembly rotates at a speed more than ten per cent (10%) in excess of the maximum for which it is designed. Overspeed damage may not produce visible indications.
13) Split - delamination of blade extending to blade surface, normally found near trailing edge or tip.

3-3. Definitions of Composite Blade Service and Repair Limits

Terms used in this manual with regard to composite blade service and repair are defined as follows:

1) Blade Life is expressed in terms of total hours of service (TT, or Total Time), time between overhauls (TBO) and in terms of hours of service since overhaul (TSO, or Time Since Overhaul). Overhaul returns the blade assembly to zero hours TSO, but *not* to zero hours TT. Occasionally, a part may be "life limited" which means that it must be replaced after a specified period of use. All references are necessary in defining the life of the propeller.

2) Damage

a) Airworthy Damage - Airworthy damage is damage that does not affect the safety or flight characteristics of the propeller blade. The maximum limits of airworthy damage are specified later in this chapter. Although a blade may continue in service with airworthy damage, this type of damage **should be repaired at the earliest practical time** to prevent further damage to the blade.

b) Unairworthy Damage - Unairworthy damage is damage that exceeds the maximum limits of airworthy damage. Unairworthy damage can affect the safety or flight characteristics of the propeller blade. **This type of damage must be repaired prior to the next flight.**

3) Repair

a) Minor Repair - correction of damage that may be safely performed in the field by a certified aircraft mechanic (preferably a mechanic who has completed Hartzell composite blade training).

b) Major Repair - correction of damage that cannot be performed by elementary operations. Major repairs must be performed by a propeller shop that has been approved by Hartzell for the specific type of major repair (refer to Chapter 7). Propeller shops must meet facility, tools and personnel requirements and may require approval of samples (see paragraph 2-2 through 2-6).

4) Overhaul is the periodic disassembly, inspection, repairing and reassembly of the composite blade assembly.

a) The period between overhauls is generally based on hours of service (operating time) or on calendar month time.

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

c) Overhaul is to be accomplished in accordance with the latest revision of this manual and other publications applicable to, or referenced in, this manual.

d) Overhaul is to be accomplished only by an approved propeller shop that meets facility, personnel, tooling and sampling requirements (see paragraph 2-2 through 2-5).

e) Composite blades are normally overhauled whenever the hub assembly is overhauled. Even if one or more blades has a relatively low TSO, it is common practice to overhaul the entire propeller assembly whenever the hub assembly is overhauled (for economic and logistic reasons).

f) Hartzell propeller TBO specifications are provided in the latest revision to Hartzell Service Letter 61.

3-4. Airworthy Damage Descriptions

A. Airworthy damage does not exceed the limits which follow herein. This type of damage will not affect the safety or flight characteristics of the propellers.

B. Areas of airworthy damage should be monitored and repaired as soon as practical.

C. Airworthy Damage Limits:

1) Nickel Erosion Shield

NOTE: The following damages, a) through h), cannot be resolved without replacement of the erosion shield, but within these limits, do not render the blade unairworthy.

a) Any gouge that does not penetrate through to the surface of composite material.

b) Any full width chordwise crack as long as the erosion shield is not debonded within 3.5 inches (8.89 cm) of the crack (Figure 3-2).

c) No two (2) full width chordwise cracks may occur within 6 inches (15.24 cm) of each other.

d) Chordwise cracks less than 0.5 inch (12.7 mm) that are not debonded within 1 inch (2.54 cm).

e) Portions of the trail side of the erosion shield may be missing due to erosion or removal due to sanding (Figure 3-2 for limits).

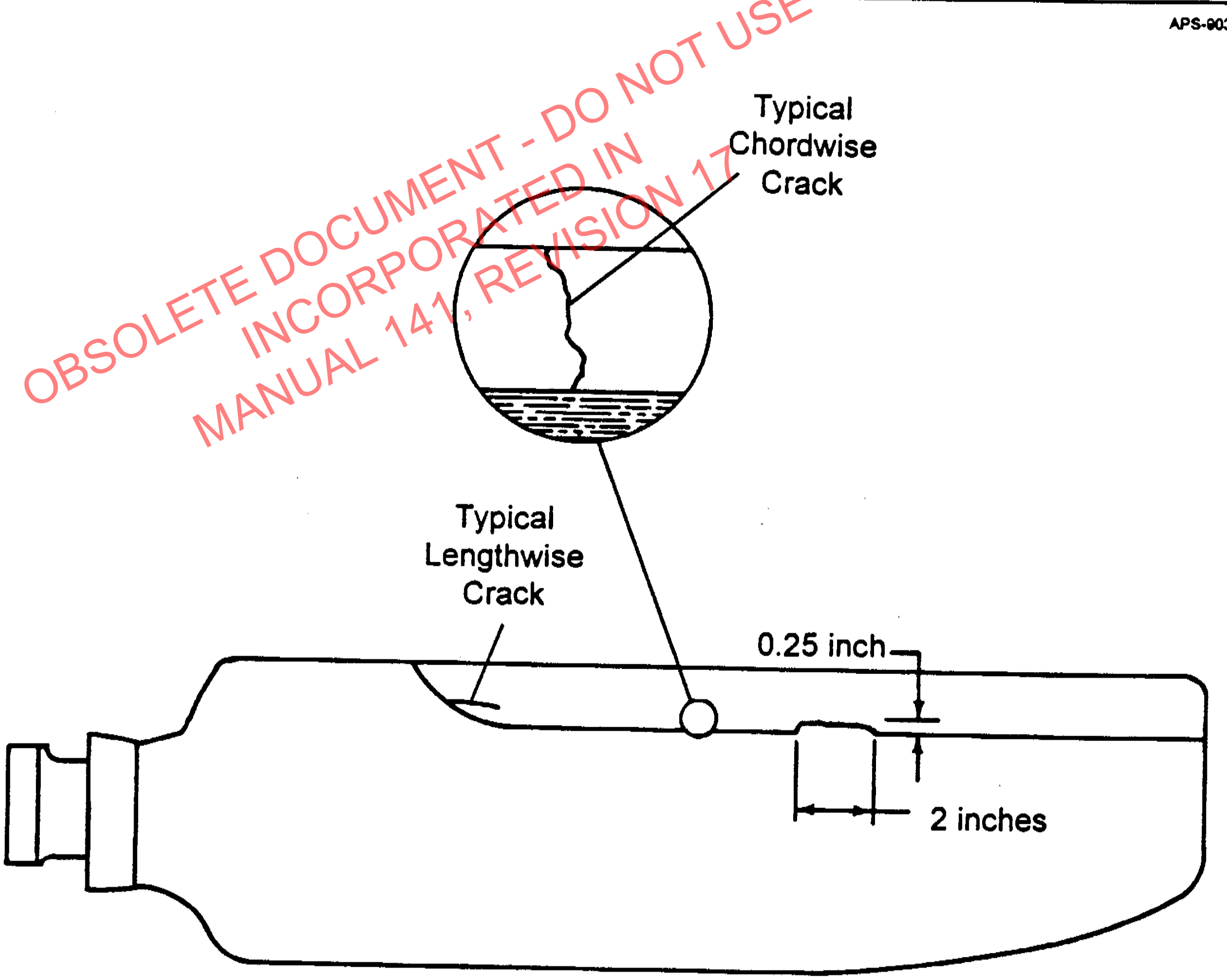
f) Lengthwise cracks less than 2 inches (5.08 cm) that are not debonded within 3.5 inches (8.89 cm) of the crack (Figure 3-2).

g) For blades with attached counterweight clamps, cracks within 1 inch (2.54 cm) of counterweight clamp that are not debonded.

h) Minor deformations due to impact damage that does not greatly affect the airfoil shape.

NOTE: The following damages, h) through k), do not render the blade unairworthy but should be repaired as soon as practical to prevent degradation of the condition.

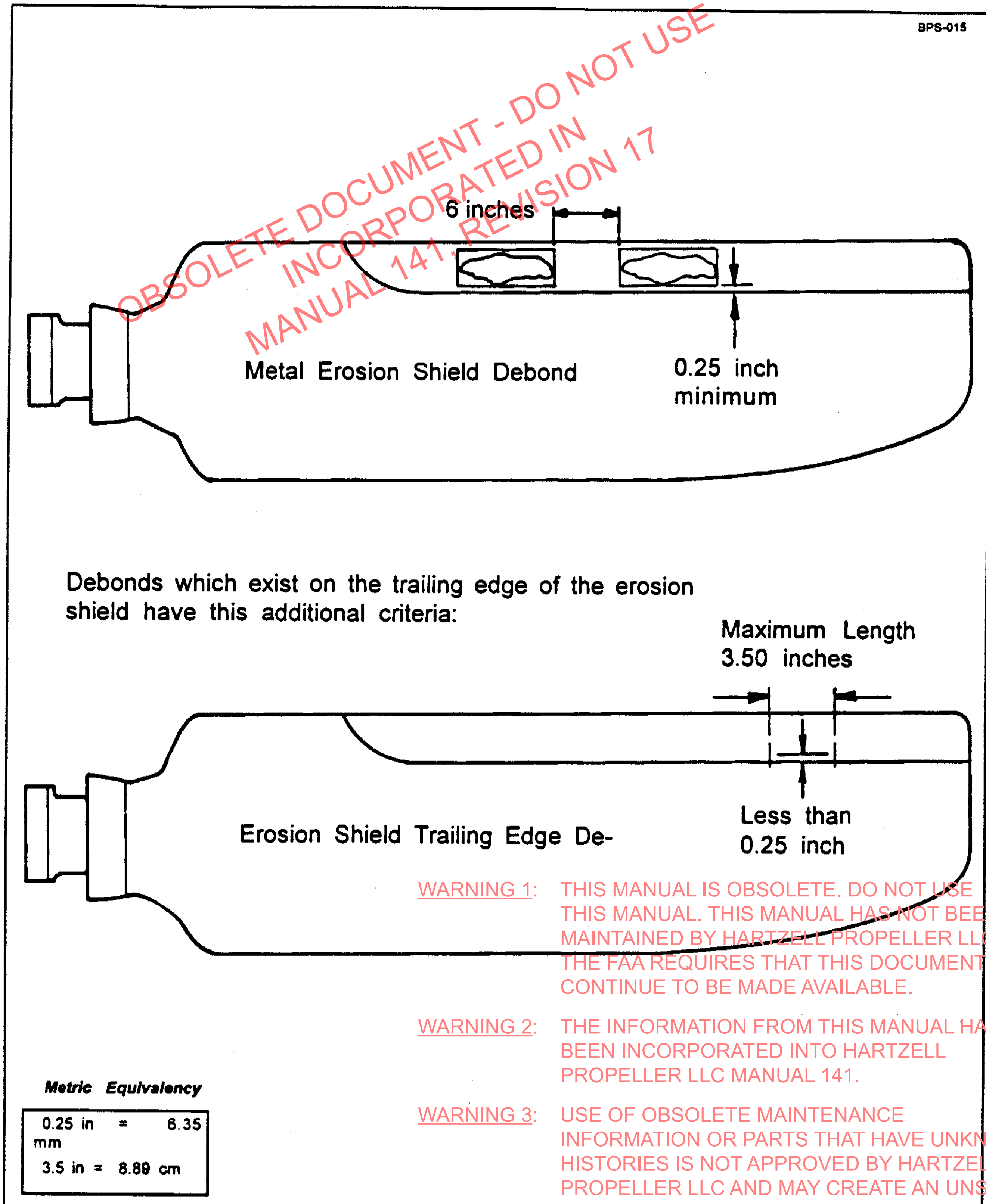
i) Debonds located along the trailing side of the erosion shield that total less than 10.5 inches (26.67 cm) in length. No individual debond may exceed 3.5 inches (8.89 cm) in length and 0.25 inches (6.35 mm) in width (Figure 3-3).



Metric Equivalency

0.25 in = 6.35mm

Missing Portions of Nickel Erosion Shield (Trail Side) and Typical Cracks
Figure 3-2



Limits of Airworthy Damage in Erosion Shield Debond
Figure 3-3

j) Debond which is located at least 0.25 inch (6.35 mm) from the erosion shield trail side and has total area less than 2.5 square inches (6.35 sq cm), and is separated by at least 6 inches (15.24 cm) from any other debond area on the same blade surface (Figure 3-3).

k) The total debonded area of all debonds may not exceed 10 square inches (25.4 sq cm).

2) Stainless Steel Erosion Shield

NOTE: Debond area requirements apply only to portions of the erosion shield not fastened with screws or rivets. If screw and rivet holes have lengthwise cracks extending from them, debond repair is no longer considered effective.

NOTE: The following damages, a) through c), cannot be resolved without replacement of the erosion shield, but within these limits, do not render the blade unairworthy.

a) No single screw or rivet hole with a chordwise crack extending from it may have any lengthwise cracks also extending from it.

b) No two (2) chordwise cracks may occur within 6 inches (15.24 cm) of each other.

c) Minor deformations due to impact damage that does not greatly affect the airfoil shape.

NOTE: The following damages, d) through h), do not render the blade unairworthy but should be repaired as soon as practical to prevent degradation of the condition.

d) Crack or gouge in the erosion shield which is less than 0.125 inch (3.175 mm) deep and less than 0.25 in (6.35 mm) square, not to exceed 0.5 inch (12.7 mm) length.

e) Debond located along the trailing side of the erosion shield which is no longer than 3.5 inches (8.89 cm) and no wider than 0.25 inch (6.35 mm) (Figure 3-3).

f) Debond which is located at least 0.25 inch (6.35 mm) from the erosion shield trail side and has total area less than 2.5 square inches (6.35 sq cm), and is separated by at least 6 inches (15.24 cm) from any other debond area on the same blade surface (Figure 3-3).

g) The total debonded area of all debonds may not exceed 10 square inches (25.4 sq cm).

h) Cadmium screw corrosion.

3) Blade Cuff (as applicable)

a) Nicks, scratches.

b) Depressions less than 1 square inch (2.54 sq cm) area and less than 0.25 inch (6.35 mm) deep.

c) Delaminations less than 2 square inches (5.08 sq cm).

d) Cracks at the root end are airworthy, but should be sealed to protect the foam from contamination (Figure 3-4) until time of overhaul where these cracks can be permanently repaired. Refer to Chapter 6 for temporary repair procedures and Chapter 7 for major repair to be performed at time of overhaul.

e) Cracks located in the area where the cuff and blade meet must be within the limits as shown in Figure 3-5.

f) No more than two (2) other cracks may be located elsewhere on the cuff. These cracks must be less than 3 inches (7.62 cm) in length.

g) No more than two (2) damaged areas per side are permitted within 6 linear inches (15.24 cm) of each other. Root end cracks and cracks where the blade and cuff meet are not included in this requirement.

h) Cuffs with no boot or erosion shield covering the leading edge may have no cracks within 2 inches (5.08 cm) of leading edge.

4) Blade

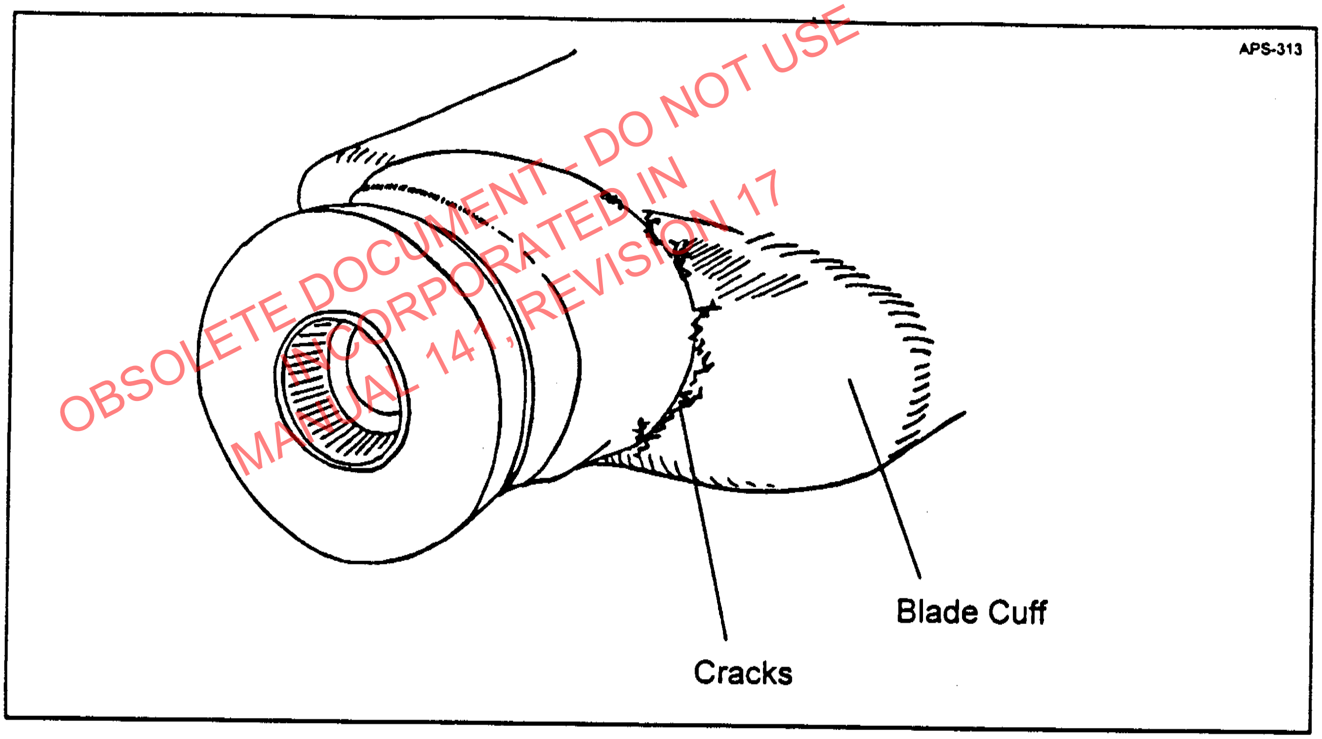
a) Gouges or loss of material less than 0.500 inch (12.7 mm) diameter or equivalent area and no more than 2.5 inches (6.35 cm) long and less than 0.020 inch (0.508 mm) deep anywhere on the outboard half of the blade.

b) Delamination on outboard half of the blade totaling less than 2 square inches (5.08 sq cm) with no dark brown or black stain (indicating presence of grease).

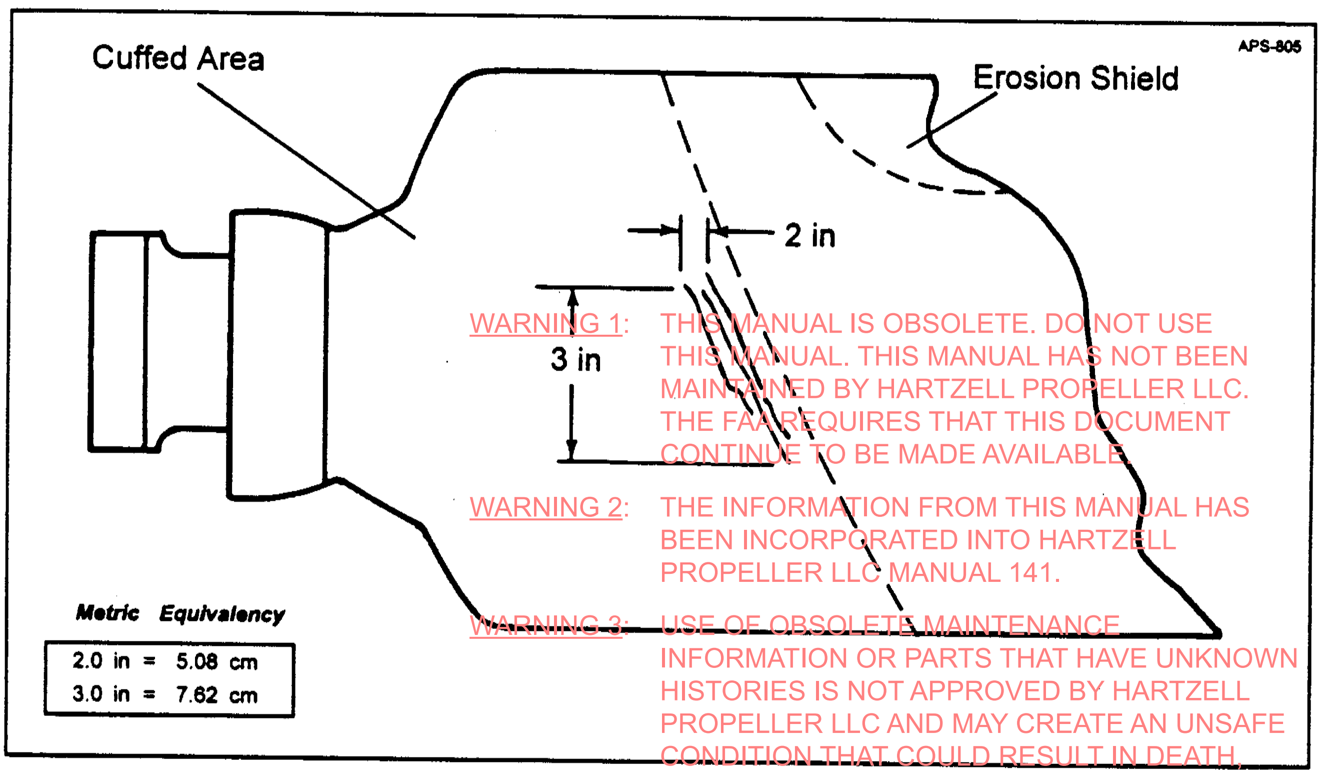
c) Gouges, loss of material, or delaminations on the inboard half of the blade can be unairworthy and the factory should be consulted.

d) Paint erosion

Exposure of less than 5 square inches (12.7 sq cm) of the composite



Blade Cuff Damage
Figure 3-4



Cracks in the Area Where Cuff Meets Blade
Figure 3-5

material and/or the primer filler.

e) "Crushed" Blade Trailing Edge (Figure 3-6)

1 Crushed area no larger than 0.25 inch (6.35 mm) deep x 1 inch (2.54 cm) long, on the outer half of the blade with no broken strands of composite material (i.e. epoxy crushed only).

f) Split Trailing Edge

1 Area less than 0.25 inch (6.35 mm) deep x 1 inch (2.54 cm) long on the outer half of the blade.

5) Erosion Screen

a) The limits of erosion screen damage which would require replacement at overhaul are given in Chapter 5. Prior to overhaul, these limits may be exceeded, with the blades still considered airworthy.

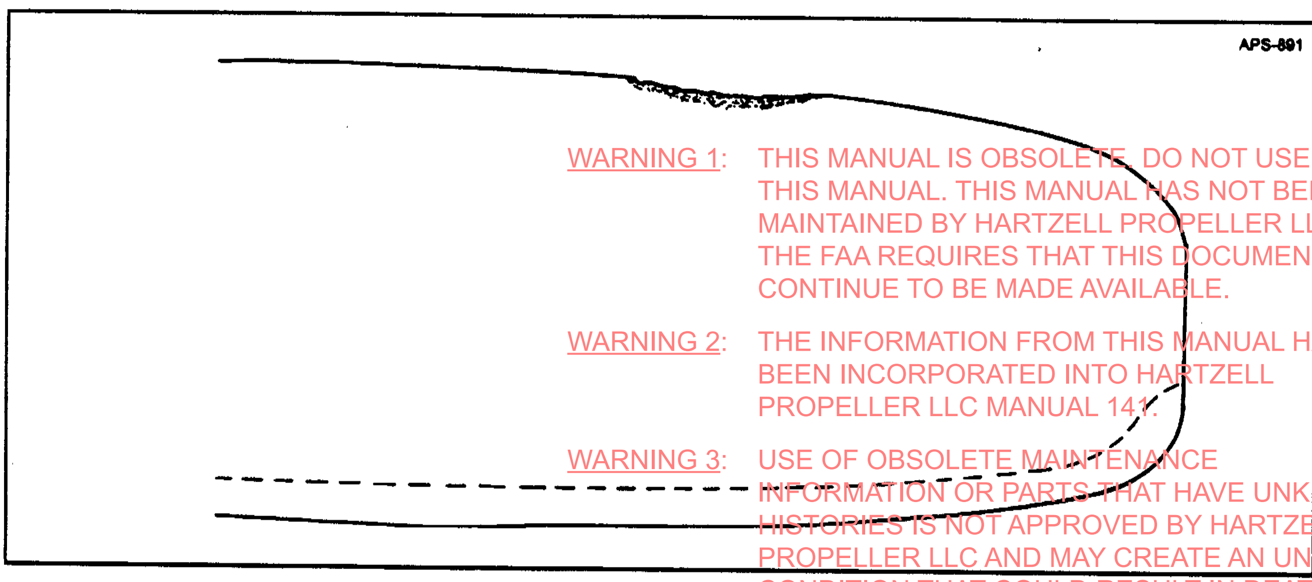
b) Operator should use best judgement as to whether screen should be replaced before overhaul. If damage is too severe, risk of rendering the blade unairworthy is possible.

NOTE: Airworthy damage to erosion screens should be repaired using limits and procedures for blade gouge minor repair.

6) Blade Retention Windings

NOTE: This applies to M shank blades only.

a) Cracks appearing in the paint over the blade retention windings are airworthy. These cracks should be repaired as soon as practical. Refer to



"Crushed" Trailing Edge
Figure 3-6

Chapter 6 for procedures.

3-5. Unairworthy Damage Description

CAUTION: UNAIRWORTHY DAMAGE TO A HARTZELL COMPOSITE BLADE MUST BE REPAIRED BEFORE THE NEXT FLIGHT.

A. Any damage which exceeds that of airworthy is considered unairworthy.

B. Areas of unairworthy damage should be repaired prior to further flight.

3-6. Lightning Strike Damage (Figure 3-7)

CAUTION: ANY COMPOSITE BLADE SUBJECT TO LIGHTNING STRIKE MUST BE INSPECTED AND MAY REQUIRE OVERHAUL.

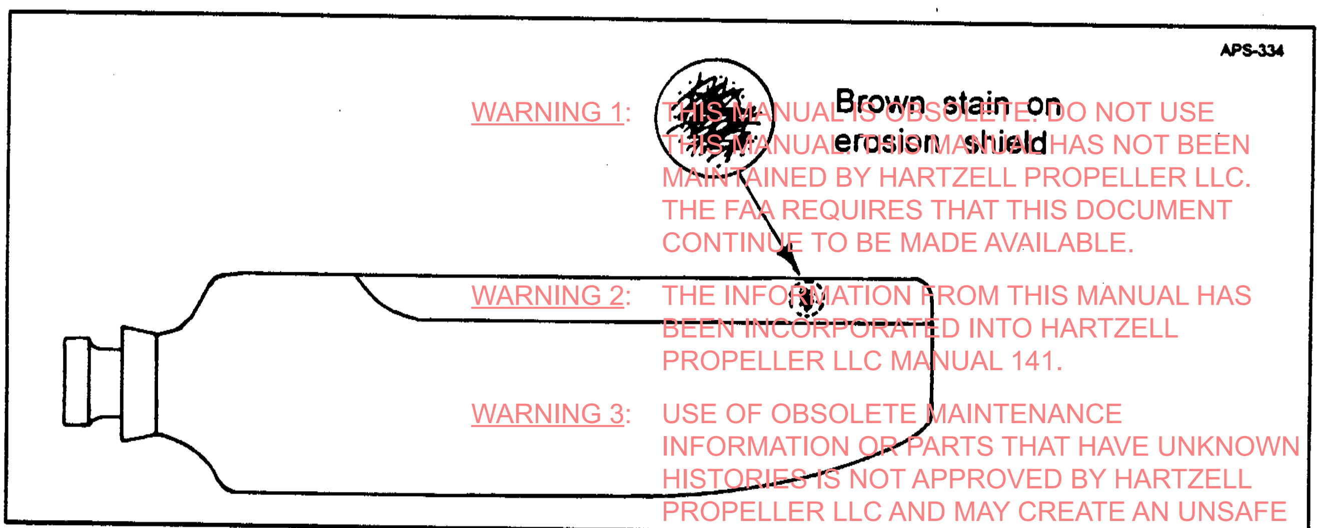
A. The following text addresses the composite blade only. Refer to S.L. 61( ) and the applicable Propeller Manual for complete overhaul procedures of propeller assembly.

B. Lightning strikes usually enter a composite blade through the metal erosion shield. If the blade has stainless steel erosion screen, the lightning strike may enter the screen instead of the erosion shield.

C. Lightning strike to the blade requires careful debond/delamination inspection (Chapter 4) to determine extent of damage and whether damage is airworthy or unairworthy (Chapter 3).

NOTE: Pay particular attention to erosion shield debonds upon inspection.

D. If only a darkened area is present on the erosion shield, and all blade damage is within limits specified, the damage is considered airworthy.



Evidence of Lightning Strike Damage to Composite Blade
Figure 3-7

E. If damage is outside of limits, return blade to factory.

3-7. Overspeed Damage

Propellers exposed to overspeed of greater than 10% of the maximum rating of

4-1. Required Record-Keeping

Composite blade damage and a description of its repair must be recorded in the propeller logbook. Maintaining a good logbook record is particularly important for composite propeller blades. Damage and/or repairs may suffer further degradation after continued use. Such degradation may be easily overlooked. Therefore it is important for inspectors to have access to accurate historical data when performing subsequent inspections.

4-2. Inspection Intervals, Inspection Requirements

A. Aircraft Daily Preflight Inspection

1) Follow propeller preflight inspection procedures as specified in the aircraft maintenance manual, or an air carrier's operational specifications, or propeller owner's manual.

2) Composite propeller blades do not require any special or additional preflight inspection requirements beyond that specified for aluminum blade propellers. However, operators should be aware of the basic characteristics of composite blade construction so that any abnormal conditions can be intelligently evaluated.

   a) Visually inspect entire blade for nicks, gouges, looseness of material, erosion, cracks and debonds.

   CAUTION: IF VISUAL INSPECTION DETECTS A DARKENED AREA (USUALLY NEAR THE TIP) AS MAY HAVE BEEN CAUSED BY A LIGHTNING STRIKE, PERFORM A "COIN-TAP" TEST IMMEDIATELY TO DETERMINE WHETHER OR NOT DEBOND OR DELAMINATION HAS OCCURRED.

   b) Visually inspect blades for lightning strike. If present, a darkened area and possible pitting, usually in the proximity of the tip, will be noticeable. If a lightning strike is suspected, perform a "coin-tap" test prior to further flight to test for debond and/or delamination.

3) Defects or damage discovered during preflight inspection must be evaluated in accordance with damage definitions described in Chapter 3 of this manual to determine whether repairs are required prior to further flight.

B. Aircraft Periodic Maintenance Inspections

1) Inspection must be performed in accordance with the aircraft maintenance manual or an air carrier's operational specifications. The following composite blade inspection is to be performed during regularly scheduled maintenance, not to exceed intervals of 500 hours of operation or 12 calendar months.

2) Perform thorough visual inspection and "coin tap" entire blade and erosion shield surface. Coin-tapping with apparent audible change will indicate a delamination or debond (Figure 4-1 and Paragraph 4-4).

NOTE: Personnel performing aircraft inspections should be thoroughly familiar with "coin-tap" inspection procedures as well as knowledgeable about the limits of "airworthy damage" as defined in Chapter 3.

3) Review blade logbook records and carefully inspect areas of airworthy damage and previously repaired areas for growth. If growing, repair is required prior to return to service, even though damage may be within "airworthy damage" definition.

4) Defects or damage discovered during scheduled inspections must be evaluated in accordance with damage definitions described in Chapter 3 of this manual to determine whether repairs are required prior to further flight. Although repair of "airworthy damage" is not essential prior to further flight, such damage should always be repaired as soon as possible, to avoid further degradation. Any "unairworthy damage" must be repaired prior to further flight.

5) De-icer Boot Inspection

a) Check boot condition and attachment. Perform either a functional check of the system or resistance check of the boot to verify that the heating element will function properly.

b) Certain blades (A10460E) may contain an internal heating element which must also be verified to function properly by resistance check and a megger inspection.

c) Megger Inspection

1 Check dielectric strength with item 59 in Figure 2-3a (or equivalent) set at 2000 megohms and 500 V. DC. Connect red lead to heater and black lead to lead edge. Turn Meg-Chek for one minute. Measurement should be 10 megohms minimum.

2 Check dielectric strength with item 60 in Figure 2-3a (or equivalent). Connect red lead to heater and black lead to lead edge. Turn on power. DO NOT TOUCH BLADE! Depress "Push to Test" button and hold. Slowly increase voltage from 0-1 KV. Hold at 1 KV for one minute. Blade must withstand 1 KV for one minute to pass inspection. (Do not repeat the Hy-Pot test on passed blades.)

3 Heat pattern test. Apply item 77 of Figure 2-10b (or equivalent) 110° F temperature indicator to lead edge to cover entire heater area. Let dry. Connect both heater leads to power supply. Apply 8 amps for approximately 3 minutes until melt pattern is seen and shut off power. The melt pattern should be seen between the 6 and 12 inch (15.24 and 30.48 cm) stations. Check for melt pattern outboard of the 12 inch (30.48 cm) station which could be cause for rejection.

4 Check dielectric strength around strain relief with item 59 of Figure 2-3a (or equivalent) set at 2000 megohms and 500 V. DC. Connect black lead to strain relief. Turn on power. Probe entire area around strain relief. If any point indicates less than 2000 megohms, hold probe at that spot for one minute. If the check indicates less than 100 megohms, the blade must be reworked to attain 100 megohm minimum in this area.

6) Record details of all damage and/or repairs in propeller logbook.

C. Propeller Overhaul or "Major Periodic Inspection"

1) Refer to the applicable Hartzell Propeller Manual for detailed overhaul requirements for the entire propeller assembly. Propeller Time Between Overhaul (TBO) specifications are published in Hartzell Service Letter 61( ) and Service Bulletin 152. This manual assumes that the blade has been removed from the propeller assembly and addresses only the composite blade assembly.

2) Detailed requirements for composite blade overhaul are found in Chapter 5.

4-3. Airworthiness Limitations

Refer to the applicable Hartzell Propeller Manual for airworthiness limitations. There may be mandatory replacement times, inspection intervals, or related procedures for the entire propeller assembly and/or its component parts.

4-4. Inspection Procedures

A. Coin-Tap Test (Figure 4-1)

1) Composite blades can be inspected for delaminations and debonds by tapping the blade, or cuff (if applicable), with a "metal washer".

2) Use a washer shaped metal tapper, approximately 2.5 inches O.D. x 1.25 inches I.D. x 0.25 inch thick, and weighing no less than 3 oz. Tap the surface, if an audible change is apparent, sounding hollow or dead, a debond or delamination is likely.

NOTE: Blades which incorporate a "cuff" will have a different tone when coin-tapped in the cuff area. To avoid confusing sounds, the cuff area and the transition area between cuff and blade should be coin-tapped separately from the blade area.

3) "Mapping" of the area to be coin-tapped is desirable to assure that the entire surface is adequately inspected. "Coin-tap" within an imaginary grid or matrix consisting of 2 inch squares during scheduled aircraft inspections. During blade overhaul, a more thorough inspection is required by using a smaller grid, a coin-tap within ½ inch squares.

a) The metal erosion shield is more likely to have problems than the blade, therefore a more thorough coin-tapping of the erosion shield is desirable. Also, slight deformations in the erosion shield may be noticed by careful visual and manual (touch) inspection. Such deformations may be the result of a debond and should be given a careful coin-tap inspection.

b) If a suspected delamination or debond is discovered, a localized, thorough coin-tap inspection is required to define precise area of delamination or debond.

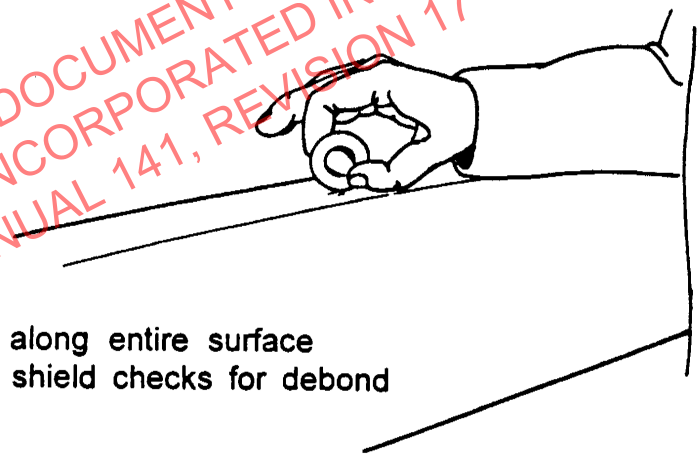
NOTE: To provide a rough guideline, routine composite blade coin-tap inspections "on-aircraft" typically require about 0.2 man-hour per blade. Coin-tap inspections during overhaul typically require about 0.5 man-hour per blade.

4) Outline the suspect area with a grease pencil to determine approximate size of damage. Record damage/repairs in the propeller logbook.

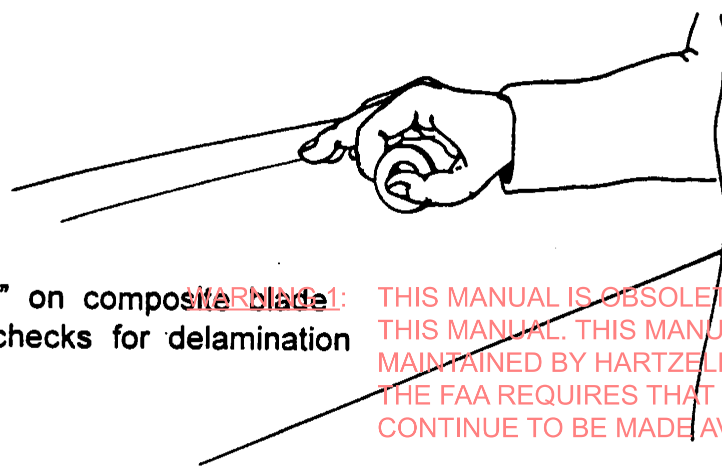
B. Shurtronics

Shurtronics Harmonics Bond Tester Mark IIB (United Western Technology Corp. Kennewick, Washington 99336) is a harmonic devise used by the factory for inspection of blade erosion shields. This method is an approved optional method (in conjunction with "coin-tap" method) to evaluate erosion shield debonds. If use of this equipment is desired in the field, contact Hartzell Product Support Department for detailed procedures.

APS-325-1, APS-319-1



"Coin-tap" along entire surface of erosion shield checks for debond



"Coin-tap" on composite blade surface checks for delamination

Using "Coin-tap" Test to Check for Debond and Delamination
Figure 4-1

C. Impactoscope

Usage of an Impactoscope Flaw Detector, Model 82M2C (Penn Instrument Corp. Spring City, Pennsylvania) is an approved optional method (in conjunction with "coin-tap" method) to determine delaminated areas of the blade. If use of this equipment is desired in the field, contact Hartzell Product Support Department for detailed procedures.

4-5. Blade Dimensional Checks

NOTE: Personnel accustomed to working on aluminum blades should not apply similar inspection tolerances to composite blades. Blade angle and face alignment tolerances for composite blades are more liberal than that for aluminum blades. With composite blades there is no effective means to adjust blade angle or face alignment. However, composite blades have greater consistency of blade widths and thickness than that found in aluminum blades. Because of this, the liberal angle and face alignment requirements have been found to be acceptable.

A. Blade Angle Check

1) Locate blade in fixture on blade table. Mark the stations on the blade as indicated on the appropriate Blade Dimensional Inspection Form.

2) Place a protractor and template on the setup station and set the protractor at 0°, then lock the blade securely in place.

3) Move protractor and the corresponding template to station on Blade Dimensional Inspection Form and measure angle change in reference to 0° setup station.

B. Face Alignment Check

1) Position blade erosion shield edge up.

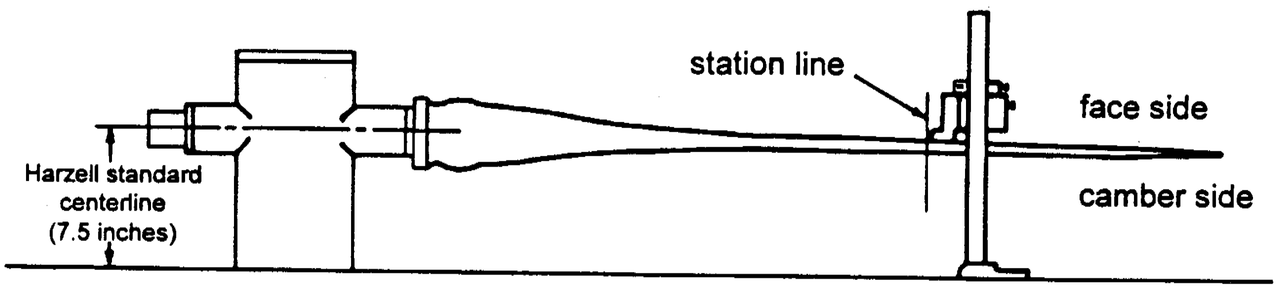
2) With grease pencil, mark appropriate station lines.

3) Mark centerline of blade with a vertical ruler at station lines.

NOTE: Hartzell standard centerline is 7.5 inches (19.05 cm) from top of table.

4) Rotate blade face side up. Place line level on blade station designated, over centerline mark. Adjust blade in fixture until blade is level. Lock blade securely in position. Remove level.

5) Place height gauge pointer in contact with centerline mark (Figure 4-2). Check height of pointer on vertical ruler. Note the dimensional difference of height of centerline of work fixture compared to the height of blade surface on the centerline of the designated blade station. Record this difference on the appropriate Blade Dimensional Inspection Form.



Face Alignment Check
Figure 4-2

C. Blade Width and Thickness Measurement

1) Measurement of blade width and thickness is not required during scheduled inspections.

2) Width measurements are not required during overhaul unless erosion shield is replaced. Refer to Chapter 5.

4-6. Dye Penetrant/Magnetic Particle Inspection

A. **There is no requirement for penetrant inspection of a composite blade or its integral metal plug.**

B. Components attached to the composite blade, if re-usable after overhaul, are to be inspected. Steel parts, except for counterweight slugs, are to be magnetic particle inspected per Hartzell Specification H-S-7 (visual inspection is satisfactory for counterweight slugs). Aluminum parts, such as counterweight clamps, are to be penetrant inspected per Hartzell Specification H-S-10. Other propeller components are to be inspected in accordance with the requirements of the applicable propeller overhaul manual.

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5-1. General

A. Refer to the applicable Hartzell Propeller Instruction Manual or Service Letter 61( ) for the recommended TBO (Time Between Overhauls) for the propeller assembly.

B. Remove blades from propeller assembly in accordance with procedures detailed in the applicable Propeller Instruction Manual. The text of this chapter assumes that the blade has been removed from the hub and addresses only the composite blade assembly.

C. All damage must be repaired during overhaul.

5-2. General Overhaul Requirements

A. Each blade model receives a different set of overhaul instructions. Outlines of these instructions are given in the form of a "traveler". A filled out sample is shown in Figure 5-1.

B. Travelers list all possible individual procedures required to perform a complete blade overhaul. Individual procedures listed on the travelers are detailed in Section 5-3. After initial inspection, the blade is assessed and the individual steps not required to perform overhaul are noted as N/R (not required) and initialed. Some blades may not require every individual procedure.

C. Each traveler must be filled out in its entirety and kept on file for a minimum of 7 years. Two steps listed on the traveler are initial and final blade inspection. These steps require the filling out of an inspection form which also must be filled out in its entirety and remain on file with the traveler for a minimum of 7 years. A filled out sample of inspection forms are shown in Figures 5-2 and 5-3.

D. Any blade requiring repair beyond that listed on traveler should be listed on the Repair Report and attached to the traveler. See chapters 6 and 7 for limits and procedures.

E. As stated in Sections 2-2 and 2-3, blade overhaul or repair of major damage must be performed in a Hartzell approved facility by Hartzell factory trained personnel. Travelers and inspection sheets make provisions for the sign-off of individual tasks. These sign-offs must be performed by the individual who performed the task.

NOTE: Master copies of the forms mentioned above may be found at the end of this chapter. Copies of these are the responsibility of each individual shop.

Overhaul
TRAVELER
Blade Model M10877K

Date 4-12-90
Work Order No. 1986 Customer Sensenick
Serial Number 6101
TSN 4500
TSO 1500

Oper	Operation Description	Per Inst.	Date	By
1	Clean Shank	Paragraph 5-3, Proc. 1)	4-12	J.W.
2	Lead Removal	Paragraph 5-3, Proc. 2)	4-12	J.W.
*3	Boot Removal	Chapter 8	4-12	J.W.
4	Paint Removal	Paragraph 5-3, Proc. 3)	4-13	L.F.
5	Initial Inspection	Paragraph 5-3, Proc. 4)	4-13	M.C.
6	Determine If Field Repairable	Chapters 5, 6, 7	4-13	J.W.
*7	Dimensional Inspection	Paragraph 5-3, Proc. 5)	4-14	J.W.
*8	Erosion Shield Winding Removal	Paragraph 5-3, Proc. 6)	4-14	D.S.
*9	Erosion Shield Removal	Paragraph 5-3, Proc. 7)	4-14	D.S.
10	Repair	See attached report	NA	D.S.
*11	Fit Erosion Shield	Paragraph 5-3, Proc. 8)	4-15	D.S.
*12	Erosion Shield Application	Paragraph 5-3, Proc. 9)	4-15	D.S.
*13	Sand Erosion Shield	Paragraph 5-3, Proc. 10)	4-16	D.S.
*14	Erosion Shield Inspection	Paragraph 5-3, Proc. 11)	4-16	D.S.
*15	Dimensional Inspection	Paragraph 5-3, Proc. 12)	4-16	D.S.
*16	Erosion Shield Winding Application	Paragraph 5-3, Proc. 13)	4-20	J.W.
17	Alignment Bearing Removal	Paragraph 5-3, Proc. 15)	4-20	J.W.
18	Prepare Bore for Bearing Installation	Paragraph 5-3, Proc. 16)	4-21	B.K.
19	Balance Tube Replacement	Paragraph 5-3, Proc. 17)	4-21	B.K.
20	Alignment Bearing Installation	Paragraph 5-3, Proc. 18)	4-21	B.K.
21	Paint Application	Chapter 9	4-22	L.A.
*22	Final Erosion Shield Inspection	Paragraph 5-3, Proc. 14)	4-24	D.S.
23	Blade Delamination Inspection	Paragraph 5-3, Proc. 20)	4-24	D.S.
24	Boot Application	Chapter 8	4-24	J.L.
25	Balance	Paragraph 5-3, Proc. 21)	4-26	J.R.
26	Complete Maintenance Release Tag	——	4-26	J.R.
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				

Unless otherwise specified, all procedures refer to Manual 135D.
*Part of erosion shield replacement process.

Properly Completed Traveler
Figure 5-1

OVERHAUL INSPECTION FORM
Blade Model No. M10877

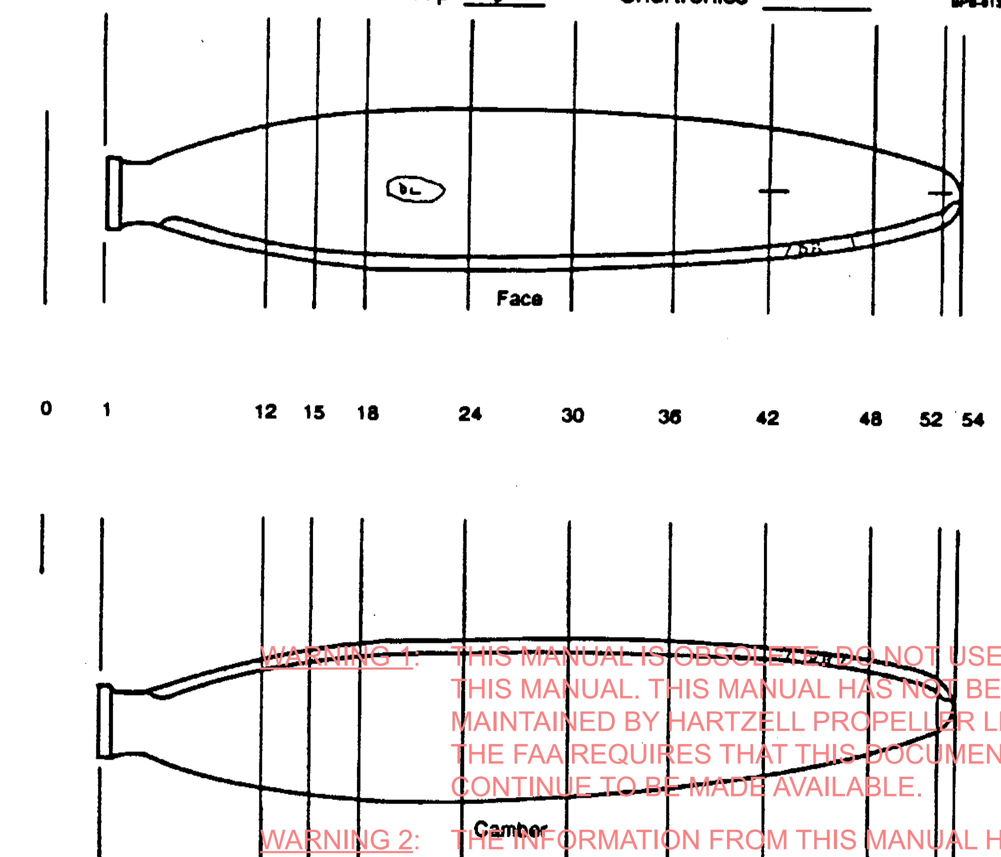
Inspected By: Jim Dunaway
Date: 4-12-90
Serial No. 6701
Work Order Number: 1986

☒ Incoming ☐ Outgoing

Method Used

Blade Delaminations: Coin Tap ✓ Impactoscope ____
Erosion Shield Debonds: Coin Tap ✓ Shurtronics ____

BPS-613



C = Crack
DL = Delamination
DB = Debond
S = Split
G = Gouge

Properly Completed Overhaul Inspection Form
Figure 5-2

BLADE DIMENSIONAL INSPECTION FORM
(Overhaul)
Blade Model M10877

Serial Number 6701

Work Order Number 1986

Width

Sta.	Minimum	Maximum	Checked
12	6.037	6.315	6.090
18	8.430	8.745	8.580
30	8.802	9.165	8.871
42	7.388	7.775	7.393
52	3.773	4.100	3.945

Blade Angle

Check 52 inch Station with 42 inch Station
set at 0° using a template
Requirement 4.1° ±0.5°

Results 4.1°

Face Alignment

Blades must match within 0.250 inch when matched in sets.
Measure blades at the 54 inch Station.

Face Alignment 6.910

Shank Inspection

Bearings Must be Tight After Installation Accept ✓ Reject

Remarks:

Revision 1 November/91

Properly Completed Blade Dimensional Inspection Form
Figure 5-3

5-3. Overhaul Procedures

The following procedures are to be performed at overhaul. To determine which specific steps to follow for a particular blade model, refer to the traveler for that blade.

1) Cleaning Shank

a) Remove most of the grease from the blade bearing bore, bearings and balance tube using a wooden or plastic stick (Figure 2-3, ref. no. 29).

CAUTION: DO NOT ALLOW SOLVENT TO STAND IN THE BLADE BEARING BORE. SOLVENTS MAY REACT WITH THE BLADE MATERIALS AND CAUSE IRREVERSIBLE DAMAGE.

b) Use solvent (Figure 2-10a, ref. no. 23) and parts brush to clean remaining grease from blade bore.

c) Thoroughly dry the bore.

NOTE: The following steps apply to M shank blades only.

d) Remove the heavier concentrations of gasket sealant from the shank with a non-metallic scraper (Figure 2-3, ref. no. 28).

NOTE: Be careful not to gouge composite material.

CAUTION: DO NOT SOAK BLADE IN SOLVENT. ANY BLADE THAT HAS BEEN SOAKED MUST BE RETURNED TO HARTZELL FOR EVALUATION. SOLVENTS MAY REACT WITH THE BLADE MATERIALS AND CAUSE IRREVERSIBLE DAMAGE.

e) Wet a shop towel with approved solvent (Figure 2-10, ref. no. 11) and use it to remove remaining gasket sealant. Immediately wipe dry with a clean towel.

2) Lead Removal

a) Determine if balance tube contains lead.

1 Insert a long, thin metal rod (Figure 2-3, ref. no. 26) into balance tube, tapping the end gently.

2 If the audible sound appears to be a "dead" thud, it contains lead.

b) Support the blade vertically in a holder to facilitate access to the balance tube and to prevent the blade from spinning.

c1) Blade Models M10083, LM10585, M10877

Use a 39/64 inch drill bit (Figure 2-3, ref. no. 17) to remove the lead.

NOTE: Be careful not to drill into the metal balance tube.

c_2) Blade Models A10460, B7421, E11990, B7466, E10950

If the blade does not contain a balance tube, use $^{47}/_{64}$ diameter full radius tip drill bit (Figure 2-3, ref. no. 16). If the blade does contain a balance tube, use a $^{39}/_{64}$ inch drill bit (Figure 2-3, ref. no. 17).

d) Tap the blade butt on a wooden or rubber surfaced work bench to dislodge and empty the lead from the balance tube.

e) Use compressed air and an air nozzle with a 12 inch extension (Figure 2-3, ref. no. 30) to blow the remaining lead from the balance tube and blade bore.

f) Inspect the balance tube for damage, and verify complete removal of the lead, with a pen light (Figure 2-3, ref. no. 18).

3) Paint Removal

CAUTION: KEEP SANDER MOVING AT ALL TIMES TO PREVENT OVER-HEATING, RESULTING IN BLADE DAMAGE. ON BLADES THAT HAVE PAINT COVERING THE WINDINGS, EXTRA CARE MUST BE TAKEN WHEN SANDING THAT AREA.

a) Sanding

Using a vibratory sander (Figure 2-3, ref. no. 6), sand the entire blade surface with appropriate abrasive (Figure 2-10a, ref. no 46), down to the primer filler. Avoid removal of blade material.

NOTE: If applicable, the epoxy filler in the area of the counterweight clamp must be completely removed.

b) Plastic Media Blasting

1 In carefully controlled use of plastic media blasting (PMB), damage to composite material is less than that from hand sanding. However, once paint has been removed, *composite material is easily penetrated by plastic media and is vulnerable when exposed to excessive blasting.*

NOTE: Any composite blade damaged by blasting should be scrapped or returned to the factory for evaluation.

2 Plastic Media Blasting is permitted with use of caution. For further details see **Service Advisory 54.**

4) Initial Inspection

a) Perform visual inspection.

1 Look for any defects such as cracks, debonds, split trailing edge, etc.

2 Record findings on applicable Overhaul Inspection Form at the end of this chapter, noting size and location and mark form as incoming. (For example of a properly completed form, see Figure 5-2).

b) Perform blade delamination inspection. There are two approved methods outlined in Chapter 4, coin-tap and impactoscope. Record findings on form and check method used.

c) If blade (A10460E) contains an internal de-icer boot, perform a resistance check (1.54 - 1.65 ohms) and a megger test value of 8 megohm minimum with a megger and ohm meter (Figure 2-3a, ref. no. 39 & 42). Refer to Chapter 4 for megger inspection procedure.

d) Perform erosion shield debond inspection. There are two approved inspection methods outlined in Chapter 4, coin-tap and shurtronics. Record findings and check method used.

e_1) The stainless steel erosion shield (on earlier models of LM10585) must meet airworthy criteria specified in Chapter 3, otherwise it must be replaced with a nickel erosion shield.

e_2) The nickel erosion shield must meet the following criteria, otherwise it must be replaced:

NOTE: The following provides criteria to determine whether erosion shield must be replaced during overhaul. This criteria differs somewhat from the airworthy damage limits described in Chapter 3.

NOTE: When making replacement decision, take into consideration that the erosion shield is expected to provide adequate service until next overhaul.

1 Any gouge or erosion that penetrates through to the surface of composite material is not permitted.

2 No chordwise cracks are permitted on the outboard half of the blade.

3 No two (2) chordwise cracks may occur within 6 inches (15.24 cm) of each other.

4 Minor amounts of the erosion shield trail edge may be missing, in accordance with airworthy limits (see Figure 3-2).

5 No lengthwise cracks are permissible except within 1 inch (2.54 cm) of the counterweight clamp that are not debonded.

6 No debonds extending to trailing edge and/or crack are permissible.

7 In all areas not covered by an external de-icer boot, erosion shield debonds may not exceed 5% of the area in any 6 inch (15.24 cm) length. No single debond may exceed 0.5 sq. inch (12.7 sq. mm). Total debond area is not to exceed 5% of erosion shield area. No debond may extend to the trailing edge of the erosion shield.

8 In areas under the de-icer boot, the total debonded area may not exceed 20% of the erosion shield area under the de-icer boot. No debond may extend to within 1 inch (2.54 cm) of where the de-icer boot coverage ends.

9 Minor deformations due to impact damage that do not greatly affect the airfoil shape.

5) **Dimensional Inspection**

This step was removed in Revision 1, dated February 1992.

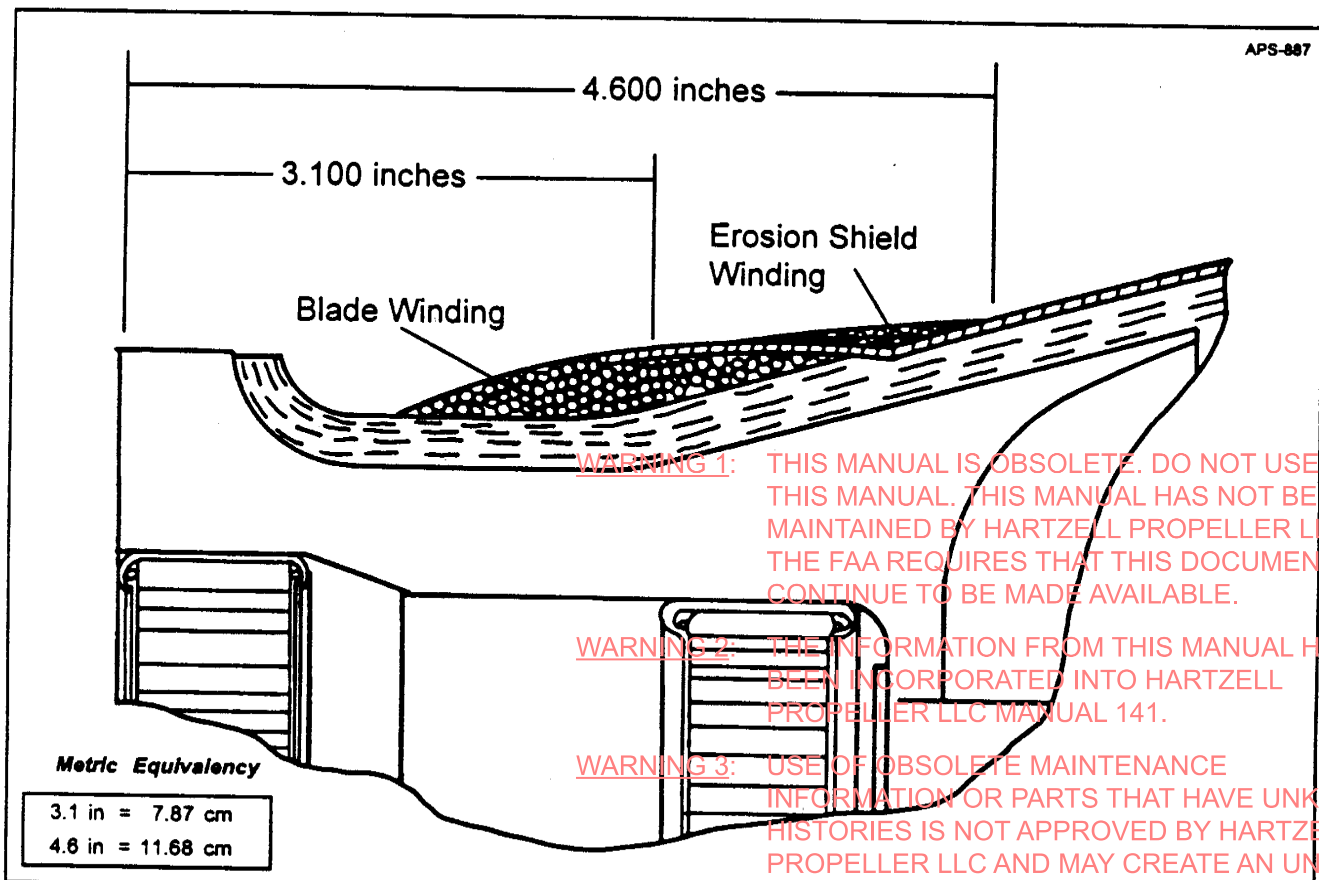
6) **Erosion Shield Winding Removal**

There are two types of erosion shield windings (Figure 5-4). The majority are fiberglass (white) and the remainder are Kevlar® (yellow). If erosion shield replacement is required, remove windings as follows:

a) Fiberglass-type Winding

With appropriate abrasive (Figure 2-10a, ref. no. 46), sand the winding until it has been removed.

NOTE: Be careful not to damage blade material or blade winding beneath the erosion shield winding.



Two Types of Windings
Figure 5-4

b) Kevlar®-type Winding

1 Cut or grind through the erosion shield winding over the erosion shield.

2 Using a utility knife (Figure 2-3, ref. no. 9), cut the winding away from the erosion shield.

3 After the winding is loose, it can be pried up and peeled away.

7) **Erosion Shield Removal**

NOTE: If removing a stainless steel erosion shield (on early LM10585 blades), remove screws and rivets before proceeding. When procedure is completed and nickel erosion shield is applied, stamp "NI" somewhere on blade butt.

CAUTION: KEEP FLAME OF PROPANE TORCH MOVING SO AS NOT TO LOCALIZE THE HEAT AND DAMAGE THE COMPOSITE BLADE.

a) Use a propane torch (Figure 2-3, ref. no. 25) to loosen the adhesively bonded metal erosion shield for removal and replacement.

b) Fan the flame back and forth across a selected area of the erosion shield, being careful not to allow a spot to get hot enough to damage the blade material beneath.

NOTE: The shank area of the blade is the best place to begin.

CAUTION: DO NOT USE EXCESSIVE FORCE TO PRY LOOSE THE EROSION SHIELD. MAKE SURE THE EROSION SHIELD IS HEATED ENOUGH TO RELEASE THE ORIGINAL BOND WITHOUT TEARING THE COMPOSITE MATERIAL BENEATH.

c) Use a broad, flat tool, such as a putty knife (Figure 2-3, ref. no. 27), to help pry on the heated side of the erosion shield.

d) If the erosion shield has been removed properly, the area beneath will be smooth with no scorching or fabric tearing.

e) Visually inspect the blade to make sure it has not been damaged during removal of the erosion shield.

f) Using appropriate abrasive (Figure 2-10a, ref. no. 46), remove all adhesive, being careful not to remove blade material.

NOTE: Visually inspect for scorched, burnt, or other damaged areas. If there are damaged areas, perform debond test (Chapter 4) to determine extent of damage.

g) If blade has internal de-icer boot, use appropriate abrasive (Figure 2-10a, ref. no. 46) to remove boot and adhesive beneath the boot, being careful not to remove blade material.

8) Fit Erosion Shield (Figure 5-5)

NOTE: Erosion Shield Replacement Kits No. A-2333-( ) (Figure 2-7) are available from the factory.

Use the applicable check-fit tool (refer to Figure 2-9) to check the fit of the tool to the sanded blade. Sand blade until proper tool fit is achieved.

NOTE: Excessive blade material removal may result in an unairworthy blade.

9) Erosion Shield Application (Figure 5-5)

a) Saturate a clean cloth with the approved solvent (Figure 2-10, ref. no. 11), and only wipe the sanded area, do not saturate.

b) Allow the solvent to evaporate (see Figure 2-10 for evaporation time).

NOTE: If the blade is going to sit longer than 2 hours, repeat the above step before continuing.

c) In a contamination-free container (Figure 2-10, ref. no. 5), mix the adhesive (Figure 2-10, no. 14) per the instructions on the can.

CAUTION: MAKE SURE THE REPLACEMENT EROSION SHIELD HAS BEEN STORED IN UNOPENED, ORIGINAL PACKAGING.

d) The erosion shield has been etched at the Hartzell factory in accordance with approved procedures and sealed in a plastic storage bag, ready for installation.

e) Spread the adhesive mixture evenly over the erosion shield area of the blade surface and the inside surface of the erosion shield.

NOTE: If fiberglass is purchased in bulk, refer to A-2333( ) Erosion Shield Replacement Kit (Figure 2-7) for appropriate size.

f_1) M10083

Apply three (3) layers of fiberglass scrim (Figure 2-10a, ref. no. 42) evenly over the entire erosion shield area of the blade.

f_2) B7421, B7466, M10585, M10877, E10950, E11990

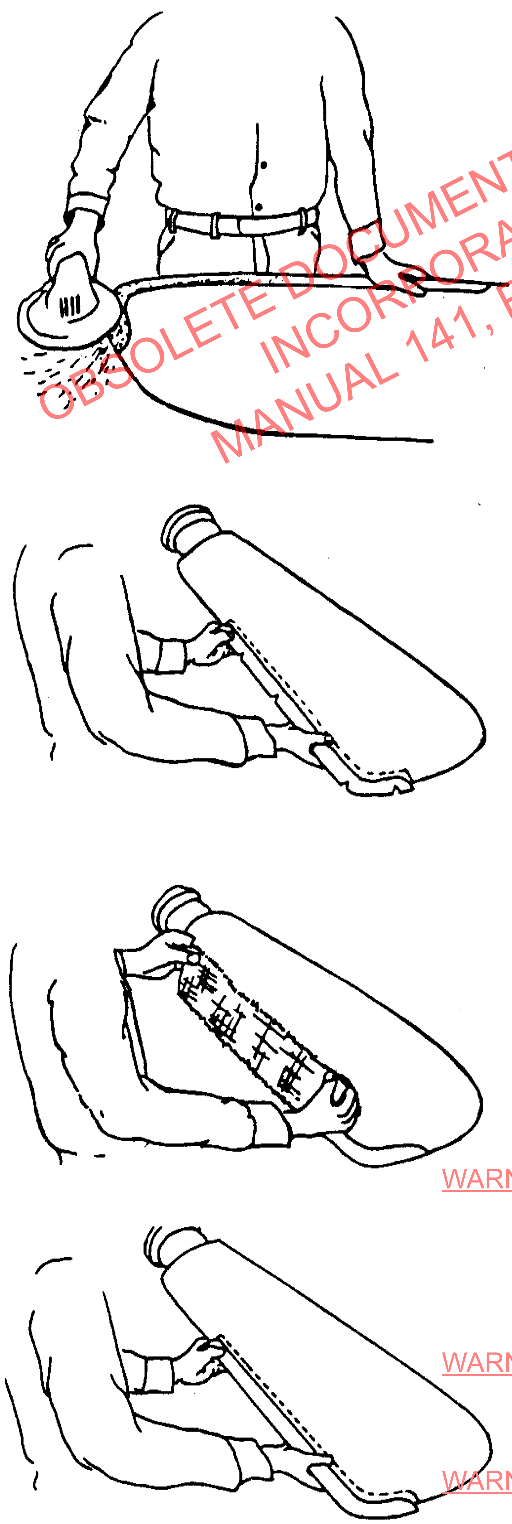
Apply two (2) layers of fiberglass scrim (Figure 2-10a, ref. no. 42) over the entire erosion shield area of the blade. An additional layer may be added to provide improved fit of erosion shield on blade.

f_3) A10460K

Apply two (2) layers of fiberglass cloth (Figure 2-10b, ref. no. 55) over recessed area of the internal boot. Apply two (2) layers of fiberglass scrim (Figure 2-10a, ref. no. 42) over entire erosion shield area of blade.

g) Saturate the fiberglass scrim with the adhesive mixture.

APS-303, APS-304, APS-305, and APS-306



Remove old adhesive

Remove any dust, and clean the sanded area

Use applicable special tool (notched, un-etched erosion shield) to check the fit of replacement shield on specific model of blade

Spread adhesive mixture evenly over erosion shield area of blade and on inside surface of erosion shield

Apply layers of fiberglass scrim, and saturate it with adhesive mixture

Position erosion shield on blade

Lay nylon release film over erosion shield

Procedure for Bonding of Nickel Erosion
Shield onto Composite Blade
Figure 5-5

h) Carefully position the nickel erosion shield on the blade.

When applying the erosion shield, use your hands approximately shoulder width apart on the middle of the erosion shield and apply as much pressure as you can while sliding the erosion shield back and forth several times. This forces the excess adhesive and air from under the erosion shield, ensuring that the erosion shield comes down on the blade edge.

i) As required, place additional layers of fiberglass over the erosion shield to aid in the transition from the erosion shield to the blade.

j) Lay a piece of nylon release film (Figure 2-10a, ref. no. 44) over the entire width of the blade, for the entire length of bonding area.

NOTE: Nylon release film is used to prevent bonding of the bonding clamp to the blade.

k) Carefully position bonding clamp over erosion shield.

l) Place a vacuum bag (Figure 2-10a, ref. no. 45) over the entire blade (Figure 5-6).

m) Place the vacuum tube (Figure 2-3, ref. no. 31) inside of bag, install the vacuum line and seal the bag.

n) Connect the pump, and pull vacuum on the erosion shield, achieving between 25 and 30 in of Hg.

o) Check for air leaks.

p) Maintain vacuum pressure at (use one of the following):

1 Room temperature [70° F (21° C) minimum] for 12 hours minimum

2 145° F ±5° (63° C ±2.8°) for 2 hours minimum

3 autoclave pressure at 25 psi maximum (20 to 25 psi preferred) at 145° F ±5° (63° C ±2.8°) for 2 hours minimum

4 autoclave pressure at 25 psi maximum (20 to 25 psi preferred) at room temperature [70° F (21° C) minimum] for 12 hours minimum

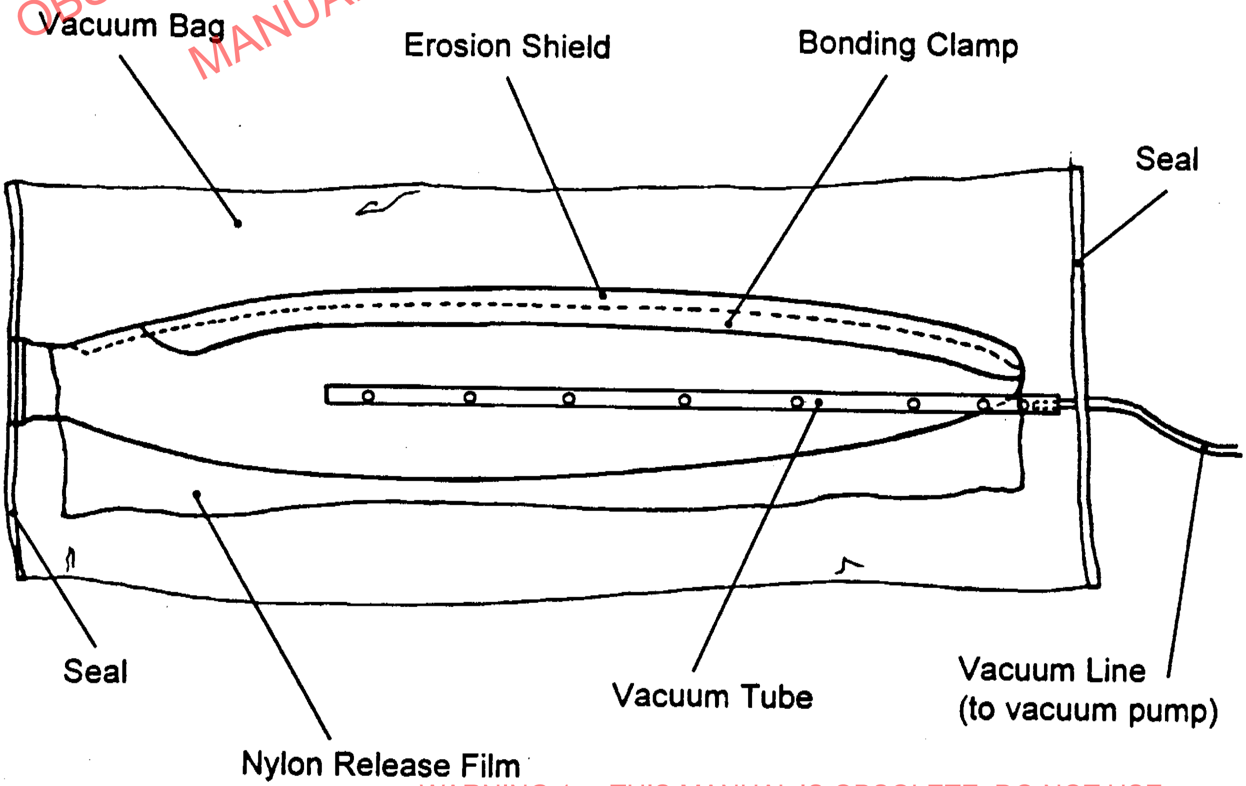
NOTE: The latter two (2) methods are preferred.

q) After minimum cure time, remove components from blade so erosion shield area can be sanded.

10) Sanding Erosion Shield

Using a vibratory sander (Figure 2-3, ref. no. 6) with appropriate abrasive (Figure 2-10a, ref. no. 46), sand excess adhesive from the blade surface to assure a smooth transition from the composite material to the nickel erosion shield.

NOTE: All adhesive and fiberglass must be removed from erosion shield.



Vacuum Bag/Installation of Erosion Shield
Figure 5-6

11) <u>Erosion Shield Inspection</u>

a) Perform erosion shield debond inspection. There are two (2) approved methods outlined in Chapter 4, coin-tap and shurtronics (Paragraph 4-4). Check a new Overhaul Inspection Form as outgoing, record findings and check method used.

b) **If the blade does not meet the following minimum requirements, erosion shield must be replaced or repaired to meet minimum requirements.**

<u>1</u> Erosion shield debonds may not exceed 5% of the area in any 6 in (15.24 cm) length. No single debond may exceed 0.5 sq in (12.7 sq mm). Total debond area is not to exceed 5% of erosion shield area. No debond may extend to the trailing edge of the erosion shield.

12) <u>Dimensional Inspection</u>

a) At the prescribed stations on the Blade Dimensional Inspection form, use calipers to measure blade widths to the nearest thousandth of an inch and record in "checked" column. (For example of properly completed form, refer to Figure 5-3.)

b) Calculate the difference and record in "diff." column. If the difference exceeds ±0.062 inch (1.57 mm), or if width is less than the specified minimum dimensions, erosion shield must be replaced.

c) Face alignment check (Chapter 4) must be done on each blade at the station on the form. Record the results in space provided.

d) Check blade angle (Chapter 4) at the stations specified on the form and record results in space provided.

13) <u>Erosion Shield Winding Application</u>

a) Clean blade in the area to receive windings with approved solvent (Figure 2-10, ref. no. 11).

b) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

c) With a grease pencil or equivalent (Figure 2-10a, ref. no. 50), mark the blade at the beginning and ending locations. [Beginning location: 3.100 inches (7.87 cm) from butt and ending location: 4.600 inches (11.68 cm) from butt.] See Figure 5-4.

d_1) <u>Winding Machine Method</u>

<u>1</u> Place blade on winding machine.

<u>2</u> In a contamination-free container (Figure 2-10, ref. no. 5), mix approved resin (Figure 2-10a, ref. no. 48) per instructions on can.

3 Apply generous amount of resin to the winding area.

4 With machine set on 40 ±5 lbs of tension, apply 22 ft ±2 ft of windings (part number found in Chapter 10), and resin simultaneously, making sure fibers are completely saturated. Resin should be applied with a contamination-free brush (Figure 2-10, ref. no. 4).

d_2) Manual Winding Application

1 In a contamination-free container (Figure 2-10, ref. no. 5), mix approved adhesive (Figure 2-10, ref. no. 15) per instructions on can.

2 Apply generous amount of adhesive to the winding area.

3 Apply 22 ft ±2 ft of windings and additional adhesive by hand simultaneously, making sure fibers are completely saturated.

NOTE: Adhesive should be applied with contamination-free brush (Figure 2-10, ref. no. 4).

e) A single layer of fiberglass scrim (Figure 2-10a, ref. no. 42) should be applied over windings to assist in providing a smooth contour.

f) Allow to cure (see Figure 2-10 for cure time).

g) Sand area until smooth, removing minimal amount of material.

14) **Final Erosion Shield Inspection**

a) If the blade paint cure has been accelerated with heat, this inspection must be performed. Otherwise, this procedure may be omitted.

b) Perform Erosion Shield Debond Inspection. There are two (2) approved methods outlined in Chapter 4, coin-tap and shurtronics (Paragraph 4-4). Compare results to first inspection. If debonds are larger, record on outgoing Overhaul Inspection Form.

c) **If the blade does not meet the following minimum requirements, erosion shield must be replaced.**

1 In all areas not covered by an external de-icer boot, erosion shield debonds may not exceed 5% of the area in any 6 in (15.24 cm) length. No single debond may exceed 0.5 sq in (12.7 sq mm). Total debond area is not to exceed 5% of erosion shield area. No debond may extend to the trailing edge of the erosion shield.

15) Alignment Bearing Removal

CAUTION: BLADE ALIGNMENT BEARINGS AND SPACER MUST BE REPLACED DURING OVERHAUL.

a) M Shank Blades

Using the proper tools (Figure 2-3, ref. no.'s 20 and 21), remove and discard:

1 large blade alignment bearing

2 small blade alignment bearing

3 spacer

b) A, B and E Shank Blades

Using the proper tools (Figure 2-3, ref. no. 22), remove and discard:

1 Blade alignment bearing

2 spacer

16) Preparing Bore for Bearing Installation

a) Use a scotch brite pad (Figure 2-10a, ref. no. 47) and drill to lightly polish bearing bore. Assure that all adhesive has been removed from the bore and that there are no deep gouges in the bore.

NOTE: Keep material removal to a minimum so as not to adversely affect bearing fit.

b) Remove any scratches that could effect bearing fit or cause damage to the bore during bearing installation.

17) Balance Tube Replacement

a) If a dark brown or black stain is observed in conjunction with a delamination, and the presence of grease is confirmed, blade retirement is required.

b) Inspect blade butt for presence of impression stamp "BT" (which indicates compliance with the current sealing procedure). If present, no further action is required. If not, remove, replace, and reseal the blade balance tube as follows:

NOTE: Not all blades contain a balance tube. All "M" shank blades have a balance tube. "A", "B", and "E" shank blades may or may not have a balance tube (usage was optional depending on amount of lead needed for balance purposes).

1 Thread the inside of the balance tube with a $^5/_8$-11 UNC tap to a depth of $^1/_2$ inch. Remove tap.

2 Install a 5/8-11 bolt and use to pull balance tube.

CAUTION: THE THREADING PROCESS WEAKENS THE TUBE'S RETAINING FLANGE. REPLACEMENT WITH A NEW TUBE IS REQUIRED.

3 DISCARD BALANCE TUBE (damage due to threading).

CAUTION: DO NOT SOAK BLADE IN SOLVENT OR USE COOLANT ON THE REMAINING OPERATIONS.

4 On A, B and E shank blades only, counterbore the hole: 0.890 inch (22.606 mm) diameter x 0.075 to 0.080 inch (1.905 to 2.032 mm) deep.

5 Ream balance hole with 49/64 inch diameter reamer (Figure 2-3a, ref. no. 40).

6 Clean old adhesive and other contaminates from the metal part of the balance tube hole by wiping with approved solvent (Figure 2-10, ref. no. 11).

7 Wipe areas to be bonded, both blade and new pilot tube, with an approved solvent (Figure 2-10, ref. no. 11) and allow to evaporate. Use a new balance tube of the same size as the original (A-4554 small 3.94 inches, A-4554-1 large 6.44 inches).

NOTE: If a small (A-4554) tube is not available, a large (A-4554-1) tube may be installed. However, this may require drilling into the foam core with a 0.750 diameter drill (Figure 2-3a, ref. no. 41) to a depth of 8 1/4 to 8 1/2 inches (20.955 to 21.590 cm) for A, B and E shank blades or 10 1/2 to 10 3/4 inches (26.67 to 27.305 cm) for M shank blades.

8 Mix approved adhesive (Figure 2-10a, ref. no. 20) according to package directions.

9 Apply adhesive around the outside of the balance tube in the areas that will contact the blade bore. Also apply adhesive into the blade bore in the areas that will contact the balance tube.

10 Install the tube into the hole by applying pressure on the lip of the tube until it is seated firmly against the bottom of the blade bore.

11 Wipe excess adhesive from the bore with a dry cloth. Any remaining adhesive should be removed with a cloth dampened with solvent (Figure 2-10, ref. no. 11).

NOTE: Do not saturate area, or bond integrity will be sacrificed.

12 Allow the adhesive to cure (Figure 2-10a, ref. no. 20 for cure time) with balance tube pointing vertically down.

13 Using a metal impression stamp, stamp the blade butt with the letters "BT" to indicate compliance.

18) **Alignment Bearing Installation for M Shank Blades**

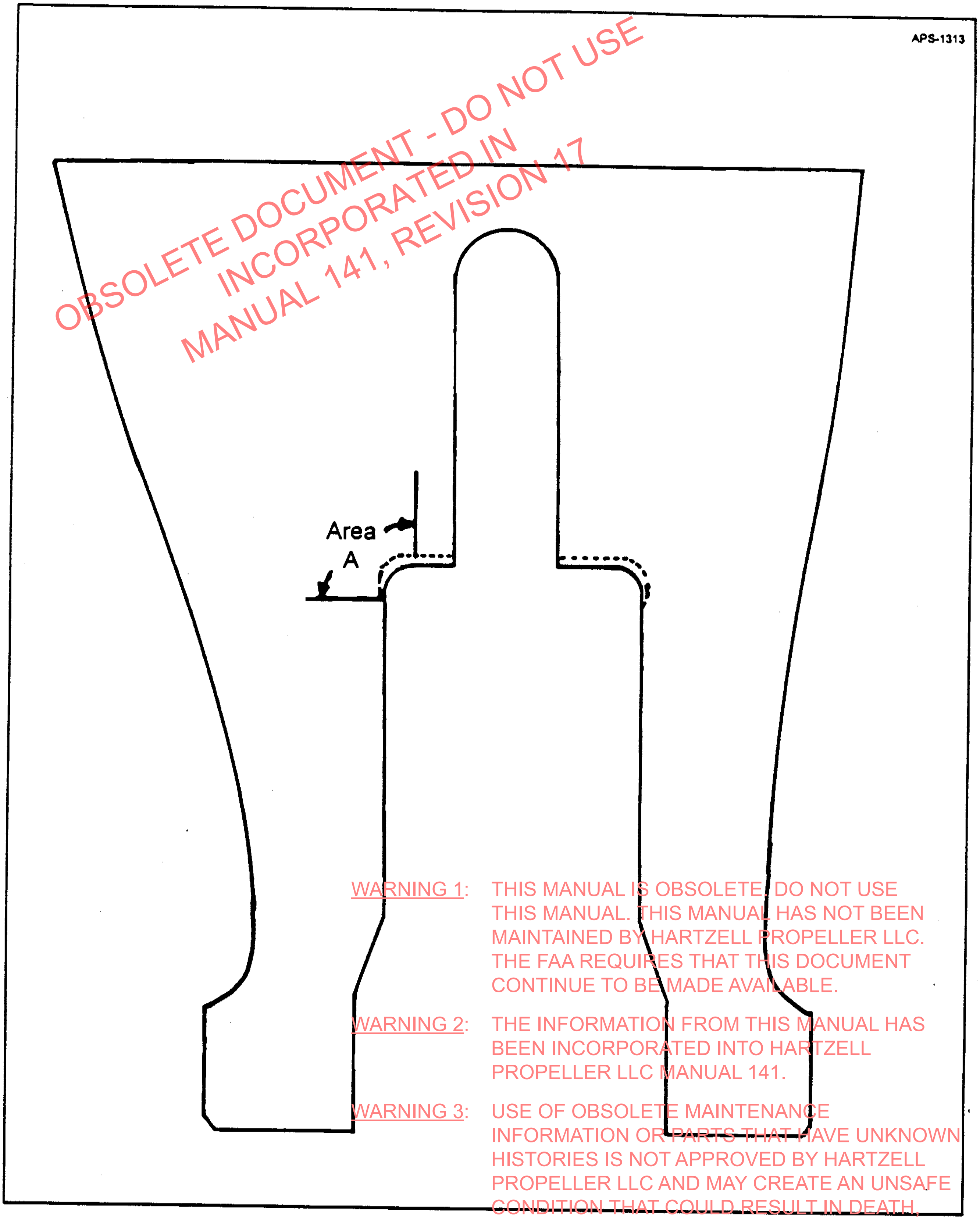
a) Paint the balance hole, area "A" in Figure 5-6a, and an additional 1/8 to 1/4 inch (3.175 to 6.35 mm) of the bearing contact area adjacent to area "A" with a thin coat of wash primer (Figure 2-10b, ref. no. 76) and allow to dry 5 to 10 minutes.

b) Using a small brush or cotton swab, paint the primed area with a thin, even coat of Polane Black (Figure 2-10a, ref. no. 33), and allow to dry before installing bearing (ref. Chapter 9 for drying schedule).

c) Determine correct replacements for the large blade alignment bearing, the small blade alignment bearing and the spacer (Chapter 10).

CAUTION: THE RADIUS SIDE OF THE SPACER MUST FACE OUTBOARD. (NOT VISIBLE ONCE PLACED IN BORE OF BLADE.)

d) Apply sealant (Figure 2-10a, ref. no. 49) to the bottom of the bore and the joint between the balance tube and the blade plug. Also apply sealant around the O.D. of the spacer. Carefully insert the spacer into the blade plug, making sure the radius side faces outboard.



Area "A" of Blade Shank
Figure 5-6a

CAUTION: DURING INSTALLATION OF NEW BLADE ALIGNMENT BEARINGS, USE A PUNCH TOOL MACHINED TO FIT THE END OF THE BEARING SHELL BEING INSTALLED TO PREVENT POSSIBLE DAMAGE WHEN IT IS PRESSED INTO THE BLADE PLUG.

e) Carefully press the small, then the large blade alignment bearings into the plug.

f) Check bearing installation for tightness. Bearing must be snug and not be able to be moved by hand.

g) Check the inside diameter (I.D.) of each bearing after installation. Slide a hub spider pilot tube into blade bearings and ensure it rotates freely.

h) Allow to dry (see Figure 2-10a, ref. no. 49 for cure time).

19) **Alignment Bearing Installation for A, B and E Shank Blades**

a) Determine correct replacement for the alignment bearing and end plug (Chapter 10).

CAUTION: THE CHAMFERED SIDE OF THE END PLUG MUST FACE OUTBOARD. (NOT VISIBLE ONCE PLACED IN BORE OF BLADE.)

b) Apply sealant (Figure 2-10a, ref. no. 49) to the bottom of the bore and the joint between the balance tube, if used, and the blade plug. Also apply sealant around the O.D. of the end plug. Carefully insert the end plug into the blade plug, making sure the chamfered side faces outboard.

CAUTION: DURING INSTALLATION OF NEW BLADE ALIGNMENT BEARINGS, USE A PUNCH TOOL MACHINED TO FIT THE END OF THE BEARING SHELL BEING INSTALLED TO PREVENT POSSIBLE DAMAGE WHEN IT IS PRESSED INTO THE BLADE PLUG.

c) Carefully press the alignment bearing into the plug.

d) Check the inside diameter (I.D.) of each bearing after installation. Use the pre-load plate from the assembly to ensure it rotates freely.

e) Allow to dry (see Figure 2-10a, ref. no. 49 for cure time).

20) **Blade Delamination Inspection**

a) There are two approved methods outlined in Chapter 4, coin-tap and impactoscope. Record findings on Overhaul Inspection Form, check method used and record as outgoing.

b) No delaminations are permitted. If any is found, blade must be repaired and re-inspected.

c) Upon successful completion of repair, note on overhaul inspection form that repairs have been made.

21) Blade Balancing

a) Blade Set Matching

1 All composite blades must be matched into sets according to the following parameters:

Item	Range
Horizontal Balance	0.75 lbs (0.34 kg)

NOTE: 0.75 lbs represents the maximum amount of lead that can be put into the large balance tube. If the blades are within 0.75 lbs of each other, they will balance at the mid-point of the balance tube.

NOTE: Cross balancing of opposing blades in pairs in propeller assemblies (2, 4, 6-way) is acceptable.

Blade Angle (most outboard station)	0.5°
Face Alignment (most outboard station)	0.250 in (0.635 cm)

2 Special Case Blade Matching

On blade model A10460E, blades with serial numbers above 1146 should not be matched with lower serial numbers.

On blade model LM10585, blades should be matched according to the serial number prefix. (Non-prefixed should go with non-prefixed, B's should go with B's, and D's with D's.)

3 Replacing One Blade of a Set

Contact Hartzell to match serial numbers.

b) Blade Balancing

NOTE: Horizontal balance is the balance between the tip and the butt of the blade. Vertical balance is the balance between the leading and trailing edges and cannot be changed on a composite blade.

1 Determine, through use of balance equipment, which blade is heaviest in horizontal balance. Using this blade for reference, determine the difference between this blade and other blades in set.

2 Horizontal balance can be corrected by adding lead as needed.

22) Erosion Screen Inspection for M10083 (Figure 5-7)

a) Visually inspect and record findings on Overhaul Inspection Form.

NOTE: Replacement of erosion screen must be performed by the Hartzell Propeller Inc. factory only.

b) **Erosion screen must be replaced at overhaul if:**

1 perimeter of blade, eroded area exceeds 0.25 inch (6.35 mm) width x 1.5 inch (3.81 cm) long. One area or more smaller areas that do not exceed 0.375 inch sq (90.73 mm sq) are allowable per side.

2 trailing edge of erosion shield, one 0.25 inch (6.35 mm) width x 1.5 inch (38.1 mm) long area or smaller areas that do not exceed 0.375 inch sq (90.73 mm sq) are allowable per side.

3 All other area camber side:

Six (6) different areas, each no larger than 0.25 inch (6.35 mm) x 0.5 inch (12.7 mm) of damaged, missing, or delaminated screen.

4 All other areas face side:

Four (4) different areas, each no larger than 0.25 inch (6.35 mm) x 0.5 inch (12.7 mm) of damaged, missing, or delaminated screen.

NOTE: The area inboard of station 42, 7.75 inches (19.685 cm) inboard of the tip on the camber side, is exempt from the above requirements and may contain damage that is not used to determine replacement.

23) **Erosion Screen Inspection for E10950**

a) Visually inspect and record findings on Overhaul Inspection Form.

NOTE: Replacement of erosion screen must be performed by the Hartzell Propeller Inc. factory only.

b) **Erosion screen must be replaced at overhaul if:**

1 perimeter of blade, eroded area exceeds 0.25 inch (6.35 mm) width x 1.5 inch (3.81 cm) long. One area or more smaller areas that do not exceed 0.375 inch sq (90.73 mm sq) are allowable per side.

2 trailing edge of erosion shield, one 0.25 inch (6.35 mm) width x 1.5 inch (38.1 mm) long area or smaller areas that do not exceed 0.375 inch sq (90.73 mm sq) are allowable per side.

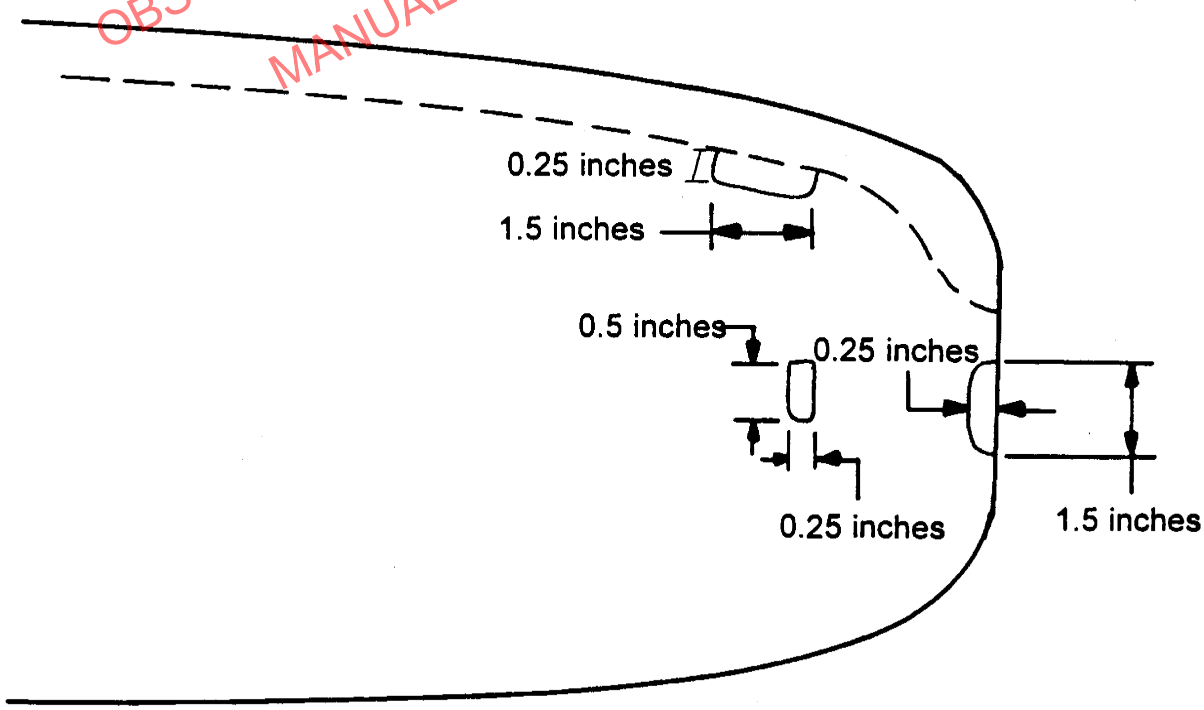
3 All other area camber side:

Six (6) different areas, each no larger than 0.25 inch (6.35 mm) x 0.5 inch (12.7 mm) of damaged, missing, or delaminated screen.

4 All other areas face side:

Four (4) different areas, each no larger than 0.25 inch (6.35 mm) x 0.5 inch (12.7 mm) of damaged, missing, or delaminated screen.

APS-690



Metric Equivalency

0.25 in	=	6.35 mm
0.5 in	=	12.7 mm
1.5 in	=	3.81 cm

Erosion Screen Overhaul Damage Limits
Figure 5-7

24) Counterweight Clamp Removal for A Shank Blades

CAUTION: COUNTERWEIGHT CLAMPS SHOULD BE RE-INSTALLED ON THE BLADES FROM WHICH THEY WERE REMOVED. IF THE CLAMP IS NOT SERIALIZED OR IF IT HAS NOT BEEN MARKED FROM A PREVIOUS OVERHAUL, THE BLADE SERIAL NUMBER SHOULD BE PERMANENTLY MARKED ON BOTH HALVES OF THE COUNTERWEIGHT CLAMP (FIGURE 5-8).

a) On those installations where the de-icer element lead and/or de-icer harness are potted into the counterweight clamp, all potting material must be removed prior to counterweight clamp removal. Using a modeling knife or razor blade, cut away potting material from around de-icer leads.

b) Remove bolts and washers holding clamp halves together.

c) Gently tap clamp halves apart.

d) Epoxy must be removed from blade by sanding during paint removal.

e) For overhaul and inspection instructions, refer to appropriate propeller overhaul manual.

25) Counterweight Clamp Installation for A Shank Blades

CAUTION: COUNTERWEIGHT CLAMPS SHOULD BE RE-INSTALLED ON THE BLADES FROM WHICH THEY WERE REMOVED.

a) Area shown in Figure 5-9 shall have 10% contact with blade.

b) Grinding of counterweight may be necessary in order to ensure proper fit on blade.

c) Any area of the counterweight that is ground must be alodined prior to installation.

d) Coat entire inside diameter of counterweight with release agent (Figure 2-10, ref. no. 19).

NOTE: Complete coverage with release agent is necessary to ensure ease of removal of counterweight should it be necessary.

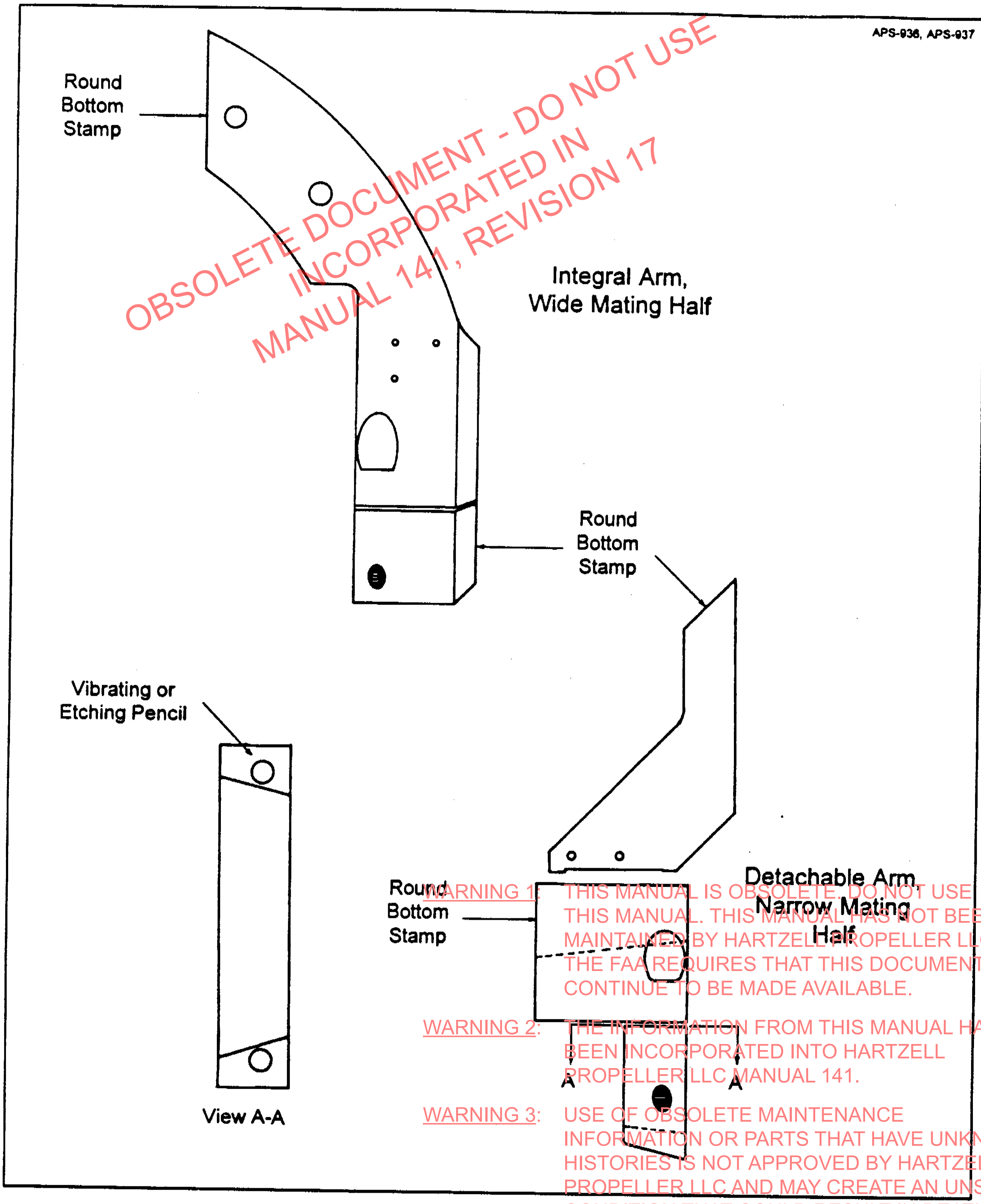
e) Prepare potting material (Figure 2-10a, ref. no. 20).

f) Liberally coat the inside diameter of both clamp halves with approved adhesive (Figure 2-10a, ref. no. 20).

g) Place counterweight around blade shank and install new clamp bolts by hand.

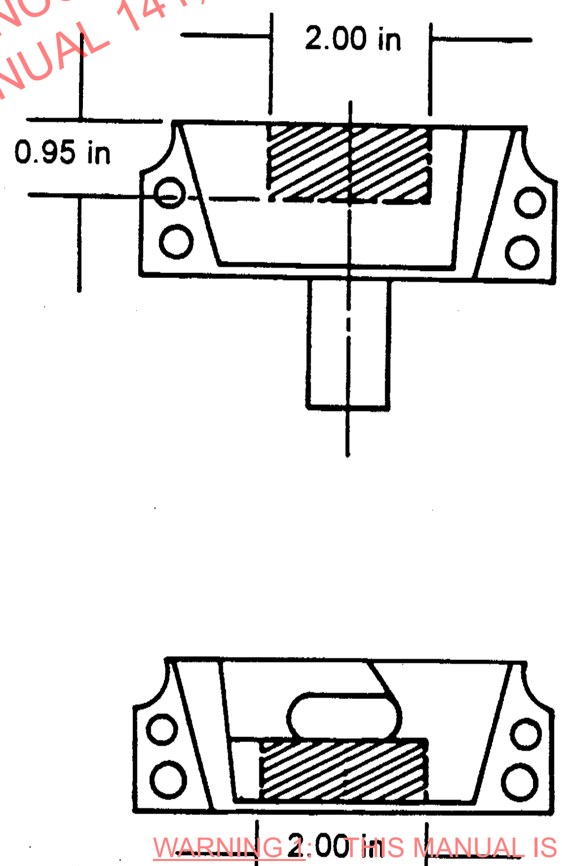
h) Run-up outboard bolts first, do not tighten.

i) Run-up inboard bolts, do not tighten.



Location of Serial Number on Counterweight Clamps
Figure 5-8

APS-888



Metric Equivalency

0.95 in	=	24.13 mm
2.00 in	=	5.08 cm

Area of Counterweight to Contact Blade
Figure 5-9

j) Tighten inboard bolts until snug, do not torque.

k) Tighten outboard bolts until gap is even, do not torque.

NOTE: It may be necessary to place a spacer (i.e. washer) between the clamp halves at the inboard end to ensure proper difference in the gap.

l) Allow to cure at room temperature, accelerated time is not permitted (see Figure 2-10a for cure time).

m) Check gaps as shown in Figure 5-10.

n) Distance between blade butt and counterweight is 1.393 ±0.063 inches (3.538 cm ± 1.6 mm). The tool (Figure 2-3a, ref. no. 38) shown in Figure 5-10 may be used.

o) Remove bolts one at a time and remove spacer(s) as necessary.

p) Place a small amount of thread locker (Figure 2-10a, ref. no. 21) on threads of mounting bolts and replace in clamp.

q) Torque outboard bolts to 12 ft-lbs.

r) Torque inboard bolts to 22 ft-lbs.

NOTE: There is a 10% torque tolerance.

s) Recheck gap to ensure it remains within allowable tolerance.

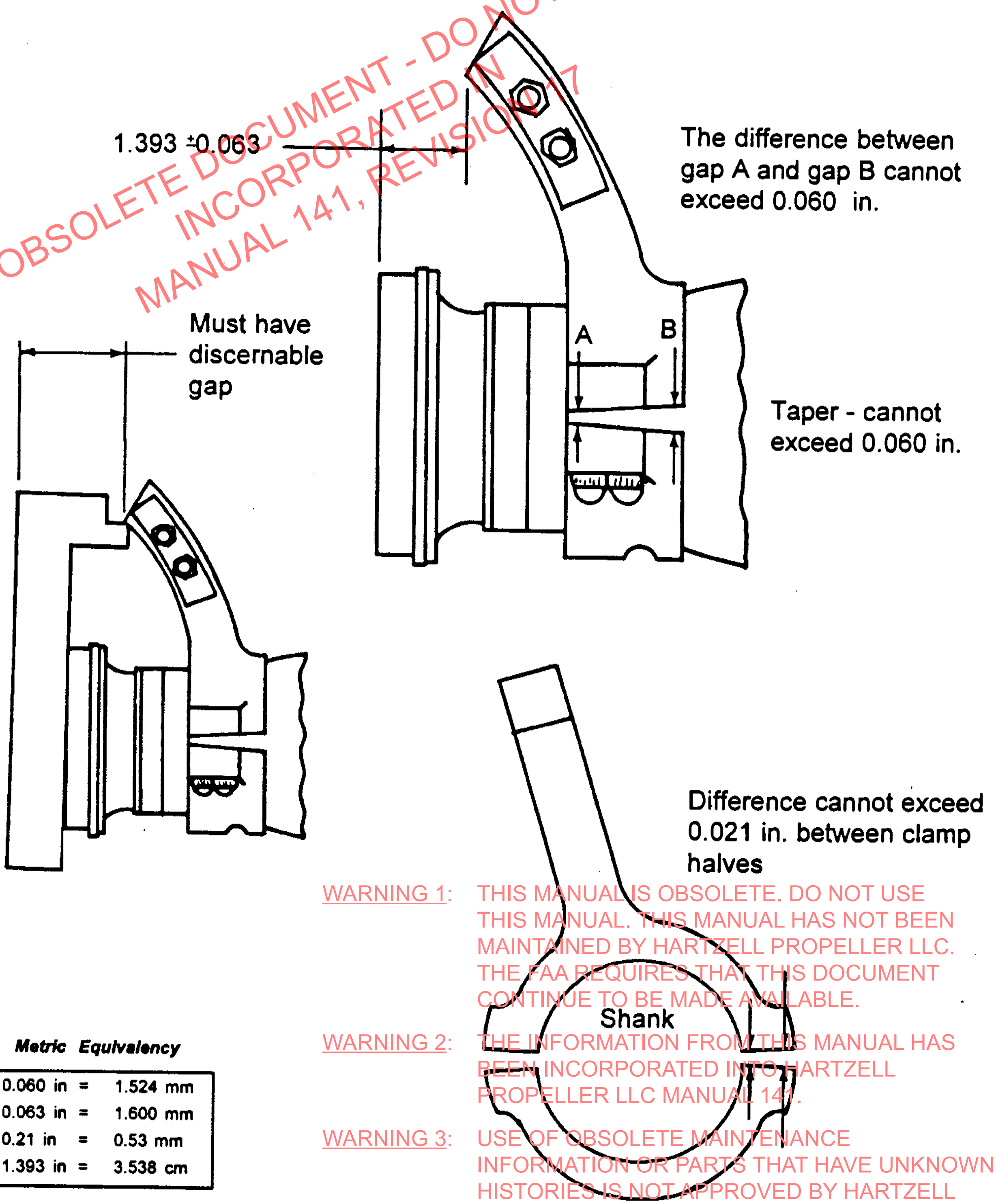
26) **Counterweight Clamp Removal for E10950 Blade**

a) Remove bolts and washers holding clamp halves together.

b) Gently tap clamp halves apart.

NOTE: Epoxy must be removed from blade by sanding during paint removal.

c) For overhaul and inspection instructions, refer to appropriate propeller overhaul manual.



Metric Equivalency

0.060 in	=	1.524 mm
0.063 in	=	1.600 mm
0.21 in	=	0.53 mm
1.393 in	=	3.538 cm

Distance Between Blade Butt and Counterweight
Figure 5-10

27) Counterweight Clamp Installation for E10950 Blade

a) Check the fit of the counterweight clamp to the blade shank.

CAUTION: WHEN REMOVING EXCESS ADHESIVE, DO NOT REMOVE ANY BLADE MATERIAL. IF BLADE MATERIAL IS REMOVED IN THIS PROCESS, THE BLADE MUST BE RETURNED TO HARTZELL FOR EVALUATION.

b) If counterweight clamp does not fit, check blade for excess adhesive from the erosion shield application procedure. Remove excess adhesive and fiberglass scrim and recheck counterweight fit. Excess material may be removed down to the blade surface. Use caution not to remove any blade material.

NOTE: Any paint removed during the fit check process must be replaced prior to continuing. See instructions in Chapter 6.

c) Apply an approved release agent (Figure 2-10, ref. no. 19) to the inside surface of the clamp halves.

NOTE: Complete coverage with release agent is necessary to ensure ease of removal of counterweight should it be necessary.

d) Prepare potting material (Figure 2-10a, ref. no. 21).

e) Apply an even layer of epoxy to the inside surfaces of the clamp halves.

f) Position the counterweight clamp in place on the blade shank.

g) Place new washer over each new bolt. Apply a small amount of thread locking compound (Figure 2-10a, ref. no. 21) on the threads of each mounting bolt.

h) Pass the bolt through the large clamp half and thread into small half. Torque the bolts to 35 ft/lbs checking that the gap on each side remains even.

NOTE: There is a 10% torque tolerance.

i) Clean away excess epoxy and wipe with Hysol dissolver (Figure 2-10, ref. no. 11).

CAUTION: POTTING COMPOUND MUST BE CURED PRIOR TO PROPELLER USE.

j) Allow potting compound to cure at room temperature, accelerated cure is not permitted (Figure 2-10a, ref. no. 20).

28) Retention Split-Bearing Removal for A, B and E Shank Blades

NOTE: The following procedure assumes that the preload plate, pitch change bracket and counterweight clamps are removed, where applicable.

a) Place the blade, butt end down, on a horizontal work bench. For B shank blades, the pitch change knob must be allowed to hang over the edge of the work surface.

b) Using a punch made of brass, aluminum or similar soft material, tap the bearing retention ring evenly around its circumference toward the blade butt.

c) Remove bearing retention ring.

d) Lift off blade retention split bearing.

e) Using a plastic scraper, peel or chip away the remaining epoxy on the blade retention radius.

NOTE: Small areas of localized lifting up or fuzzing of the top layer of composite material is normal. If amount of damaged area is questionable contact the Hartzell product support department (address on page 1-3) for assistance.

29) Retention Split-Bearing Installation for A, B and E Shank Blades

a) Apply approved adhesive (Figure 2-10, ref. no. 16) to the inner races of the blade retention split-bearing to fill void between bearing and blade retention radius.

CAUTION: THE PARTING LINE OF THE BEARING RACE MUST BE 90° FROM THE LEADING AND TRAILING EDGES OF THE BLADE.

CAUTION: LUBRICANT ON THE MATING SURFACE OF THE BLADE IS ESPECIALLY CRITICAL ON COMPOSITE BLADES. IF LUBRICANT IS NOT PLACED AROUND BLADE SHANK, THE ADHESIVE WILL BOND TO THE COMPOSITE MATERIAL.

b) Apply lubricant (Figure 2-10, ref. no. 12) to the mating surface of the blade, and place the bearing races onto the radius of the blade base.

c) Press the bearing retention ring onto the bearing races and blade base.

d) Apply 6,000 lbs of force uniformly during bearing retention ring installation to assure proper seating of bearing races against mating surface of blade.

1 A minimum of thirty seconds at 6,000 lbs of force is required.

2 Clean off excess epoxy.

e) Bearing race must be held firmly against radius of blade base for a period of six (6) hours. This may be done by installing blades into the hub and setting blade preload as described, immediately after bearing race installation.

NOTE: **Hub halves should be together for this step.**

30) **Delrin Seal Ring Inspection (Figures 5-12 through 5-15)**

a) Check seal ring for wear. Seal ring must be replaced if worn below minimum diameter:

"A" Shank 3.613 inches (9.177 cm)

"B" & "E" Shank 3.356 inches (8.524 cm)

b) Visually check seal area for any deformations that could cause a grease leak. If any is found, replace.

NOTE: Some "E" shank blades were equipped with Teflon tape. These shanks should have Teflon replaced with delrin. See Figure 5-15 for seal ring groove diameter and location.

31) **Delrin Seal Ring Removal**

a) Using a knife, pick one end of the delrin seal loose and peel off blade. Remove remaining adhesive on lathe.

CAUTION: IF SOFT JAWS ARE NOT USED, THE BLADE WILL BE DAMAGED.

b) Place blade in lathe. Secure blade in soft jaws which have been bored to a depth of 7/16 inch (11.1125 mm) to accept the 4.500 inch (11.43 cm) diameter.

c) Use the rubber support block (Figure 2-3a, ref. no. 38) to support the blade tip. Apply light pressure adequate to support the blade.

NOTE: Use of the rubber support block is not mandatory.

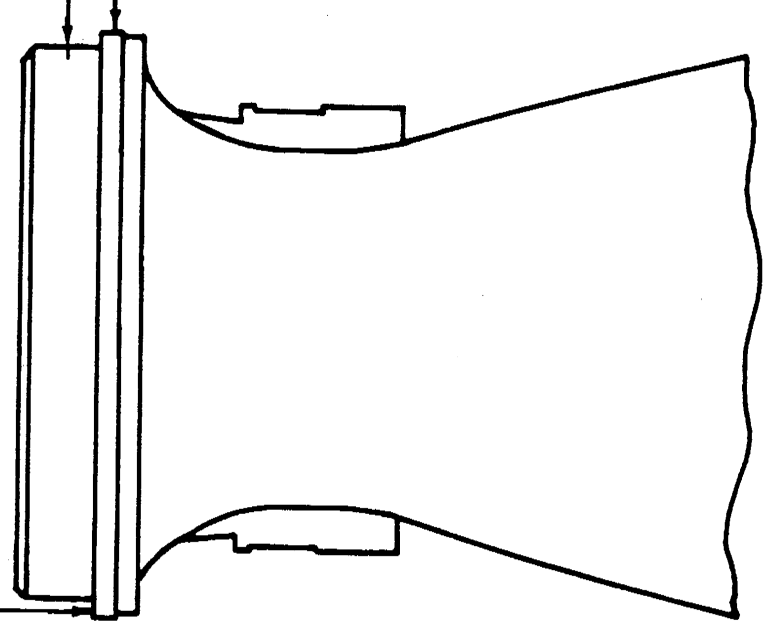
d) Check run-out of shank on surface shown in Figure 5-11, correct as necessary.

CAUTION: ASSURE THAT THE BLADE IS SECURELY CHUCKED PRIOR TO TURNING ON THE LATHE. DO NOT EXCEED 100 RPM IF THE RUBBER SUPPORT BLOCK IS NOT USED.

e) Remove material in the seal area. Refer to appropriate figure (Figures 5-12 through 5-15) for dimensions and tolerance.

f) Inspect seal area for smoothness.

APS-939



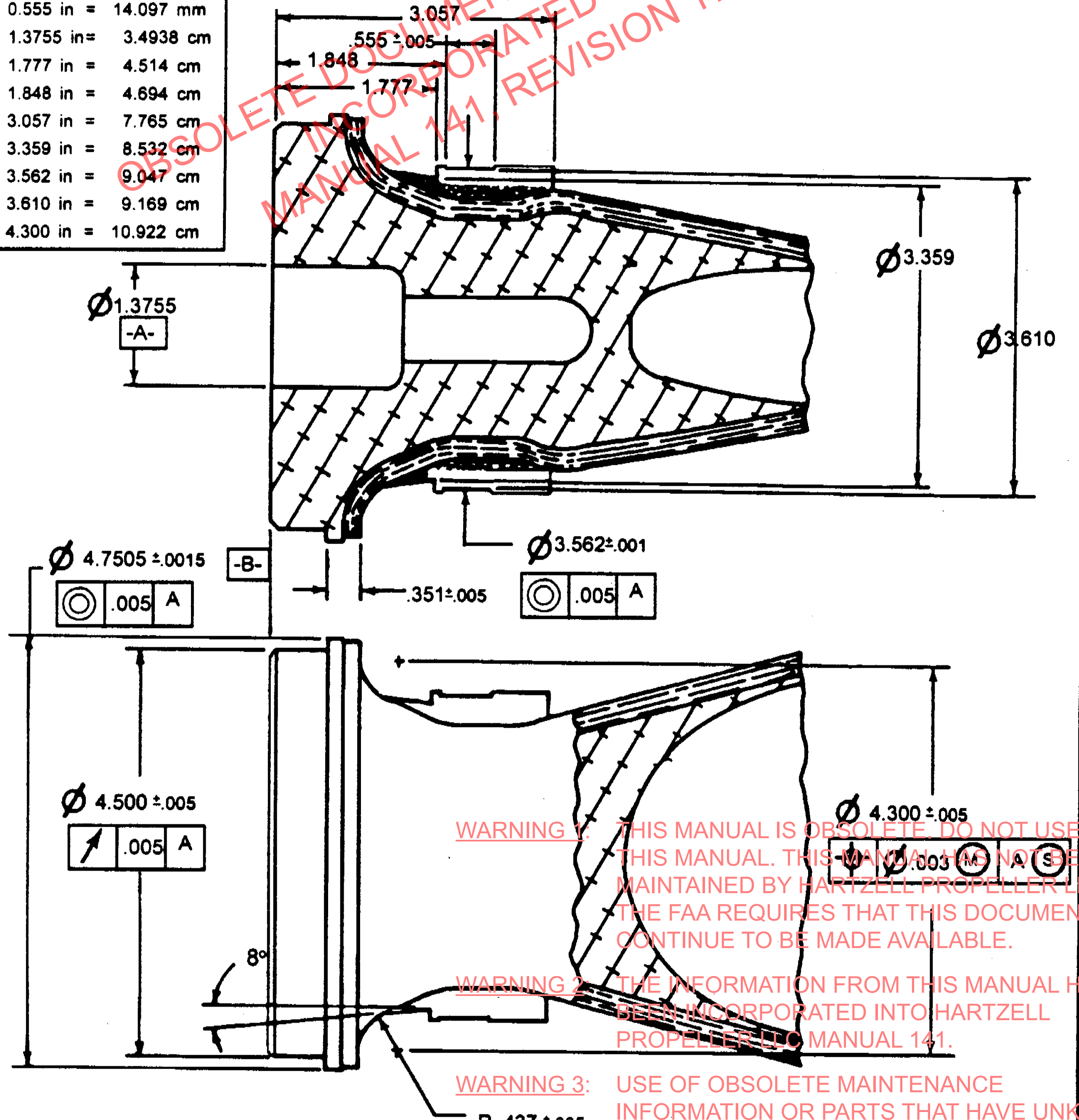
Metric Equivalency

0.0005 in=	0.0127 mm
0.001 in =	0.025 mm

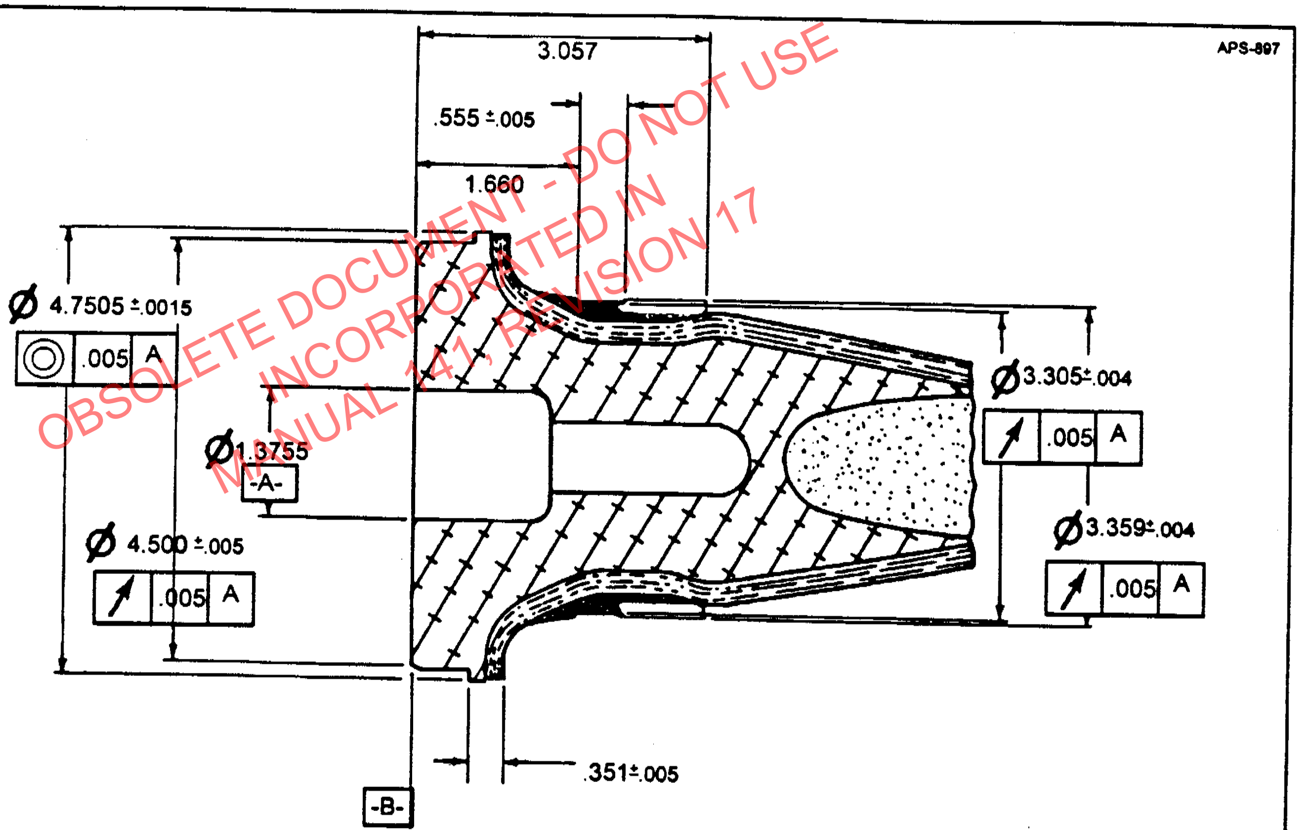
Where to Check Run-Out of Shank
Figure 5-11

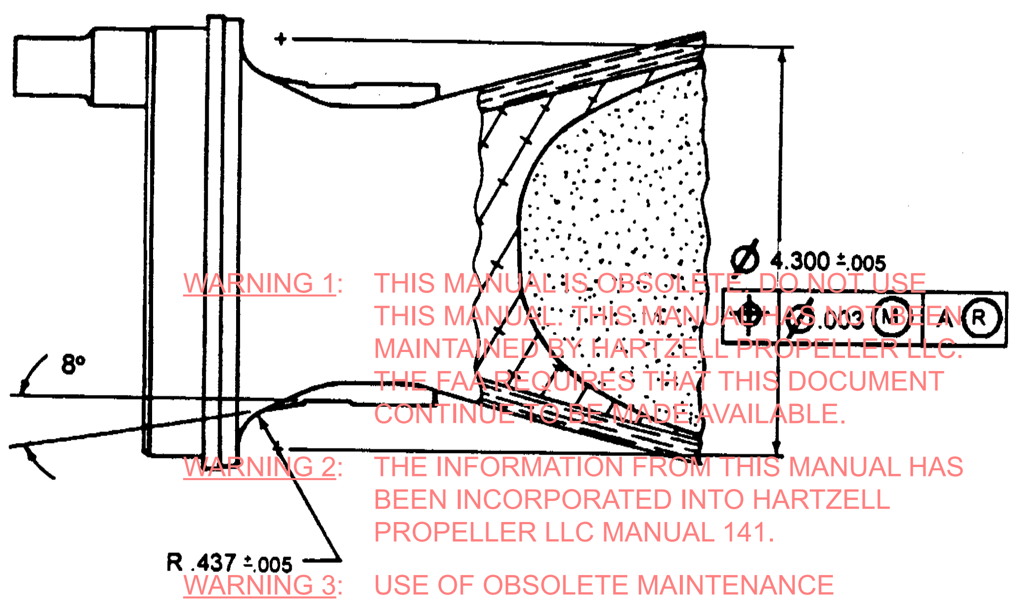
Metric Equivalency

0.001 in	=	0.025 mm
0.003 in	=	0.076 mm
0.005 in	=	0.127 mm
0.351 in	=	8.915 mm
0.437 in	=	11.100 mm
0.555 in	=	14.097 mm
1.3755 in	=	3.4938 cm
1.777 in	=	4.514 cm
1.848 in	=	4.694 cm
3.057 in	=	7.765 cm
3.359 in	=	8.532 cm
3.562 in	=	9.047 cm
3.610 in	=	9.169 cm
4.300 in	=	10.922 cm



Seal Ring Groove Diameter and Location
on "A" Shank
(Blade Model: A10460)
Figure 5-12





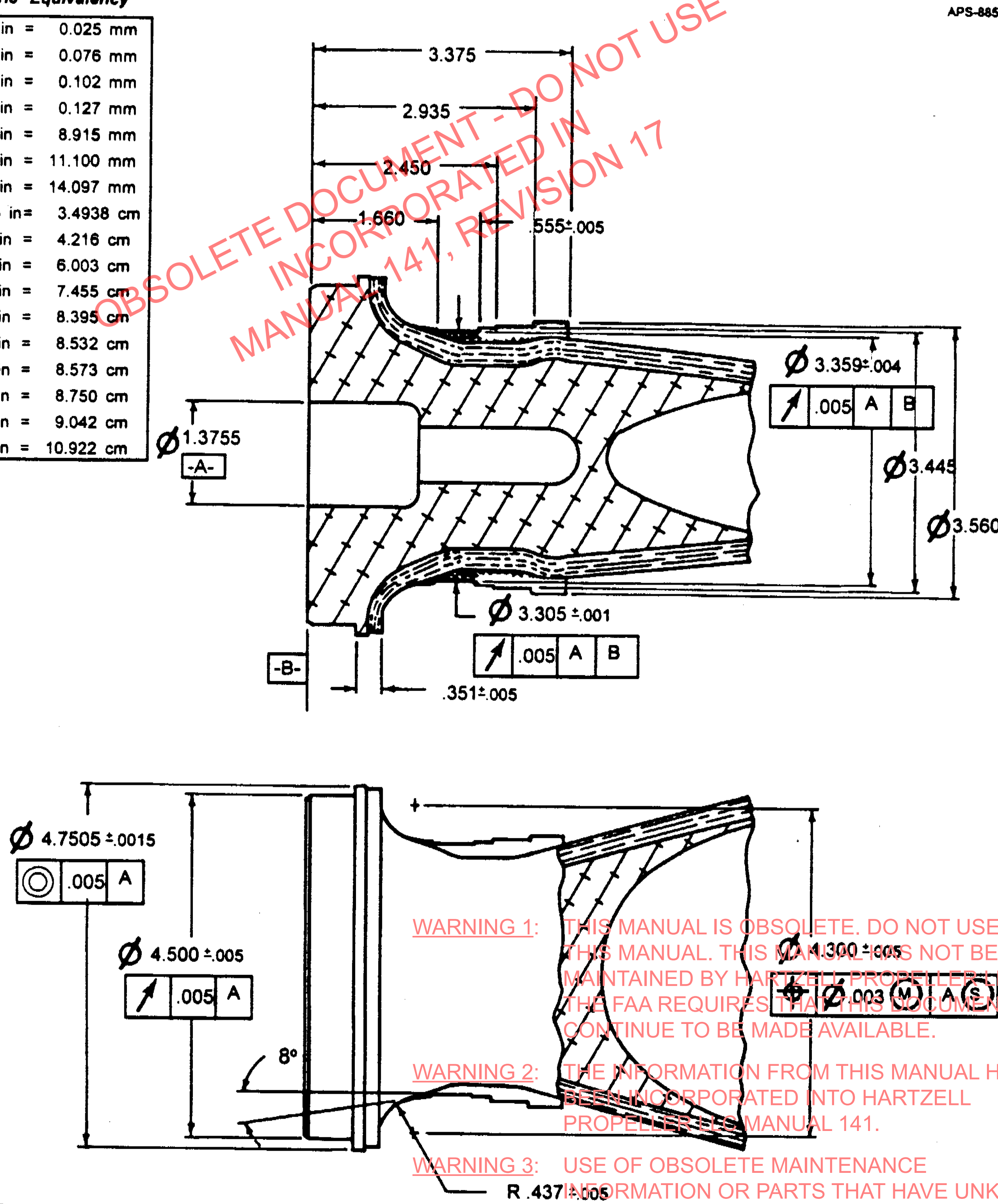
Metric Equivalency

0.003 in	=	0.076 mm
0.004 in	=	0.102 mm
0.005 in	=	0.127 mm
0.437 in	=	11.100 mm
0.555 in	=	14.097 mm
0.351 in	=	8.915 mm
1.3755 in	=	3.4938 cm
1.660 in	=	4.216 cm
3.057 in	=	7.765 cm
3.305 in	=	8.395 cm
3.359 in	=	8.532 cm
4.300 in	=	10.922 cm

Seal Ring Groove Diameter and Location
on "B" Shank
(Blade Models: B7421, B7466)
Figure 5-13

Metric Equivalency

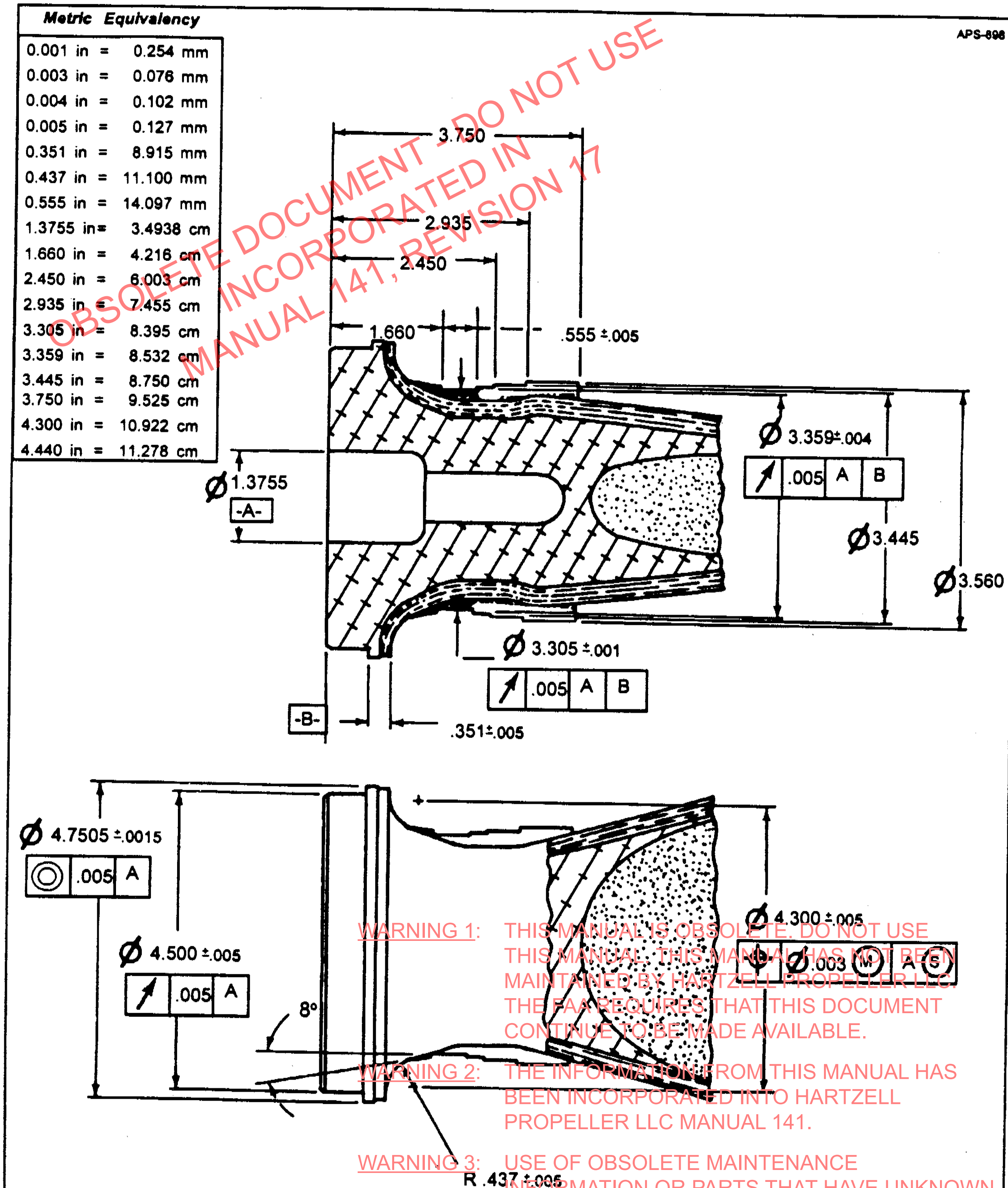
0.001 in	=	0.025 mm
0.003 in	=	0.076 mm
0.004 in	=	0.102 mm
0.005 in	=	0.127 mm
0.351 in	=	8.915 mm
0.437 in	=	11.100 mm
0.555 in	=	14.097 mm
1.3755 in	=	3.4938 cm
1.660 in	=	4.216 cm
2.450 in	=	6.003 cm
2.935 in	=	7.455 cm
3.305 in	=	8.395 cm
3.359 in	=	8.532 cm
3.375 in	=	8.573 cm
3.445 in	=	8.750 cm
3.560 in	=	9.042 cm
4.300 in	=	10.922 cm



Seal Ring Groove Diameter and Location
on "E" Shank
(Blade Model: E10950)
Figure 5-14

Metric Equivalency

0.001 in	=	0.254 mm
0.003 in	=	0.076 mm
0.004 in	=	0.102 mm
0.005 in	=	0.127 mm
0.351 in	=	8.915 mm
0.437 in	=	11.100 mm
0.555 in	=	14.097 mm
1.3755 in	=	3.4938 cm
1.660 in	=	4.216 cm
2.450 in	=	6.003 cm
2.935 in	=	7.455 cm
3.305 in	=	8.395 cm
3.359 in	=	8.532 cm
3.445 in	=	8.750 cm
3.750 in	=	9.525 cm
4.300 in	=	10.922 cm
4.440 in	=	11.278 cm



Seal Ring Groove Diameter and Location
on "E" Shank
(Blade Model: E11990)
Figure 5-15

g) If area did not clean up or if undersized, use epoxy (Figure 2-10b, ref. no. 68) to fill in low area and re-turn.

h) While on the lathe, clean excess epoxy (from previous seal ring installation procedures) from windings. Refer to appropriate figure (Figures 5-12 through 5-15) for dimensions.

32) Delrin Seal Ring Installation

NOTE: The delrin seal ring should be installed following the finish procedures in Chapter 9.

a) Using appropriate abrasive (Figure 2-10b, ref. no. 54), roughen the inside diameter of the seal ring (part no. found in Chapter 10).

b) Thoroughly clean seal ring with approved solvent (Figure 2-10, ref. no. 11).

c) Wipe the recessed area of the shank with approved solvent. Be careful to wipe with the windings so as not to produce fuzz.

d) Apply masking tape (Figure 2-10b, ref. no. 74) to the outside of the seal. The tape should be 1/8 inch (3.175 mm) wider than the seal, and be positioned with equidistant overhangs.

e) Apply masking tape against the edge of the recessed area to protect windings. Be careful to not cover the recessed area.

f) No more than four (4) blades may be done at one time because of the set-up time of the adhesive. Mix appropriate epoxy (Figure 2-10b, ref. no 68) for the number of blades to be sealed.

g) Brush on the epoxy in the entire recess evenly.

h) Immediately install the seal ring in the recess. Start the application by centering the seal on the face centerline and squeezing out epoxy around the shank until the split meets on the camber side.

i) Wrap masking tape (Figure 2-10b, ref. no. 75) over the seal:

1 Unwrap 4 inches (10.16 cm) of tape on roll and stick 2 inches (5.08 cm) on the end of the seal in a way so when pulled on the roll, the tension closes the opening of the split.

2 With tension applied, wrap tape across split and around seal while firmly pressing tape in place and forcing all air from under seal. Excess epoxy oozes out of edges to form a complete seal.

3 Wrap a second layer of tape over the first.

<u>CAUTION</u>: MAKE SURE THAT THE WINDINGS ARE NOT PULLED UP DURING TAPE REMOVAL

j) Remove all masking tape after the epoxy has set.

k) Use appropriate abrasive (Figure 2-10b, ref. no. 63) to sand the seams at the edges of the seal smooth along with any fuzz raised during tape removal.

l) Finish sanding the surface smooth with appropriate abrasive (Figure 2-10b, ref. no. 61)

33) Counterweight Clamp Removal for E11990K

<u>CAUTION 1</u>: COUNTERWEIGHT CLAMPS SHOULD BE REINSTALLED ON THE BLADES FROM WHICH THEY WERE REMOVED. IF EITHER CLAMP HALF IS NOT SERIALIZED, THE BLADE SERIAL NUMBER SHOULD BE PERMANENTLY MARKED ON BOTH HALVES OF THE COUNTERWEIGHT CLAMP.

<u>CAUTION 2</u>: DO NOT PERMANENTLY MARK THE COUNTERWEIGHT CLAMP HALVES WHILE THEY ARE INSTALLED ON THE BLADE. PERMANENT DAMAGE TO THE BLADE MAY RESULT.

A. Inspect for the presence of the blade serial number stamped onto the outboard end of the counterweight clamp halves. If necessary, temporarily mark the serial number of the blade onto the counterweight clamp halves. After removal of the counterweight clamp, permanently mark the counterweight halves with round bottom impression stamps on the outboard surface of the clamp.

B. Remove all balance weights, weight slugs, and hardware attached to the counterweight clamp (Fig. 10-4, item 6), if applicable. Discard all fasteners.

C. Remove the bolts (Fig. 10-4, item 8) and washers (Fig. 10-4, item 7) holding the clamp halves together. Discard the bolts.

<u>CAUTION</u>: DO NOT APPLY SIDE LOADS TO THE CLAMP. DAMAGE TO THE BLADE DOWEL PIN HOLE MAY RESULT.

D. Gently tap the clamp halves (Fig. 10-4, item 6) from the blade.

<u>NOTE</u>: Epoxy filler under the counterweight clamp will be removed from the blade during paint removal.

E. If applicable, remove the dowel pins (Fig. 10-4, item 9) from the counterweight clamps.

F. If the dowel pin is retained in the blade, it must be removed.

(1) One method of removal is to create threads on the outside of the pin and attach a slide hammer for removal.

G. Additional inspections and repair.

(1) Remove anodize in accordance with Chromic Acid Anodizing chapter of the Hartzell Standard Practices Manual 202A (61-01-02).

(2) Dye penetrant inspect in accordance with Dye Penetrant Inspection chapter of the Hartzell Standard Practices Manual 202A (61-01-02).

(a) No relevant dye penetrant indications are acceptable.

(3) Local spot repairs are permitted on the blade contacting surface up to 0.025 inch (0.64 mm) deep.

(4) No more than 25 percent of the blade contacting surface of the clamp may be reworked as stated in step (3) in this section.

(5) All rework must blend smoothly and have a surface finish of 100 microfinish or better.

(6) Dye penetrant inspection must be repeated after rework is complete.

(7) Use a soft cotton wheel to dress out and polish damage anywhere on the clamp.

(8) Clean the counterweight clamps in accordance with the Cleaning chapter of the Hartzell Standard Practices Manual 202A (61-01-02).

(9) Re-anodize the counterweight clamps in accordance with Chromic Acid Anodizing chapter of the Hartzell Standard Practices Manual 202A (61-01-02).

34) Counterweight Clamp Installation for E11990K

A. Check the fit of the counterweight clamp to the blade shank.

(1) Make sure that the serial number marked on the clamp match the blade serial number. Make sure that the dowel pin hole in the counterweight clamp aligns with the dowel pin hole in the blade.

CAUTION 1: IF REMOVING EXCESS ADHESIVE, DO NOT REMOVE ANY BLADE MATERIAL. IF BLADE MATERIAL IS REMOVED DURING THIS PROCESS, THE BLADE MUST BE RETURNED TO HARTZELL FOR EVALUATION.

CAUTION 2: CARE MUST BE TAKEN ON BLADES INCORPORATING CONDUCTIVE COATING, SO AS NOT TO DISRUPT THE CONDUCTIVE PATH. IF THE CONDUCTIVE PATH IS DISRUPTED THE BLADE MUST BE REPAINTED IN ACCORDANCE WITH FINISH PROCEDURES CHAPTER IN COMPOSITE BLADE MAINTENANCE MANUAL 135F (61-13-35)

B. If the counterweight clamp does not fit, check the blade for excess adhesive left on the surface from the erosion shield application procedure. Remove excess adhesive and fiberglass scrim. Excess material may be removed down to the blade surface. Recheck the fit of the counterweight.

NOTE: Minor amounts of paint may be removed during the fit check process beneath the counterweight clamp. Areas of paint removed that are not covered with the counterweight clamp must be repaired using the Minor Blemish Correction procedure in the Finish Procedures chapter of Composite Blade Maintenance Manual 135F (61-13-35).

C. Apply primer CM127 to the threads of both bolts (item 5) used to hold the clamp halves together and to the mating threaded holes in the clamp. Allow the primer to dry at room temperature for a minimum of 5 minutes.

D. Apply release agent CM19 to the inside surface and the inboard and outboard edges of the clamp halves. Allow the release agent to dry.

NOTE: Complete coverage with release agent is necessary to ensure ease of removal of the counterweight clamp at a later date.

E. Mix adhesive.

(1) Thoroughly mix adhesive CM20 in accordance with the manufacturer's specifications until mixture is a uniform color.

(2) Adhesive CM94 may be used as an alternate for CM20:

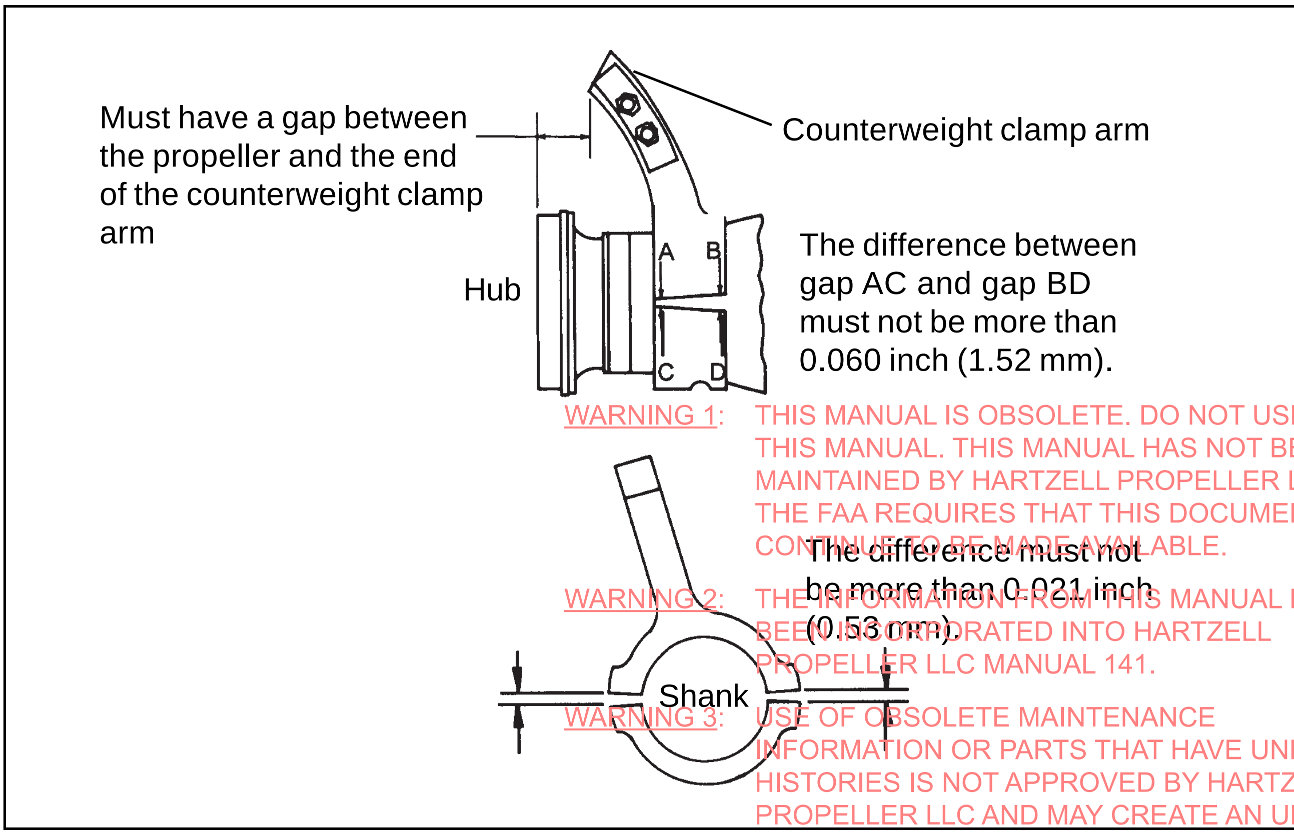
(a) Thoroughly mix adhesive CM94 in accordance with the manufacturer's specifications until the mixture is a uniform color.

(b) Add 15 percent (by volume) of aluminum powder CM110 and mix thoroughly.

F. Apply an even layer of adhesive to the inside surfaces of the clamp halves.

G. Position the counterweight clamp on the blade shank.

H. Place a washer (item 4) over each new bolt (item 5). Make sure the washer is placed with the ID chamfer toward the head of the bolt.



Gap Limits for Counterweight Clamps
Figure 5-15.1

CAUTION: TORQUING AND FINAL POSITIONING OF THE BOLTS MUST BE ACCOMPLISHED WITHIN 3 MINUTES OF THE APPLICATION OF THE RETAINING ADHESIVE, TO MAKE SURE THAT THE ADHESIVE DOES NOT SETUP BEFORE FINAL POSITIONING.

I. Apply one drop of retaining compound CM74 to the threaded holes in the clamp and to each thread of both bolts.

CAUTION: THE USE OF ELECTRIC OR PNEUMATIC TOOLING FOR THE INSTALLATION OF BOLTS MAY CAUSE THREAD DAMAGE AND IS NOT PERMITTED.

J. Install the bolts and hand tighten. Alternately tighten each bolt a small amount at a time until the clamp halves contact the blade. Refer to Figure 5-15.1 in this chapter for gap requirements.

(a) Install the dowel pin (item 7) through the hole in the clamp to a depth of 0.600 inch (15.24 mm), when measured at the longest side of the slanted dowel hole.

CAUTION: IMPROPER CLAMP ALIGNMENT CAN CAUSE CROSS THREADING.

K. Alternately tighten each bolt a small amount until the bolts are torqued to 30 ft-lbs (42 N•m), while continually checking to make sure that the gaps between the clamp halves remain equal. Refer to Figure 5-15.1 in this chapter for gap requirements.

L. Cotter pins are used in the heads of the bolts to make sure that the bolts do not loosen. Inspect the position of the four holes in the head of the bolts. If necessary, tighten each bolt until the hole is aligned with the edge of the cutout (1/4 turn maximum).

CAUTION: DO NOT TIGHTEN BOLT, BEYOND 1/4 TURN MAXIMUM, TO PERMIT COTTER PINNING.

M. Remove excess adhesive with a dry rag. If smeared adhesive can not be removed, slightly moisten the rag with Denatured Alcohol CM11 only.

N. Cut the cotter pin to approximately 0.50 inch (1.27 cm) long and install the pin into the hole of the bolt that is just past the counterbore of the clamp. Spread the prongs of the pin, inside the head of the bolt, to prevent it from coming out of the hole.

CAUTION 1: ADHESIVE MUST BE CURED BEFORE PROPELLER USE.

CAUTION 2: HEAT ACCELERATED CURE IS NOT PERMITTED.

O. Cure at room temperature for a minimum of 24 hours before the propeller is used. Processing may continue during the cure cycle.

35) Serial Number Inspection for LM10585

a) Certain LM 10585 blades with stainless steel erosion shields require special inspection and modification, unless previously accomplished. This requirement applies only to blades with prefix “D” in the serial number (e.g. D274). Four (4) serial number categories have been established, each category has different modification requirements. (By this date, all affected blades should have been modified. However, this should be confirmed by inspection during overhaul.)

NOTE: The following information does NOT apply to blades that have had replacement nickel erosion shields installed. Nickel erosion shields are adhesively bonded and do not use any screws or rivets.

Category	Blade Serial Numbers
A	0274 through 0394
B	01 through 0273
C	0395 through 0448
D	0449 through 0548

b) With reference to blades in Categories A, C, and D:

1 Erosion shield retention screws were factory-installed on the camber side at approximately 2 inches (5.08 cm) spacing out to and including the 34 inch (86.36 cm) station reference radius.

2 Screws were factory-installed on the face side at approximately 2 inches (5.08 cm) spacing out to and including the 28 inch (71.12 cm) radius.

3 Screws also were factory-installed at the 31 inch (78.74 cm) and 33 inch (83.82 cm) radii.

4 Rivets were factory-installed at approximately 4 inch (10.16 cm) spacing starting at the 36.250 inch (92.075 cm) radius and continuing out to and including the 51.250 inch (13.018 cm) radius.

c) With reference to blades in Category B:

1 Erosion shield retention screws were factory-installed at approximately 1 inch (2.54 cm) spacing out to a point 4 inches (10.16 cm) beyond the de-icer boot.

2 No rivets were factory-installed on Category B blades.

d) Additional retention screws and rivets must be installed on Categories A,B, C and D blades which have not been modified to assure acceptable spacing between screw and/or rivets.

1 Inspect any blade with the designated serial number to determine whether modification is required.

2 If installation of screws or rivets is necessary, follow the same procedure for stainless steel erosion shield debond repair in Chapter 6.

3 Screws also were factory-installed at the 31 inch (78.74 cm) and 33 inch (83.82 cm) radii.

4 Rivets were factory-installed at approximately 4 inch (10.16 cm) spacing starting at the 36.250 inch (92.075 cm) radius and continuing out to and including the 51.250 inch (13.018 cm) radius.

c) With reference to blades in Category B:

1 Erosion shield retention screws were factory-installed at approximately 1 inch (2.54 cm) spacing out to a point 4 inches (10.16 cm) beyond the de-icer boot.

2 No rivets were factory-installed on Category B blades.

d) Additional retention screws and rivets must be installed on Categories A, B, C and D blades which have not been modified to assure acceptable spacing between screw and/or rivets.

1 Inspect any blade with the designated serial number to determine whether modification is required.

2 If installation of screws or rivets is necessary, follow the same procedure for stainless steel erosion shield debond repair in Chapter 6.

Overhaul
TRAVELER
Blade Model E11990

Date ____________

Work Order No. ________________ Customer ________________________________

Serial Number ____________

TSN ____________

TSO ____________

Oper	Operation Description	Per Inst.	Date	By
1	Counterweight Clamp Removal	Paragraph 5-3, Proc. 33)		
2	Retention Split-Bearing Removal	Paragraph 5-3, Proc. 28)		
3	Clean Shank	Paragraph 5-3, Proc. 1)		
*4	Boot Removal	Chapter 8		
5	Paint Removal	Paragraph 5-3, Proc. 3)		
6	Initial Inspection	Paragraph 5-3, Proc. 4)		
7	Determine if Field Repairable	Chapters 5, 6, 7		
*8	Erosion Shield Removal	Paragraph 5-3, Proc. 7)		
9	Repair	See attached report		
*10	Fit Erosion Shield	Paragraph 5-3, Proc. 8)		
*11	Erosion Shield Application	Paragraph 5-3, Proc. 9)		
*12	Sand Erosion Shield	Paragraph 5-3, Proc. 10)		
*13	Erosion Shield Inspection	Paragraph 5-3, Proc. 11)		
*14	Dimensional Inspection	Paragraph 5-3, Proc. 12)		
15	Alignment Bearing Removal	Paragraph 5-3, Proc. 15)		
16	Lead Removal	Paragraph 5-3, Proc. 2)		
17	Balance Tube Replacement	Paragraph 5-3, Proc. 17)		
18	Prepare Bore for Bearing Installation	Paragraph 5-3, Proc. 16)		
19	Alignment Bearing Installation	Paragraph 5-3, Proc. 19)		
20	Paint Application	Chapter 9		
*21	Final Erosion Shield Inspection	Paragraph 5-3, Proc. 14)		
22	Blade Delamination Inspection	Paragraph 5-3, Proc. 20)		
23	Delrin Seal Ring Inspection	Paragraph 5-3, Proc. 30)		
24	Delrin Seal Ring Removal	Paragraph 5-3, Proc. 31)		
25	Delrin Seal Ring Installation	Paragraph 5-3, Proc. 32)		
26	Boot Application	Chapter 8		
27	Balance	Paragraph 5-3, Proc. 21)		
28	Retention Split-Bearing Installation	Paragraph 5-3, Proc. 29)		
29	Apply Counterweight Clamps	Paragraph 5-3, Proc. 34)		
30	Complete Maintenance Release Tag	—		
31				
32				
33				
34				
35				
36				

Unless otherwise specified, all procedures refer to Manual 135D or 156A.
*Part of erosion shield replacement process.

REPAIR REPORT

Blade Model ____________

Date ____________

Work Order No. ________________ Customer ______________________________

Serial Number ____________

TSN ____________

TSO ____________

Oper	Operation Description	Per Inst.	Date	By
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
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27				
28				
29				
30				
31				
32				
33				
34				
35				
36				

Unless otherwise specified, all procedures refer to Manual 135D or 156A.

OVERHAUL INSPECTION FORM
Blade Model No. E11990

Inspected By: ______________________________

Date: ______________________________

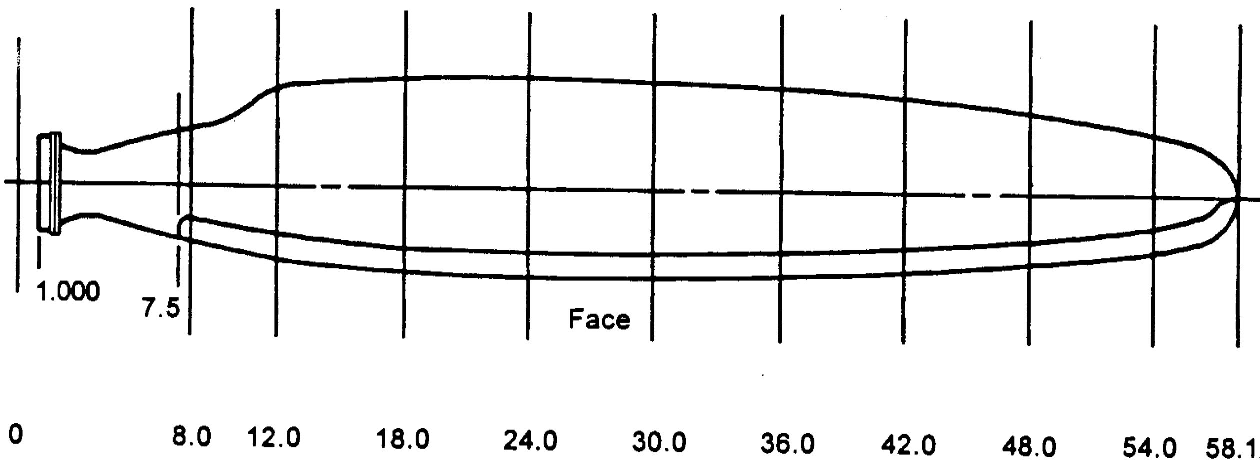
Serial No. ______________________________

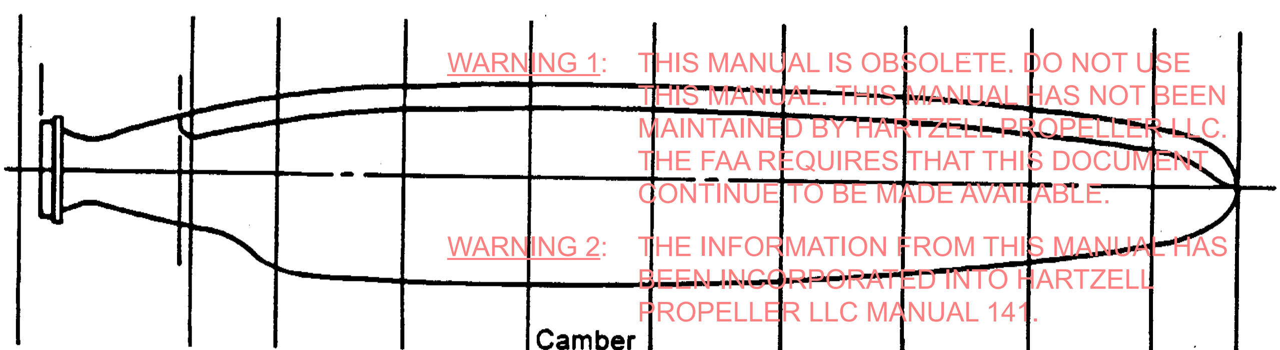
Work Order Number: ______________________________

❑ Incoming ❑ Outgoing

	Method Used	
Blade Delaminations:	Coin Tap _____	Impactoscope _______
Erosion Shield Debonds:	Coin Tap _____	Shurtronics _______

APS-915





C = Crack
DL = Delamination
DB = Debond
S = Split
G = Gouge

BLADE DIMENSIONAL INSPECTION FORM
(Overhaul)
Blade Model E11990

Serial Number ____________________

Work Order Number ______________

Width

Sta.	Minimum	Maximum	Checked
12	7.761	7.960	
24	9.076	9.287	
36	8.605	8.927	
48	6.890	7.236	
54	5.278	5.622	

Blade Angle

Check 54 inch Station with 42 inch Station
set at 0° using a template
Requirement 7.7° ±0.5°

Results ________________

Face Alignment

Blades must match within 0.250 inch when matched in sets.
Measure blades at the 52.125 inch Station.

Face Alignment

Shank Inspection

Bearings Must be Tight After Installation Accept ____ Reject ______

Remarks:

6-1. General

A. **This section refers to minor repair only.**

B. Minor repair is correction of damage that may be safely performed in the field by a certified aircraft mechanic (preferably a mechanic who has completed Hartzell composite blade training).

C. De-icer boot replacement is considered minor repair and is addressed in Chapter 8.

6-2. Nickel Erosion Shield

NOTE: Early production LM10585 blades used stainless steel erosion shields. Later production (with suffix "N", e.g. LM10585ANK) use a nickel erosion shield. *ALL other blade designs use only nickel erosion shields.*

A. Debond Extending to Trailing Edge and/or Crack (Figure 6-1)

1) This repair may be performed to debonds along the trailing side that total less than 10.5 inches (26.67 cm) in length. No individual debond may exceed 4.5 inches (11.43 cm) in length and 0.75 inch (19.05 mm) in width. If these limits are exceeded, the erosion shield must be replaced.

2) Perform a debond test (there are two approved methods outlined in Chapter 4, coin-tap and shurtronics). Outline the area of debond in erosion shield with a grease pencil.

3) Using a small plastic wedge (Figure 2-3, ref. no. 32) or equivalent, gently lift erosion shield and clean debonded area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) In a contamination-free container (Figure 2-10, ref. no. 5) mix adhesive (Figure 2-10, ref. no. 14) as described on the adhesive can.

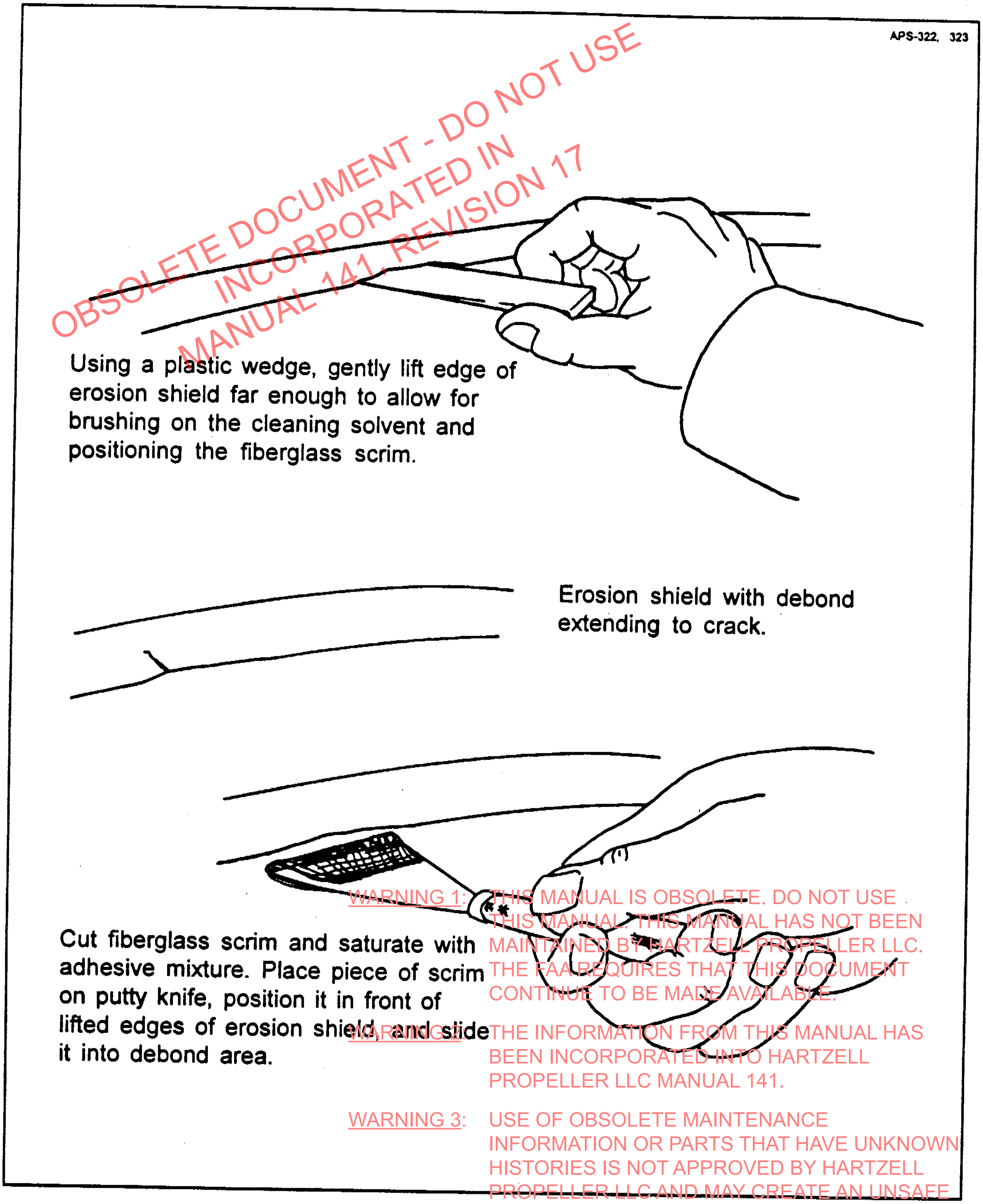
6) Cut fiberglass scrim (Figure 2-10a, ref. no. 42) so when folded in half, it is the size of debond area, and saturate with adhesive mixture.

7) Slide saturated scrim under the erosion shield using a clean putty knife (Figure 2-3, ref. no. 27) or equivalent.

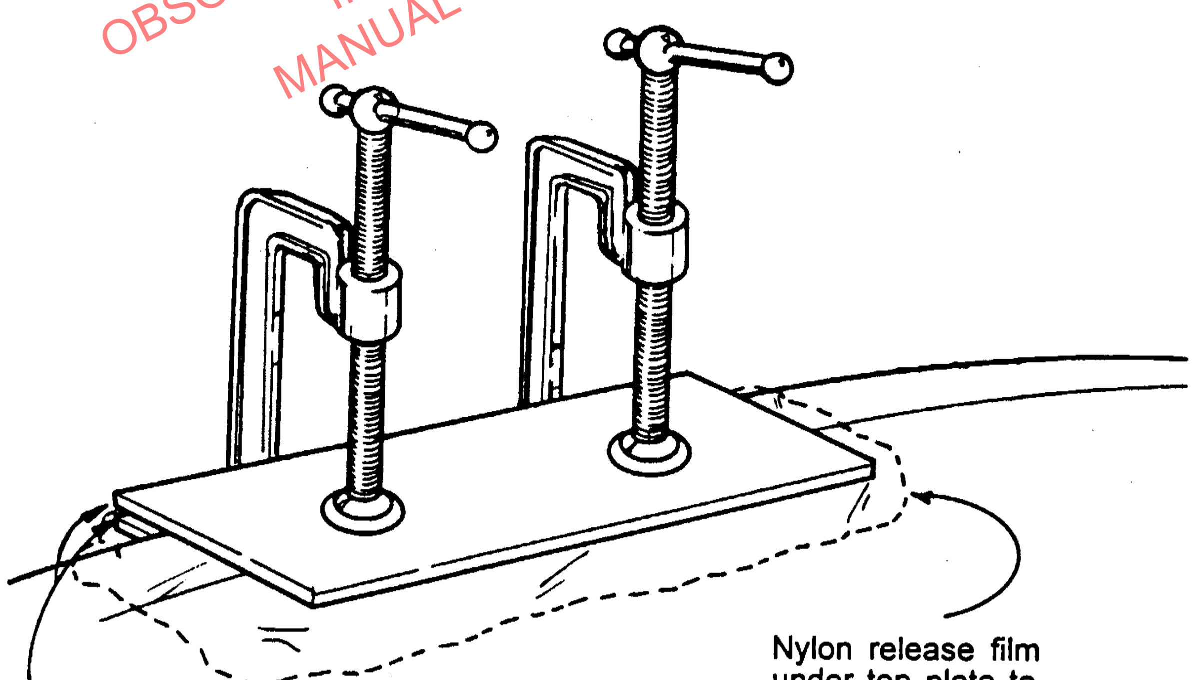
8) Lay a sheet of nylon release film (Figure 2-10a, ref. no. 44) over the repair area to prevent the top plate (Figure 2-3, ref. no. 33) shown in Figure 6-2 from bonding to the blade. Place one thin wooden (or plastic) plate over the repair area and another plate on the opposite side of the blade.

   a) Position "C" clamps on the plates, and tighten the clamps enough to apply moderate pressure to the repair. One clamp at each end of the damage area is enough.

   NOTE: Extra care must be taken to ensure that the raised portions of the erosion shield lie flat after the adhesive has cured.



Repair of Debond at Edge of Nickel Erosion Shield
Figure 6-1



Using "C" Clamps to Apply Pressure
to Erosion Shield Debond Repair
Figure 6-2

b) Allow adhesive to cure (see Figure 2-10 for cure time).

c) Remove the clamps, plates and nylon release film.

9) Sand the area smooth.

10) Inspect with a debond test in Chapter 4 (Paragraph 4-4). The repair should be within the limits specified in Chapter 3 before being released to service.

11) Refinish following the procedure in Paragraph 6-8.

B. Gouge (Figure 6-3)

NOTE: This repair is temporary only. Any blade that has had this repair performed must have the erosion shield replaced at overhaul.

1) This procedure is a temporary repair of gouges that are damaged through to the blade.

2) No more than 0.25 sq inch (6.35 sq mm) area of erosion shield may be missing.

3) Damage to the blade surface beneath the erosion shield may not be more than 0.020 inch (0.508 mm) deep.

4) If any foam material is exposed, the blade must be returned to the factory for evaluation.

5) Procedure

a) If applicable, use a vibratory sander (Figure 2-3, ref. no. 6) and appropriate abrasive (Figure 2-10b, ref. no. 54) to clean and remove all paint from the metal surface in the area to be repaired. Attempt to minimize abrasion to the metal surface.

b) Use a pick or brush (Figure 2-10) to remove any loose paint.

c) Wipe the area with an approved solvent (Figure 2-10, ref. no. 11).

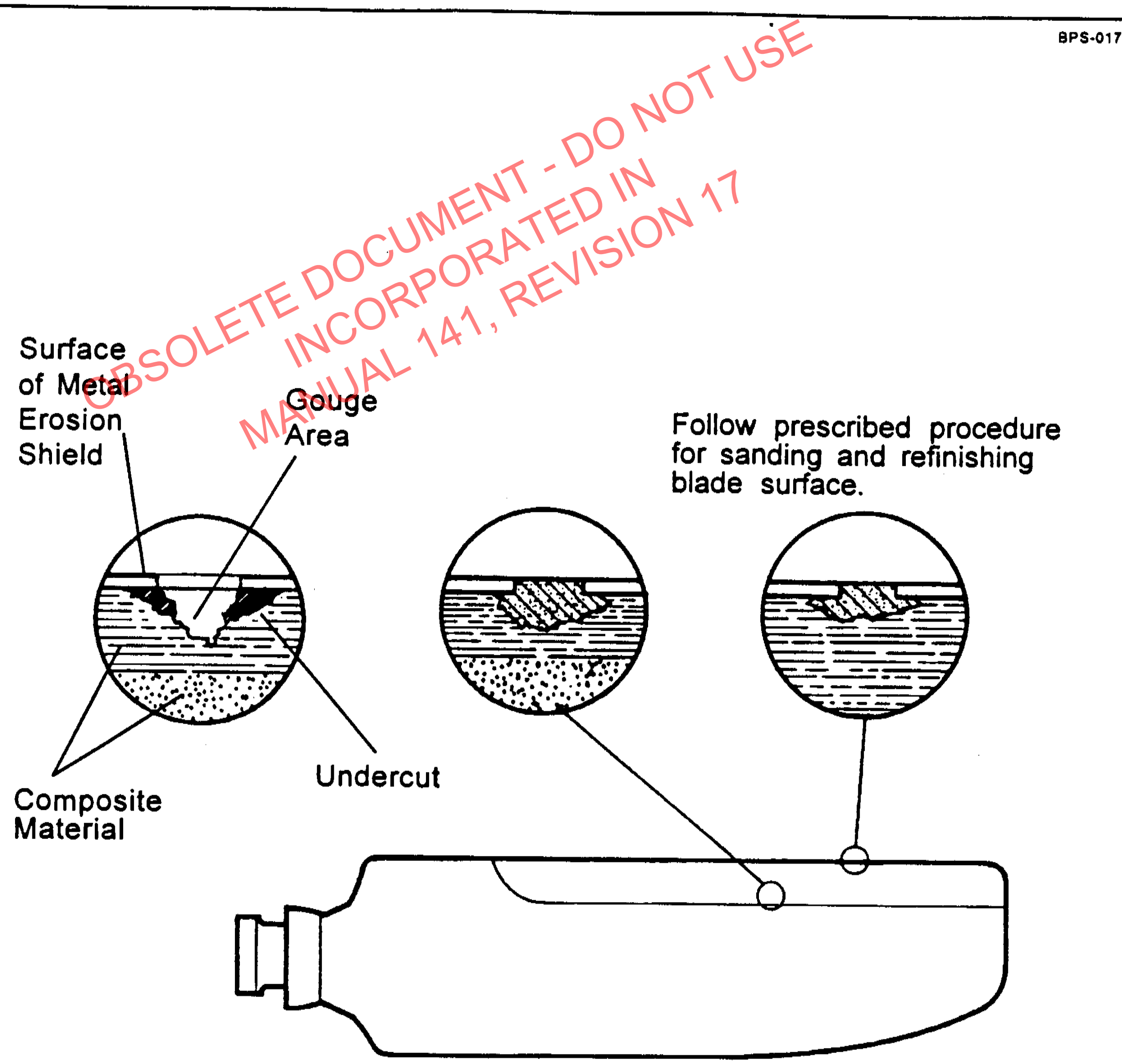
d) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

CAUTION: DO NOT REMOVE SURFACE MATERIAL TO A DEPTH THAT EXCEEDS 0.020 IN (0.508 MM) DEEP INTO THE COMPOSITE MATERIAL.

e) Use a dove-tail cutter (Figure 2-3, ref. no. 37) to undercut the erosion shield around the repair area so the composite material will be retained better when the void is filled.

f) In a contamination-free container (Figure 2-10, ref. no. 5), mix the approved structural adhesive (Figure 2-10, ref. no. 14 or 15) as described on the adhesive can.

g) Add an equal amount of milled fibers (Figure 2-10b, ref. no. 56) to the adhesive, creating a paste. The milled fibers must be saturated with adhesive. Add adhesive mixture as necessary to assure saturation.



Field Repair of Minor Damage in Erosion Shield
Figure 6-3

h) Fill the void in the erosion shield with the proper mixture of adhesive and milled fibers.

i) Sand the filled area to smoothness.

j) Inspect repaired area for adhesion and proper shape.

k) Refinish following the procedure in Paragraph 6-8.

6-3. Stainless Steel Erosion Shield

A. The following repair procedures apply only to a *stainless steel* erosion shield (used on early production LM10585 blades).

B. Debond

1) This repair may be performed within the airworthy limits specified in Chapter 3. If these limits are exceeded, the erosion shield should be replaced with a nickel erosion shield.

2) If the debond is inboard of the 36 inch (91.44 cm) blade radius, use stainless steel machine screws (Figure 2-10b, ref. no. 52) for repair.

3) If the debond is outboard of the 36 inch (91.44 cm) blade radius, use copper rivets (Figure 2-10b, ref. no. 53) for repair.

4) Refer to Figure 6-4 to determine method for field repair of stainless steel erosion shield damage.

NOTE: It is recommended that any blade requiring rivet or screw repair have identical repair performed to the opposite blade of a set to maintain proper balance. As an alternative, either lead weight may be added or subtracted, or dynamic balance may be used.

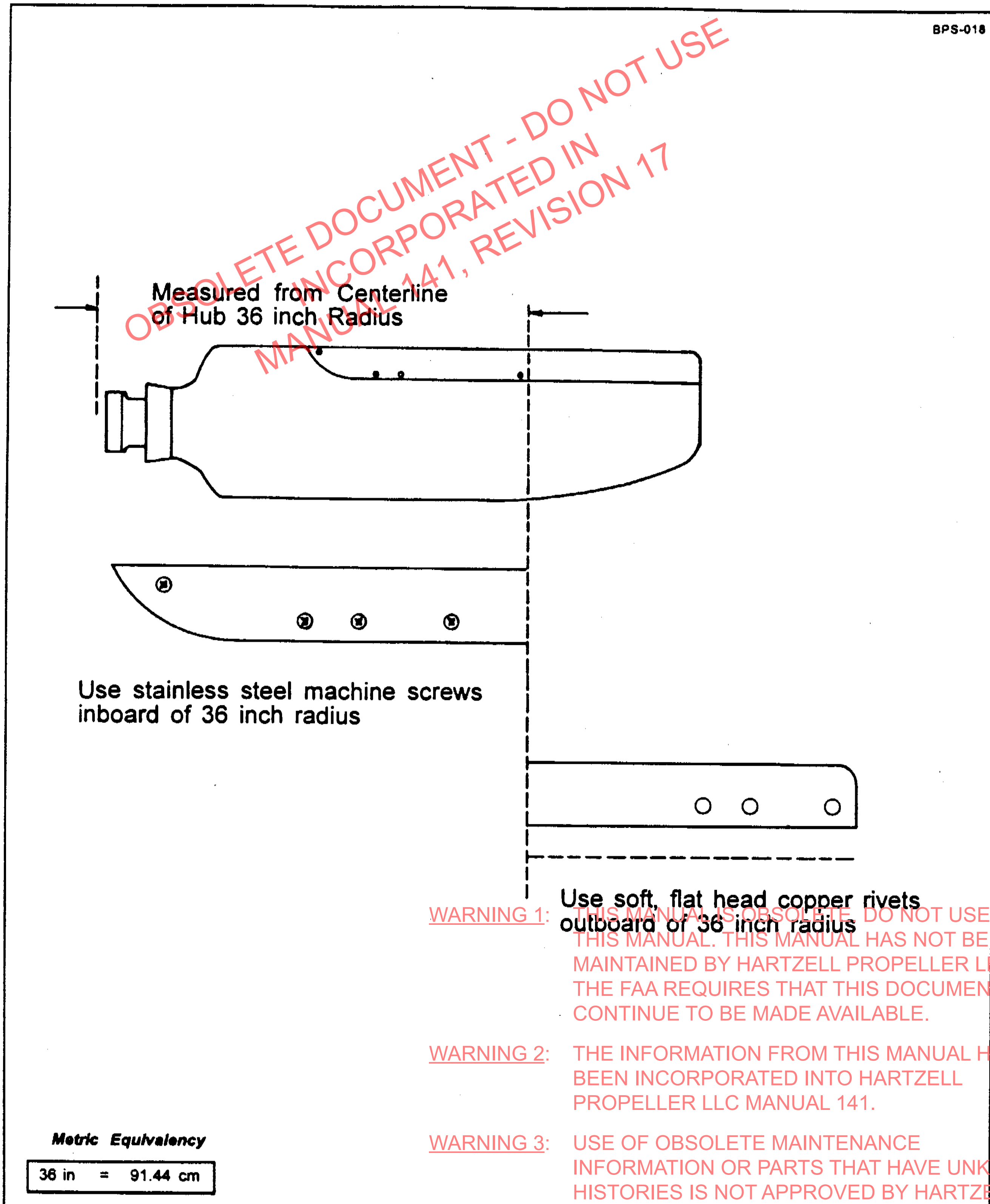
5) Using Screws for Repair (Figure 6-5)

CAUTION: WHEN SCREWS ARE USED TO REPAIR A DEBOND INBOARD OF THE 36 INCH (91.44 CM) RADIUS, MAKE SURE THEY DO NOT INTERFERE WITH RETENTION SCREWS ON THE OPPOSITE SIDE OF THE BLADE.

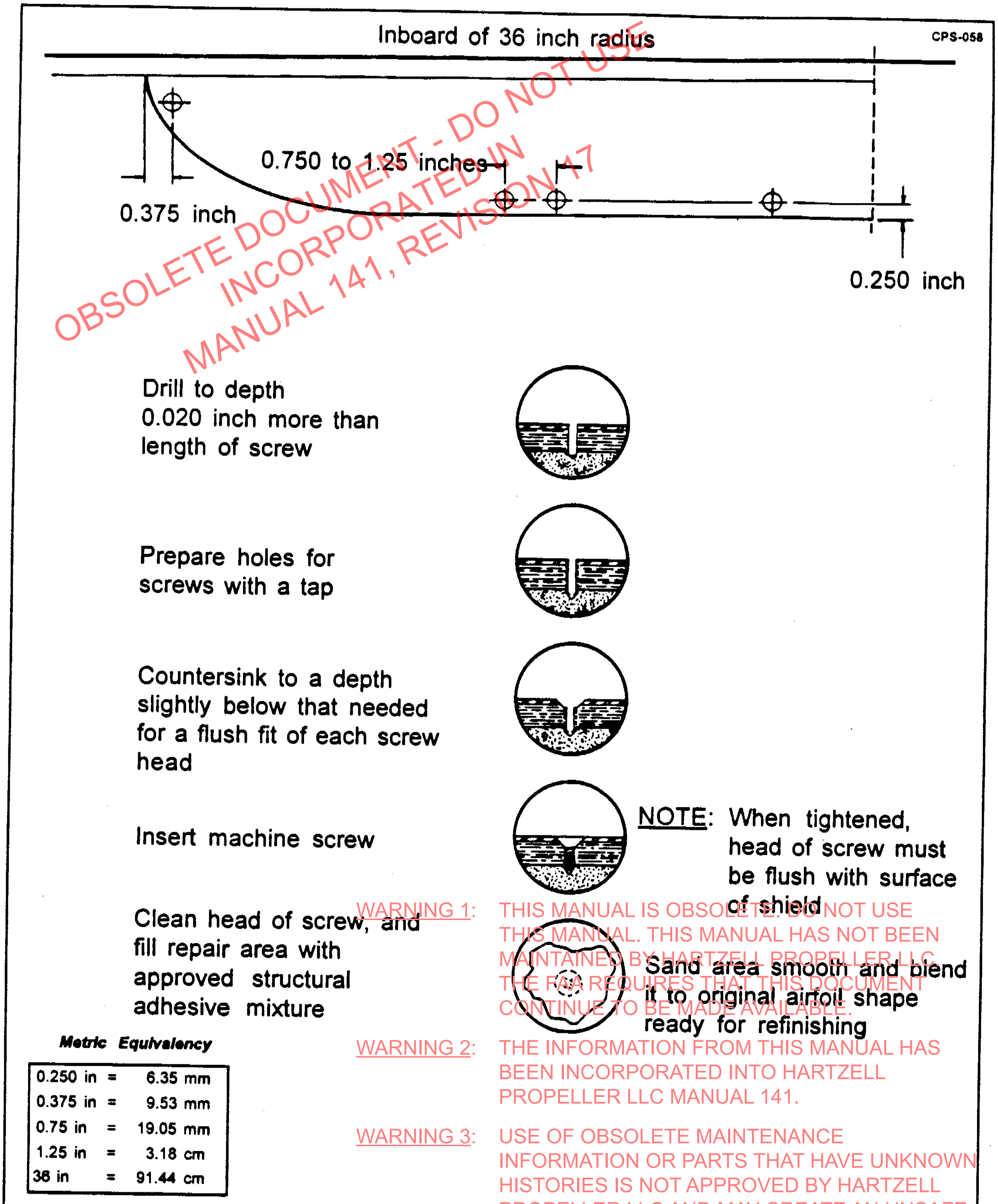
a) Locate spacing for the screws on a line 0.250 inch (6.35 mm) in from where the composite material and stainless steel erosion shield meet.

b) Mark the location for a screw at each end of the debond and evenly space marks in between so screws will be no closer than 0.750 inch (19.05 mm) and no further apart than 1.25 inches (3.18 cm). Use only the number of screws needed for adequate repair of the debond area.

c) Center punch the erosion shield at each screw location.



Determining Method for Repair
of Stainless Steel Erosion Shield Debond
Figure 6-4



Metric Equivalency

0.250 in	=	6.35 mm
0.375 in	=	9.53 mm
0.75 in	=	19.05 mm
1.25 in	=	3.18 cm
36 in	=	91.44 cm

Using Stainless Steel Machine Screws to Repair Debond in Stainless Steel Erosion Shield
Figure 6-5

d) With appropriate size bit (Figure 2-3, ref. no. 34), drill a hole at each screw location to a depth 0.040 inch (1.016 mm) deeper than the length of the screw.

NOTE: Penetration into the foam core is acceptable. Once the foam has been penetrated, there is no reason to go deeper.

e) Use a tap (Figure 2-3, ref. no. 35) to prepare the holes for screws.

CAUTION: DO NOT COUNTERSINK DEEPER THAN NECESSARY.

f) Use a countersink (Figure 2-3, ref. no. 36) to depth slightly below that needed for a flush fit of each screw head.

g) Clean screws (Figure 2-10b, ref. no. 52) entirely with approved solvent (Figure 2-10, ref. no. 11).

h) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

i) In a contamination-free container (Figure 2-10, ref. no. 5), mix the structural adhesive (Figure 2-10, ref. no. 14 or 15) as described on the adhesive can.

j) Apply some of the adhesive mixture in the hole.

k) Insert screws.

l) Clean the head of each screw and the area around it with approved cleaning solvent.

m) Allow solvent to evaporate.

n) Fill screw heads with the adhesive mixture.

o) Allow adhesive to cure (see Figure 2-10 for cure time).

p) Sand each repair area smooth and clean.

q) Visually inspect for flushness. Inspect each screw for proper set. The erosion shield should not be lifted from the blade surface.

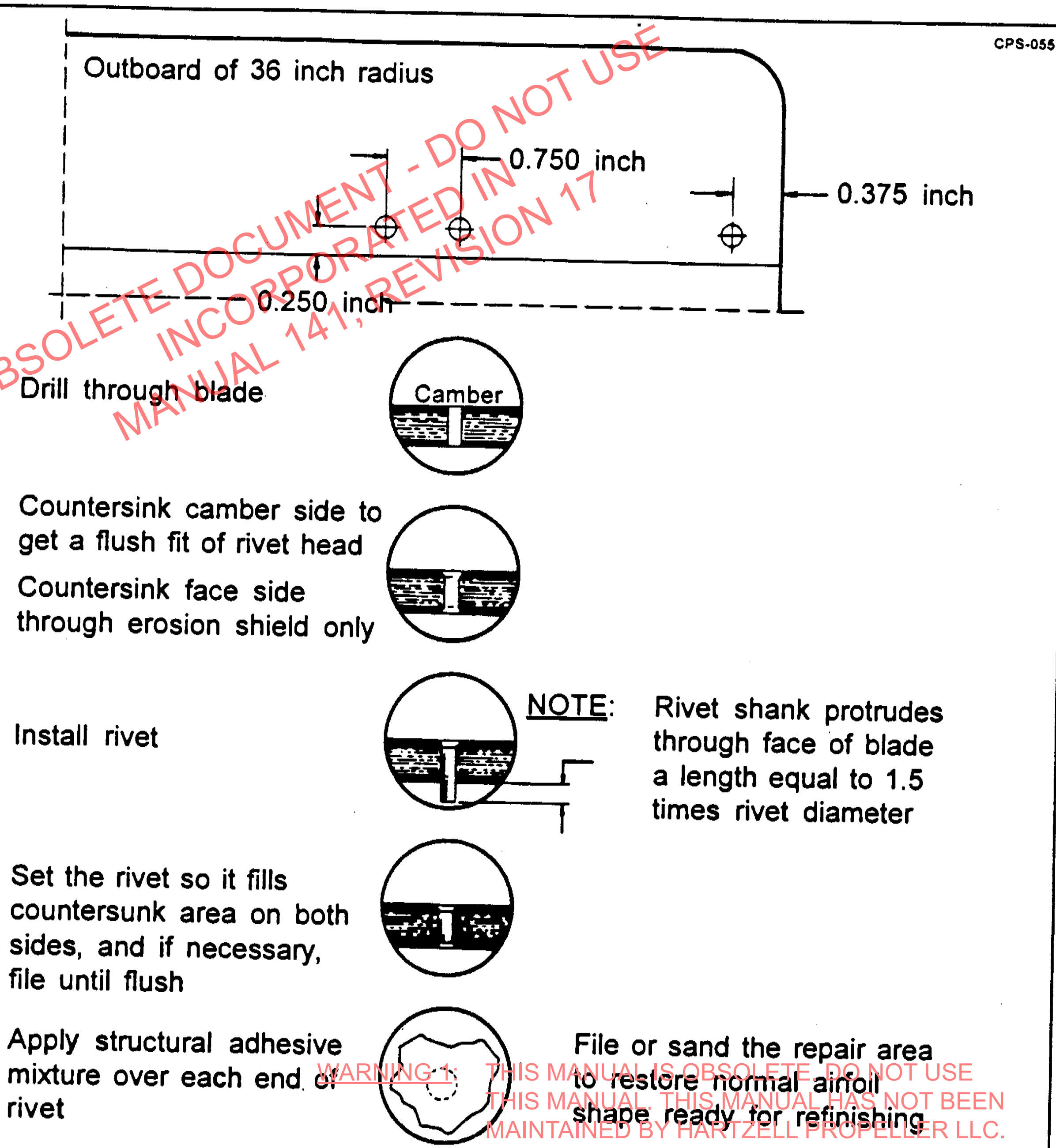
r) Refinish following the procedure in Paragraph 6-8.

6) Using Rivets for Repair (Figure 6-6)

a) On camber side of blade, locate spacing for rivets on a line 0.250 inch (6.35 mm) in from where the composite material and stainless steel erosion shield meet.

b) Mark the location for a rivet at each end of the debond and evenly space marks in between so rivets will be no closer than 0.750 inch (19.05 mm) and no further apart than 1.25 inches (3.18 cm).

c) Centerpunch the erosion shield at each rivet location.



Metric Equivalency

0.250 in	=	6.35 mm
0.375 in	=	9.53 mm
0.75 in	=	19.05 mm
1.25 in	=	3.18 cm
36 in	=	91.44 cm

Using Rivets to Repair Debond in Stainless Erosion Shield
Figure 6-6

CAUTION: ALIGN DRILL SO CENTERLINE OF THE EXIT HOLE IS AT LEAST 0.250 INCH (6.35 MM) FROM THE TRAILING EDGE OF THE EROSION SHIELD ON THE FACE OF THE BLADE.

d) Use a drill with appropriate size bit (Figure 2-3, ref. no. 34) to drill a hole completely through the blade at each rivet location.

CAUTION: DO NOT COUNTERSINK DEEPER THAN NECESSARY.

e) Use a countersink (Figure 2-3, ref. no. 36) on the camber side of the blade to a depth sufficient for chamfering the steel erosion shield to get a flush fit of the rivet head.

f) On the face side of the blade, countersink through the erosion shield. Do not penetrate composite material.

g) Insert rivet (Figure 2-10b, ref. no. 53) from camber side.

h) Cut proper length from face side. 1.5 times the diameter should protrude from the face side.

i) Set each rivet enough to fill the countersunk area on both sides of the blade.

j) File rivets flush with the edge on both sides as required.

k) If voids exist, mix the structural adhesive (Figure 2-10, ref. no. 14) as described on the can in a contamination-free container.

1 On each side of the blade, apply a small amount of the adhesive mixture to the end of each rivet.

2 Allow adhesive mixture to cure (see Figure 2-10 for curing time).

l) Sand until smooth.

m) Visually inspect for flushness. Inspect each rivet for proper set. The erosion shield should not be lifted from the blade surface.

n) Refinish following the procedure in Paragraph 6-8.

C. Corroded Cadmium-Plated Screw

1) Corroded screws are repairable provided pitting is less than 0.010 inch (2.54 cm) depth, otherwise screw replacement is required.

2) Screw Repair

CAUTION: REMOVE THE LEAST POSSIBLE AMOUNT OF MATERIAL FROM A CORRODED SCREW HEAD.

a) Use a highspeed rotary tool (Figure 2-3, ref. no. 6) with appropriate abrasive (Figure 2-10a, ref. no. 46) to remove all evidence of corrosion from surface of screw head.

b) Thoroughly clean the screw head with the approved solvent (Figure 2-10, ref. no. 11).

c) Apply a coating of primer (Figure 2-10a, ref. no. 27) for corrosion protection.

d) In a contamination-free container (Figure 2-10, ref. no. 5), mix the structural adhesive (Figure 2-10, ref. no. 14) as described on the adhesive can.

e) Fill the slot in the machine screw head (and the surrounding area) with the adhesive mixture, and allow the adhesive to cure (see Figure 2-10 for cure time).

f) When the adhesive mixture has cured, sand the surface area smooth and blend it into the normal airfoil shape.

g) Wipe the repaired area with approved solvent.

h) As necessary, follow the Refinishing Procedures detailed in Chapter 9.

NOTE: If necessary, also follow the prescribed procedure for restoring the black ink stamped blade identification serial number and design number on the camber side.

3) Screw Replacement

a) Clear the paint primer and adhesive from the slot in the head of the screw.

CAUTION: USE A MINIMUM AMOUNT OF HEAT TO SOFTEN THE ADHESIVE WHICH RETAINS THE SCREW.

b) Heat a screwdriver to soften the adhesive which retains the screw. Insert screwdriver into the slot, and apply gentle loosening pressure.

c) As the pressure and heat loosen the screw, back it out of the blade.

d) Retap the threaded hole.

e) In a contamination-free container (Figure 2-10, ref. no. 5), mix the adhesive (Figure 2-10, ref. no. 14) as described on the adhesive can.

f) Coat a new screw with the adhesive mixture, and insert it into the retapped hole.

g) Tighten the screw into place.

h) When the adhesive mixture has cured, sand the surface area smooth and blend it into the normal airfoil shape.

i) Wash the repaired area with approved solvent (Figure 2-10, ref. no. 11).

j) As necessary, follow the Refinishing Procedures detailed in Chapter 9.

NOTE: If necessary, follow the prescribed procedure for restoring the black ink stamped blade identification serial number and design number on the camber side.

6-4. Blade Cuff (Figure 6-7)

A. Cracks at the Root End of Cuff

1) This type of damage should be sealed to prevent moisture from penetrating the cuff foam. This repair is temporary *until time of overhaul*, at which time a major repair must be performed.

2) Sand the area by hand with abrasive (Figure 2-10a, ref. no. 54).

3) Clean area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Lay a bead of approved sealant (Figure 2-10, ref. no. 9) around entire area of crack and blend to normal airfoil shape.

6) Allow sealant to cure (see Figure 2-10 for cure time).

7) Inspect repaired area for proper adhesion and coverage.

8) Refinish following the procedure in Paragraph 6-7, being careful not to disturb sealant.

B. Nick or Scratch

1) Remove paint with approved abrasive (Figure 2-10b, ref. no. 54), exposing entire area to be repaired.

2) Sand entire area until all damaged material is removed.

3) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass fabric (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

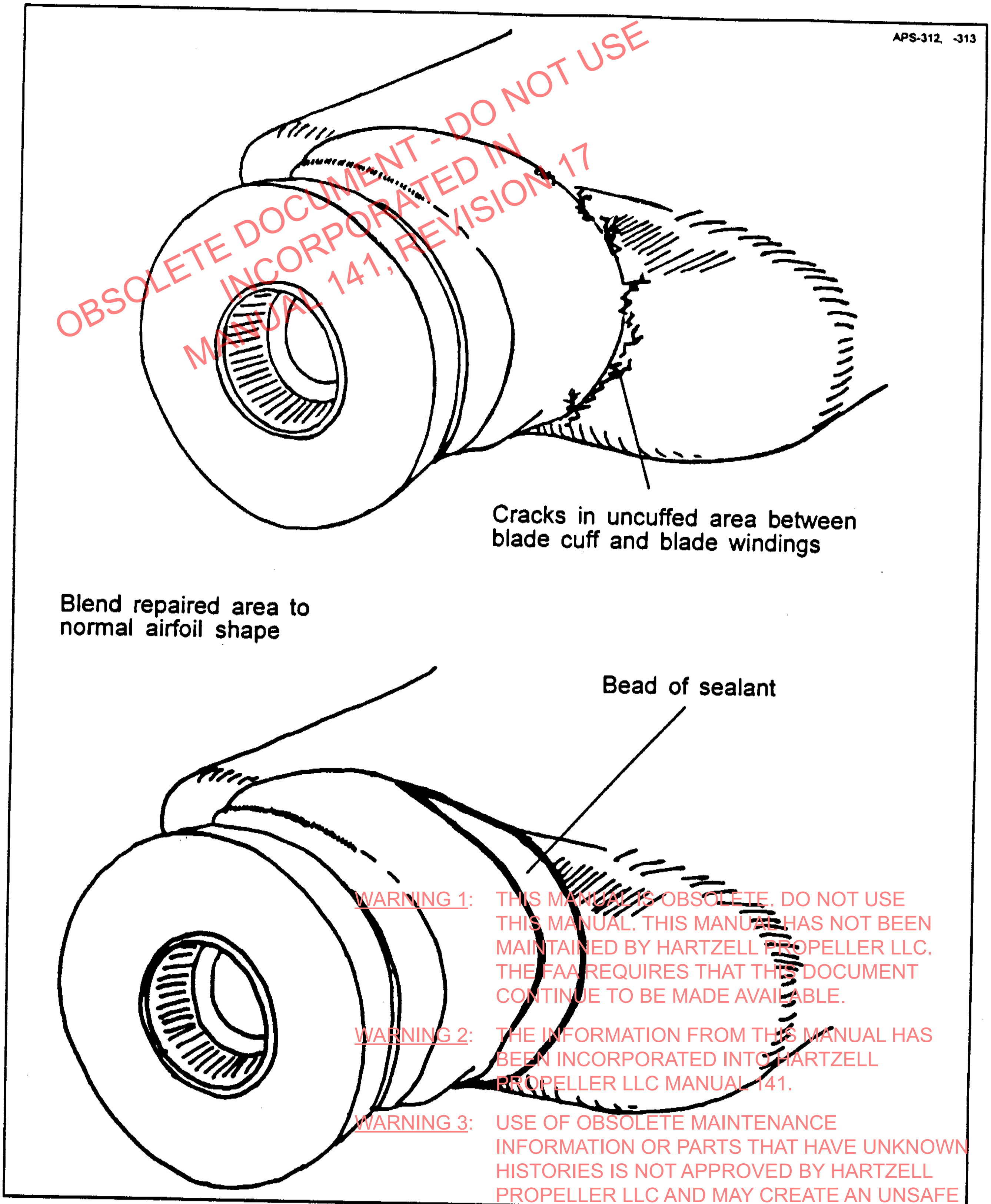
9) Refinish following the procedure in Paragraph 6-8.

C. Cracks

1) This repair may be performed on cracks within the airworthy limits specified in Chapter 3.

CAUTION: BE CAREFUL NOT TO REMOVE FOAM OR KEVLAR® BLADE MATERIAL.

2) With approved abrasive (Figure 2-10b, ref. no. 54), remove material damaged by crack, feathering into undamaged area 1 inch (2.54 cm) around cracked area.



Blade Cuff Crack Repair
Figure 6-7

3) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass fabric (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

D. Delamination

1) This repair may be performed on delaminations within the airworthy limits specified in Chapter 3.

2) Remove delaminated materials by sanding with appropriate abrasive (Figure 2-10b, ref. no. 54).

3) Clean with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass material (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

6-5. Blade

A. Gouges or Loss of Material

1) This repair may be performed on gouges or loss of material of the blade up to 2 sq. inches or on the erosion screen within the airworthy limits specified in Chapter 3.

2) Lightly sand affected area with sandpaper (Figure 2-10a, ref. no. 54) to remove any loose material.

3) Clean with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass material (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repair area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

B. Crushed Trailing Edge (Figures 6-8 and 6-9)

1) This repair may be performed on a crushed trailing edge within the airworthy limits specified in Chapter 3.

NOTE: Some of the blade material even though damaged, may be left on the blade. If damaged material has been deprived of resin and is fully intact, it should be left on the blade. If more than one layer is left on the blade and they are separated, they must be injected with adhesive (Figure 2-10, ref. no. 14) between these layers when the repair is made.

2) Remove desired material using a grinder or sander, creating a bevel that extends from the repair area from 0.500 to 1.00 inch (12.7 to 25.4 mm), depending on the size of repair.

3) Determine the amount of layers of fiberglass (Figure 2-10b, ref. no. 55) needed to repair blade. Each layer of fiberglass is 0.010 inches (0.254 mm) thick. Then, cut each layer of fiberglass to match the shape of the beveled area, to create a stair step pattern when laminating.

4) Prepare plates, which can be made of metal, plastic, masonite, etc., to clamp over repair area. One of these plates should be long enough so that when clamped on the blade, the clamps will not interfere with the repair area.

5) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

6) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

7) If applicable, inject adhesive (Figure 2-10, ref. no. 14) between layers of material left at the repair area.

8) Laminate desired layers of fiberglass with adhesive on one side of blade.

9) Place nylon release film (Figure 2-10a, ref. no. 44) over repair area.

10) Place the longest plate over the repair area and clamp on each end.

11) Laminate other side of blade with desired layers of fiberglass and adhesive.

12) Place nylon release film over repair area.

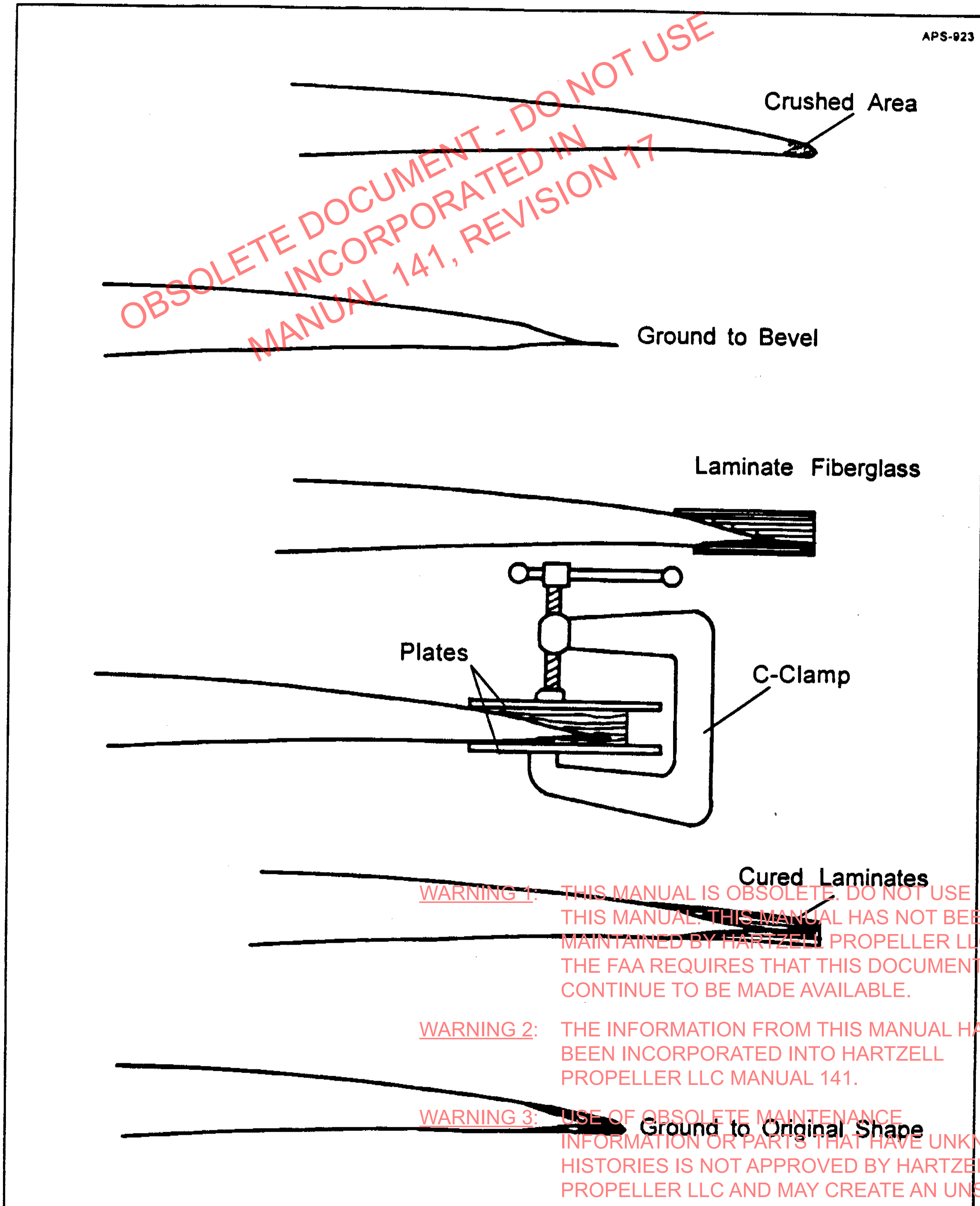
13) Place smallest plate over the repair area and clamp to first plate using moderate pressure.

14) Allow to cure (see Figure 2-10 for cure time).

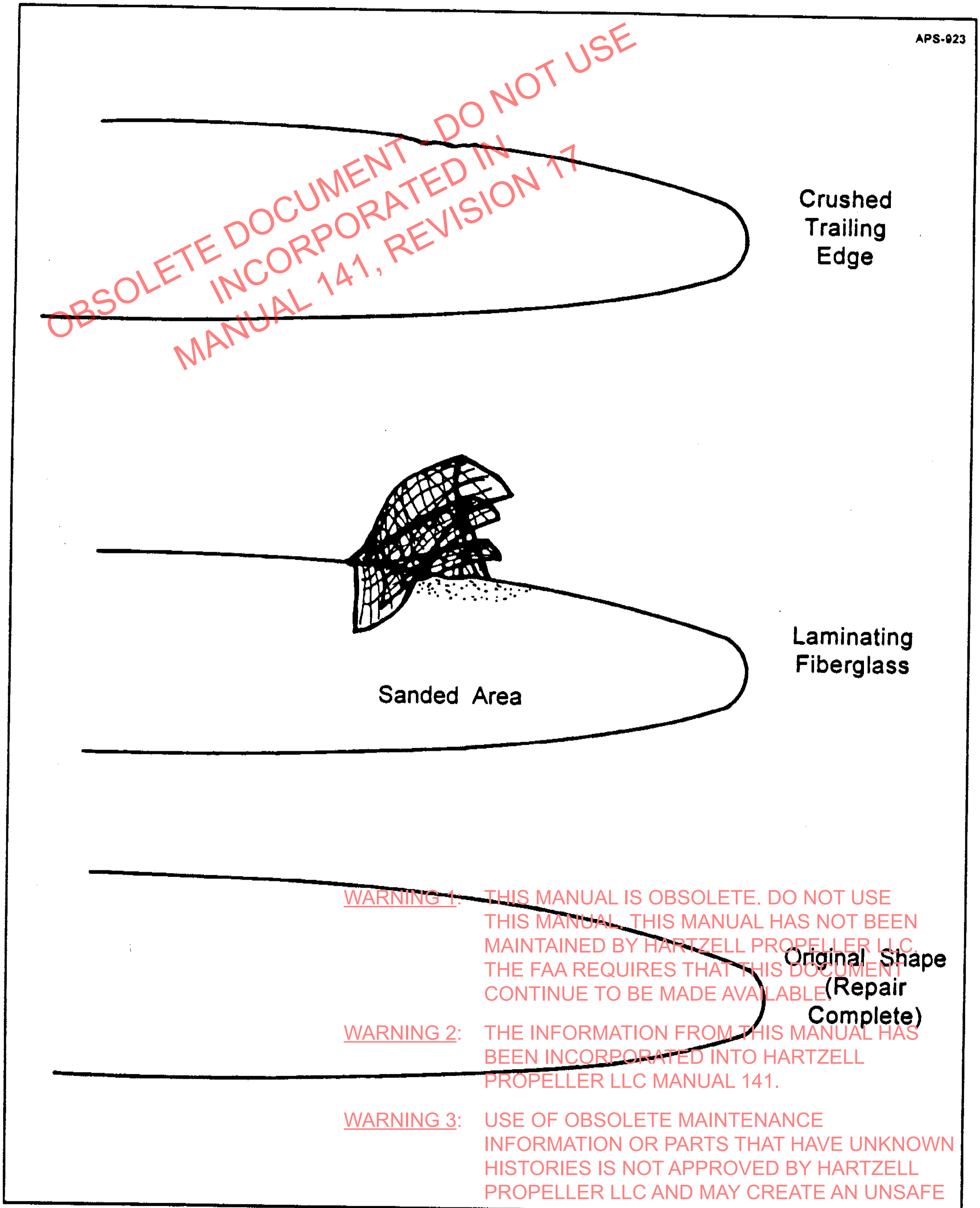
15) Remove plates from blade, grind or sand to original airfoil shape.

16) Inspect repair area. Repair any delaminations or voids.

17) Refinish blade according to Chapter 9.



Crushed Blade Trailing Edge Repair (Cross Section View)
Figure 6-8



Crushed Blade Trailing Edge Repair (Camber Side View)
Figure 6-9

C. Split Trailing Edge

1) This repair may be performed on the outer half of the blade to a split trailing edge or blade tip. There may be no damaged fibers or exposed foam. If these limits are exceeded, the blade must be sent to Hartzell.

2) Using a clean tongue depressor or utility knife (Figure 2-10a, ref. no. 43 or Figure 2-3, ref. no. 9), gently pry apart the split edge and inspect for contaminates.

3) Contaminates can be removed with a small pick or equivalent (Figure 2-10b, ref. no. 57).

4) Mix appropriate amount of adhesive (Figure 2-10, ref. no. 14 or 15). Place adhesive in syringe (Figure 2-10, ref. no. 3) and inject as much adhesive as possible into split, ensuring coverage of entire surfaces.

5) Place nylon release film (Figure 2-10a, ref. no. 44) over repair area.

6) C-clamp plates made of metal, plastic, masonite, etc. (Figure 2-3, ref. no. 12) over repair area, one on face side and one on camber side, using moderate pressure.

7) Allow adhesive to cure (see Figure 2-10 for cure time).

8) Inspect repaired area using debond/delamination inspections in Chapter 4 (coin-tap, shurtronics and impactoscope).

9) Refinish blade according to Chapter 9.

6-6. Blade Retention Windings of M Shank Blades

A. Cracks

1) Using appropriate abrasive (Figure 2-10b, ref. no. 61), lightly sand area of crack to remove paint in area approximately 0.25 inch (6.35 mm) wide over entire length of crack, feathering paint edges.

2) Clean area with approved solvent (Figure 2-10, ref. no. 11) and allow solvent to dry.

3) Apply a bead of sealant (Figure 2-10, ref. no. 8) over the top of the crack, working sealer into crack and blending smoothly onto adjacent feathered paint edges.

4) Allow sealant to cure until tack-free (see Figure 2-10 for cure time).

5) Apply outer paint coating to repair area. Refer to Paragraph 6-8 for refinishing procedure.

6) Inspect repaired area for proper adhesion and coverage.

6-7. Lightning Strike

A. For definition and allowable, see Chapter 3.

B. Follow the applicable damage repair procedures in this chapter.

6-8. Refinishing

NOTE: Specific paint application instructions are located in Chapter 9.

A. This procedure may be performed on an area under 10 inches (25.4 cm) that can be sanded smooth without exposing "fuzzy" Kevlar®, and may be primed with spray sealer (Figure 2-10a, ref. no. 29).

1) Mask off area to be painted (masking procedure in Chapter 9).

2) Spray sealer on repair area.

3) Allow sealer to dry (see Figure 2-10 for drying time).

NOTE: It may be necessary to apply more than one coat of sealer. If so, lightly sand between coats using appropriate abrasive (Figure 2-10b, ref. no. 60).

4) Follow the minor blemish correction procedure in Chapter 9 as necessary.

5) Final sanding of sealer is done using appropriate abrasive (Figure 2-10b, ref. no. 61), feathering areas where masking was done.

6) Apply final paint to repair area and feather.

B. This procedure may be performed on all blades requiring refinishing of more than 10 sq inches (25.4 sq cm).

1) Remove old paint as specified in Chapter 5. Leave at least 6 inches (15.24 cm) of old paint outboard of the counterweight clamp or windings. Feather by sanding from old paint to primer filler layer over a 2 to 3 inch (5.08 to 7.62 cm) length.

2) Apply paint in order specified in Chapter 9.

3) On blades with "P" Static or Lightning Guard, be sure that prior to application of "P" Static or Lightning Guard, the exposed "P" Static or Lightning Guard from the sanding operation is not covered. When applying "P" Static or Lightning Guard, be sure new layer overlaps the old layer.

4) Continue as specified in Chapter 9.

C. This procedure may be performed on an area that has exposed "fuzzy" Kevlar® fibers or porosity.

1) Mask off area to be painted.

2) Roll on primer filler (Figure 2-10a, ref. no. 27).

3) Allow filler to dry (see Chapter 9 for drying time).

4) Sand smooth with appropriate abrasive (Figure 2-10b, ref. no. 60).
5) Spray sealer on repair area.
6) Allow sealer to dry (see Chapter 9 for drying time).

NOTE: It may be necessary to apply more than one coat of sealer. If so, lightly sand between coats using appropriate abrasive (Figure 2-10b, ref. no. 60).

7) Follow the minor blemish correction procedure in Chapter 9 as necessary.
8) Final sanding of sealer is done using appropriate abrasive (Figure 2-10b, ref. no. 61), feathering areas where masking was done.
9) Apply final paint to repair area and feather.

7-1. General

A. All major repairs permitted in the field *must* be performed in a Hartzell Propeller Inc. approved facility with personnel trained and approved by Hartzell for the specific type of major repair involved.

B. Major repairs are to be performed only in a Hartzell approved facility. Exceptions to this policy may be possible but require written authorization from Hartzell.

C. Major repair is correction of damage that cannot be performed by elementary operations. Major repairs must be performed by a propeller shop that has been approved by Hartzell for the specific type of major repair. Propeller shops must meet facility, tools and personnel requirements and may require approval of samples (see paragraph 2-2 through 2-6).

D. Personnel performing major repairs in the field are urged to consult with the factory whenever there is any question regarding major repairs. Most incidents which require major repairs are unique in the location/degree of damage and/or the extent of repair required. Factory assistance is available and, in many cases, essential.

7-2. Nickel Erosion Shield

A. Debond Repair greater than 0.25 inch from trailing edge

CAUTION: BE CAREFUL NOT TO DAMAGE COMPOSITE MATERIAL BENEATH THE NICKEL EROSION SHIELD DURING THE REPAIR OPERATION.

1) This repair may be performed on debonds within the airworthy limits specified in Chapter 3. If damage exceeds these limits, the erosion shield must be replaced.

2) Use a debond test (there are two approved methods in Chapter 4, coin-tap or shurtronics) to outline the area of debond in a metal erosion shield.

3) Drill two 0.125 inch holes, one at each end of the debond.

4) In a contamination-free container (Figure 2-10, ref. no. 5), mix the structural adhesive (Figure 2-10, ref. no. 14) as described on the adhesive can.

5) Puddle a small amount of the adhesive mixture over one hole.

6) Using a vacuum pump (Figure 2-3, ref. no. 1), place the vacuum tube over the other hole.

7) Pull adhesive through with a vacuum until it enters the vacuum tube (Figure 7-1).

8) Lay blade so adhesive does not run out of holes, and allow adhesive to cure (refer to Figure 2-10 for cure time).

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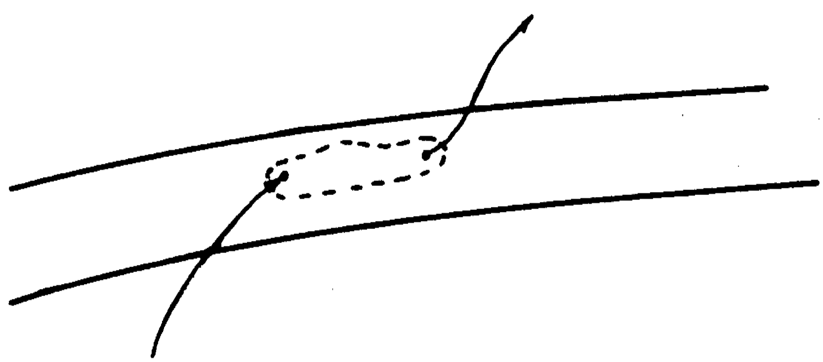

Pulling Adhesive Through Debond
0.25 inches from Trailing Edge
Figure 7-1

9) Sand the area smooth.

10) Visually inspect repaired area for soundness.

11) Refinish following the procedure in Paragraph 6-7.

B. Erosion Shield Replacement

1) Erosion shield replacement is considered a major repair. However, replacement procedures are listed in the overhaul section (Chapter 5). Since all required erosion shield replacement procedures are also required for overhaul, it is recommended that the blade is overhauled whenever erosion shield replacement is required.

7-3. Blade Cuff

A. Depression

1) This procedure may be performed on depressions within the airworthy limits specified in Chapter 3. If these limits are exceeded, the blade must be sent to Hartzell.

2) Remove paint by sanding area with approved abrasive (Figure 2-10b, ref. no. 54), exposing entire area to be repaired.

3) Wash area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass fabric (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

B. Delaminations

1) This repair may be performed on delaminations up to 4 sq. inches (10.16 cm). If this is exceeded, the blade must be sent to Hartzell.

2) With appropriate abrasive (Figure 2-10a, ref. no. 54), remove delaminated materials.

3) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass fabric (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

C. Cracks Where Blade and Cuff Meet

1) This repair may be performed on cracks not exceeding a 2 inch (5.08 cm) area around foam and blade interface. If cracks exceed this area, the blade must be sent to Hartzell.

CAUTION: BE CAREFUL NOT TO REMOVE FOAM OR KEVLAR® BLADE MATERIAL.

2) With appropriate abrasive (Figure 2-10b, ref. no. 54), remove material damaged by crack, feathering into undamaged area 1 inch (2.54 cm) around cracked area.

3) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass fabric (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

D. Cracks Other than Root or Outboard End

1) This repair may be performed on cracks that do not penetrate the Kevlar® surface. If the surface is penetrated, the blade must be sent to Hartzell for evaluation.

CAUTION: BE CAREFUL NOT TO REMOVE FOAM OR KEVLAR® BLADE MATERIAL.

2) With appropriate abrasive (Figure 2-10b, ref. no. 54), remove material damaged by crack, feathering into undamaged area 1 inch (2.54 cm) around cracked area.

3) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass fabric (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

7-4. Blade

A. Gouge

1) This repair may be performed on a gouge in a 6 sq. inch (15.24 cm) area on outboard half of blade, no larger than 0.02 inch (0.508 mm) deep. If damage exceeds this, the blade must be sent to Hartzell for evaluation.

2) Lightly sand affected area with sandpaper (Figure 2-10a, ref. no. 54) to remove any loose material.

3) Clean with approved solvent (Figure 2-10, ref. no. 11).

4) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

5) Laminate enough fiberglass material (Figure 2-10a, ref. no. 42) using adhesive (Figure 2-10, ref. no. 15) to achieve original airfoil shape.

6) Allow adhesive to cure (see Figure 2-10 for cure time).

7) Sand until smooth.

8) Inspect repaired area. Repair any delaminations or voids.

9) Refinish following the procedure in Paragraph 6-8.

B. Delaminations

1) This repair may be performed on a delamination on the outboard half of the blade less than 6 sq. inches (15.24 cm) and 0.02 inch (0.508 mm) deep. If damage exceeds this, the blade must be sent to Hartzell.

   NOTE: A dark brown or black stain in the area of delamination indicates the presence of grease. Once this condition is confirmed to be the result of grease contamination, the blade must be retired as there is no effective repair.

2) Remove delaminated material with approved abrasive (Figure 2-10a, ref. no. 54).

3) Remove one layer of undamaged material 1 inch (2.54 cm) around the perimeter of delaminated area.

4) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

5) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

6) Cut fiberglass fabric (Figure 2-10b, ref. no. 55) to shape of delamination area, matching the fiberglass weave direction with the blade materials weave direction.

7) Cut another piece of fiberglass to shape, only 1 inch (2.54 cm) larger than in step 6) and match weave.

8) In a contamination free container (Figure 2-10, ref. no. 5), mix approved adhesive (Figure 2-10, ref. no. 14).

9) Laminate fiberglass pattern cut in step 6).

10) Laminate fiberglass pattern cut in step 7).

11) Laminate an additional layer of fiberglass (Figure 2-10a, ref. no. 42) to aid in the transition over the entire repair area.

12) Allow adhesive to cure (see Figure 2-10 for cure time).

13) Sand to original shape.

14) Inspect repaired area. Repair any delaminations or voids.

15) Refinish according to Chapter 9.

C. "Crushed" Blade Trailing Edge (Figure 6-8)

NOTE: Some of the blade material even though damaged may be left on the blade. If damaged material has been deprived of resin, yet fully intact, it should be left on the blade. If any layers left on the blade are separated, they must be injected with adhesive (Figure 2-10, ref. no. 14) between layers when the repair is made.

1) This repair may be performed on a crushed blade trailing edge up to 0.6 inches (15.24 mm) deep x 2 inches (5.08 cm) long. If damage exceeds this, the blade must be sent to Hartzell.

2) Remove desired material using a grinder or sander, creating a bevel that extends from the repair area 0.500 to 1.00 inch (12.7 to 25.4 mm), depending on the size of repair.

3) Determine the amount of layers of fiberglass (Figure 2-10b, ref. no. 55) needed to repair blade. Each layer of fiberglass is 0.010 inch (0.254 mm) thick. Then, cut each layer of fiberglass to match the shape of the beveled area to create a stair step pattern when laminating.

4) Prepare vacuum bag (Figure 2-10a, ref. no. 45) long enough to be placed over the blade tip and extend past the repair area. Leave an opening at the tip end of the bag so that a vacuum hose (Figure 2-1, ref. no. 2) can be inserted.

5) Wipe area with approved solvent (Figure 2-10, ref. no. 11).

6) Allow solvent to evaporate (see Figure 2-10 for evaporation time).

7) If applicable, inject adhesive between layers of material left at the repair area.

8) Laminate desired layers of fiberglass with adhesive on one side of blade.

9) Place Teflon bleeder cloth (Figure 2-10b, ref. no. 58) over blade, extending past repaired area.

10) Place polyester absorbent cloth (Figure 2-10b, ref. no. 59) over Teflon bleeder cloth in immediate repair area only.

11) Place a thin flexible plate (Figure 2-3, ref. no. 33) over repair area and secure with tape to avoid waviness.

12) Laminate desired layers of fiberglass with adhesive on one side of blade.

13) Place Teflon bleeder cloth over blade, extend past repaired area.

14) Place polyester absorbent cloth over Teflon bleeder cloth in immediate repair only.

15) Place a thin flexible plate over repair area, and secure with tape to avoid waviness.

16) Place vacuum bag over tip of blade beyond repair area and seal toward inboard side.

17) Insert vacuum tube in opening at tip end of vacuum bag. Place tube close to repair area and seal bag around tube.

18) Maintain 26 to 30 H.I.G. for 12 hours at room temperature.

19) Remove repair components from blade.

20) Inspect repaired area. Repair any delaminations or voids.

21) Refinish blade according to Chapter 9.

References:

Hartzell Specification H-S-2 Installation of De-Icers.
BF Goodrich Report 59-728L or later approved revision.

WARNING: BOOT REMOVAL/INSTALLATION INVOLVES THE USE OF A VARIETY OF SOLVENTS, PAINTS, OR OTHER CHEMICALS WHICH MAY BE HAZARDOUS (FLAMMABLE AND/OR TOXIC). COMPLIANCE WITH MANUFACTURER'S SAFETY PRECAUTIONS AND DISPOSAL REQUIREMENTS ARE ESSENTIAL.

8-1. Removal of Boots

A. External de-icer boots are to be removed and replaced at each overhaul. This is required regardless of the condition of the boot. Boot removal is necessary to provide for adequate inspection and reconditioning of the blade surface beneath the boot.

B. Before removing the boot, make note of the boot part number in order to confirm that the correct replacement boot will be used.

C. If removing boot from assembled propeller, note the boot's dimensional location and location with respect to attaching hardware prior to removal.

D. Prior versions of this manual used solvents to remove de-icer boots. **This procedure is no longer recommended.** The following procedure is preferred.

CAUTION: USE EXTREME CAUTION NOT TO CUT INTO COMPOSITE MATERIAL.

E. Procedure

1) Starting at one end of the boot, carefully use a razor blade scraper to cut the adhesive between the boot and the blade while pulling the boot away from the side of the blade.

2) After boot is removed, use a vibratory sander (Figure 2-3, ref. no. 6) with appropriate (Figure 2-10a, ref. no. 46) abrasive to remove any remaining adhesive, filler or sealer in the boot area.

8-2. Preparation with Blades Installed in Propeller Assembly

A. Refinish area using procedures in Chapter 9.

B. Follow paint cure requirements.

CAUTION: CLEANLINESS IS ESSENTIAL FOR PROPER BOOT ADHESION. ALL SOLVENTS MUST BE FREE OF CONTAMINANTS. BRUSHES AND CLOTHS MUST BE CLEAN AND LINT FREE.

DO NOT TOUCH SURFACES ONCE THEY HAVE BEEN PREPARED.

C. Position new boot in location noted prior to removing old boot. Place boot with centerline on lead edge of blade and mark outer edge with grease pencil.

D. Mask off area 1 inch (2.54 cm) outside of pencil line (Figure 8-2).

E. Clean area to be booted with approved solvent (Figure 2-10, no. 11), (other solvents may adversely affect polane coatings.) If paint has a high gloss, *very* light sanding with approved abrasive (Figure 2-10b, ref. no. 61) is desirable prior to cleaning. Wipe dry with clean, lint-free cloth.

8-3. Preparation with Blades Removed from Propeller Assembly

CAUTION: CLEANLINESS IS ESSENTIAL FOR PROPER BOOT ADHESION. ALL SOLVENTS MUST BE FREE OF CONTAMINANTS. BRUSHES AND CLOTHS MUST BE CLEAN AND LINT FREE. DO NOT TOUCH SURFACES ONCE THEY HAVE BEEN PREPARED.

NOTE: Polane paint should be allowed to cure (Paragraph 9-7) before boot installation.

A. Position new boot with "A" dimension chart shown in Figure 8-1. Also mark location on strap or terminal connector on blade. Place boot with centerline on lead edge of blade and mark outer edge with grease pencil.

B. Mask off area 1 inch (2.54 cm) outside of pencil line (Figure 8-2).

C. Clean area to be booted with approved solvent (Figure 2-10, no. 11), (other solvents may adversely affect polane coatings.) If paint has a high gloss, *very* light sanding with approved abrasive (Figure 2-10b, ref. no. 61) is desirable prior to cleaning. Wipe dry with clean, lint-free cloth.

8-4. Cement Application

A. Mark centerline on glazed side of de-icer (for later alignment on blade leading edge).

B. Moisten a clean cloth with approved solvent (Figure 2-10, no. 13). Clean unglazed (back) surface of the de-icer and strap. Change side of cloth frequently.

C. Allow solvent to evaporate (see Figure 2-10 for evaporation time).

D. Mix approved adhesive (Figure 2-10, ref. no. 10) thoroughly and brush on one even coat on de-icer and 1.5 inches (3.81 cm) on strap. Brush on one even coat on area of blade to be booted.

E. Allow to cure (see Figure 2-10 for cure time).

F. Apply a second coat of cement evenly on de-icer and blade. Let dry until cemented surfaces reach the tacky stage.

NOTE: Use of Bostic cement as described in BF Goodrich manual #59-728L is acceptable.

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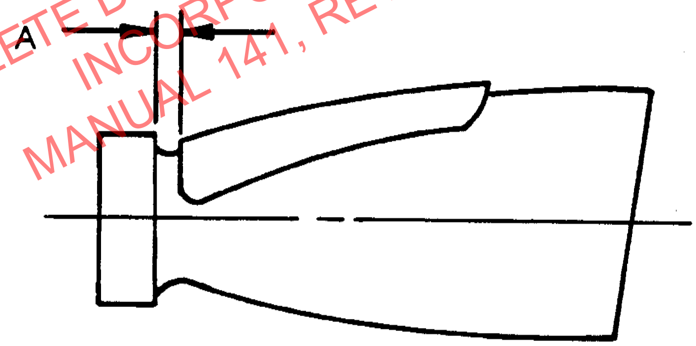
CAUTION: EACH DE-ICER BOOT ON A SINGLE PROPELLER ASSEMBLY MUST BE LOCATED THE SAME DISTANCE FROM THE HUB FOR ROTATIONAL BALANCE.



Composite Blade Model Number	Boot P/N	Dimension A ± .0625-inch	Resistance Ohms
B7421K	4E2200-3	2.648 (6.73 cm)	4.67 - 5.17
M10083K	4E2336-12	1.312 (3.33 cm)	3.06 - 3.38
A10460(E)K (external)	4E2890-07	adjacent outboard edge of cwt clamp	1.54 - 1.65
LM10585(A)B+4	4E2336-10	apply to fit	3.42 - 3.65
LM10585ANK+4	4E2336-12	2.1875 (5.56 cm)	3.06 - 3.38
M10877K	4E2560-10	1.6875 (4.29 cm)	3.26 - 3.60
E10950K	4E3017	bottom edge of de-icer against top edge of cwt clamp	2.683 - 2.966
E11990K	4E2839-1	2.75 from outer winding (6.99 cm)	19.38 - 21.53

De-Icer Boot Location on Composite Blade
Figure 8-1

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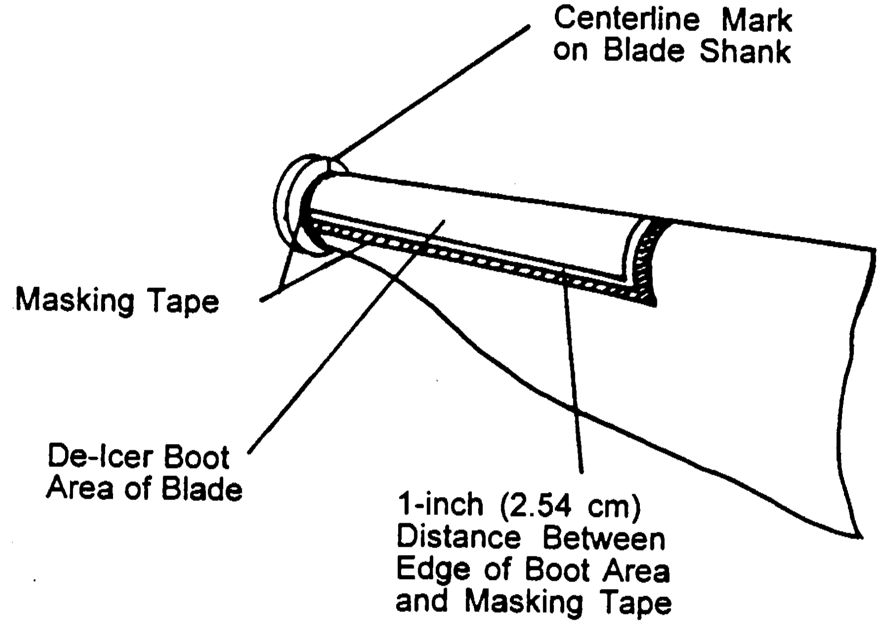

Masking Off De-Icer Boot Location on Blade
Figure 8-2

8-5. Boot Installation (Figure 8-3)

A. Rolling De-Icer Boot onto Blade

1) Starting at the shank end, place de-icer on end mark and align centerline with blade leading edge.

2) Working outward toward the tip, tack the de-icer centerline to the leading edge of the blade.

   a) If de-icer becomes misaligned, pull up with a quick motion and reapply de-icer.

   b) If adhesive is removed from either surface, completely remove de-icer and reapply.

   c) If adhesive becomes too dry, apply a *very light* coat of additional adhesive to area. Let this become tacky and roll boot down.

3) When correctly positioned, roll firmly along the centerline with a rubber roller.

   NOTE: Make sure no air is trapped under the boot.

4) Use a forefinger to work out any "puckers" or waves in the boot material along the side edges. **Such waves are not acceptable.**

5) Use an edge of a nylon roller (Figure 2-3, ref. no. 11) to firmly roll down the tapered side and outboard edges of the de-icer boot.

   NOTE: A *metal* roller is usable as long as it is used within 0.1875 inch (4.763 mm) from any edge, i.e. the roller does not contact (and possibly damage) any portion of the heating element.

B. Inspection of De-Icer Boot Installation

1) When the de-icer boot installation has dried, use a thumb to check around the entire edge of the boot and make sure it adheres tightly to the blade surface.

2) Apply the approved adhesive mixture (Figure 2-10, ref. no 10) to any areas which are not tightly cemented.

3) Re-check the "A" dimension (Figure 8-2) to make sure the de-icer boot edge is correct distance from shank of blade.

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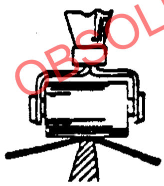
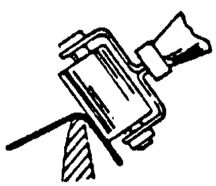
Apply adhesive mixture to blade surface and de-icer surface, allow to dry, apply second coat



Allow adhesive to become "tacky" dry

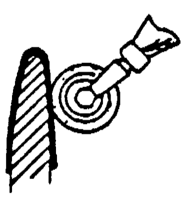
Starting at shank end of blade, tack de-icer boot to blade along pre-established centerline

Use rubber roller along centerline of correctly positioned de-icer boot to press it firmly against leading edge of blade



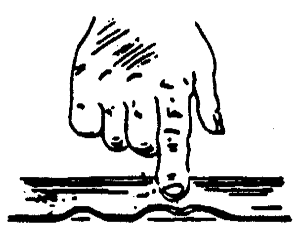
Gradually tilt the rubber roller, and carefully work the de-icer boot over each side of the leading edge contour

CAUTION: WORK OUT ANY EXCESS MATERIAL AT OUTBOARD EDGES OF BOOT BEFORE ROLLING FIRMLY DOWN SIDE OF BOOT



Roll firmly outward from centerline to side edges

Use finger to work out any puckers in boot material along side edges



Use edge of rubber roller to firmly roll down tapered side and outboard edges of boot

CAUTION: AREA AROUND LEAD STRAP AND FILLER MUST BE THOROUGHLY SEALED

Procedure for Rolling De-Icer Boot onto Blade
Figure 8-3

8-6. Filler Application

NOTE: Filler is used only on boots with a strap 3 inches (7.62 cm) or longer.

NOTE: Boot adhesive should be allowed to cure prior to application of filler, otherwise filler tends to soften or dissolve the adhesive.

A. Apply an even coat of the filler (Figure 2-10, ref. no. 8 or other approved filler) around the inboard edge of the de-icer boot, the lead strap (or wire), and beneath strap where glue ends (Figure 8-4).

B. An even coat of filler around the side edges and the outboard edges of the boot is permitted (optional). The height of the filler should be the same as the height of the de-icer boot surface.

NOTE: Many early boot designs had a thick edge. These boots normally used a filler between the boot edge and blade. Most later boot designs have a tapered edge and do not require a filler on the edges.

NOTE: Complete curing of filler is not required prior to sealant application.

8-7. Paint Sealer Application

A. Mask the blade and boot so that when sealer is applied, it will cover (minimum overlap):

1) all areas of exposed cement

2) 0.125 inch (3.18 mm) of the blade surface beyond the cemented area

3) 0.125 inch (3.18 mm) beyond all filled areas

4) 0.250 inch (6.35 mm) of the de-icer boot edges

B. Wash Primer (Mix #3) Application (Chapter 9)

C. Prepare Paint Sealer (black polane paint, mix #5, in Chapter 9).

D. Apply one even coat of the paint sealer to the area around the de-icer boot.

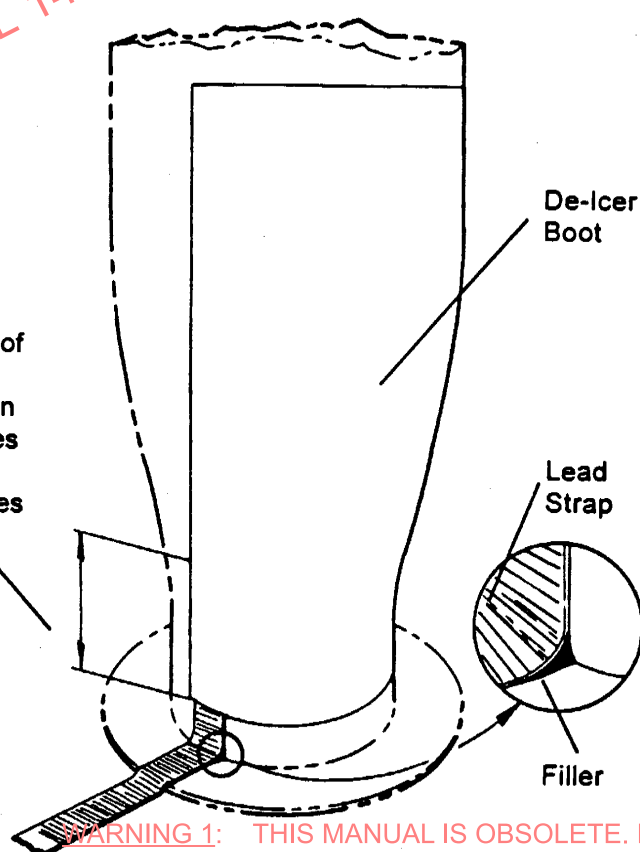
E. Remove all masking tape immediately, and allow to cure.

8-8. Paint Instructions

NOTE: Refer to Chapter 9 for specific instructions.

A. De-icer boots are covered with (specified color) polane black (Mix #5).

B. Overlap paint around edges of boot by 0.5 inch (1.27 cm) up to 1.5 inches (3.81 cm) in to ensure that excess boot adhesive on blade is covered for a neat appearance.



TYPICAL STANDARD-TYPE PROPELLER

De-Icer Boot Filler Application
Figure 8-4

8-9. Inspection Procedures

A. Inspect the edge of the de-icer with thumb to see if de-icer is cemented tightly. If de-icer is not tight, re-cement these areas. If not previously accomplished, verify correct distance from shank to de-icer edge.

B. After assembly of propeller or prior to ship out of blade, perform an electrical resistance check (see BF Goodrich, or other boot manufacturer's, requirements).

C. The following cure times are recommended:

1) 12 hours before starting the aircraft engine.

2) 24 hours before operating the de-icer system.

WARNING: THE INGREDIENTS OF FINISH MATERIALS ARE FLAMMABLE. KEEP THEM AWAY FROM HEAT AND FLAME. USE THEM ONLY WHERE THERE IS ADEQUATE VENTILATION. AVOID BREATHING VAPORS AND SPRAY MISTS. AVOID CONTACT WITH SKIN AND EYES. DO NOT TRANSFER INGREDIENTS TO OTHER CONTAINERS FOR STORAGE.

NOTE: See Figure 2-12 for approved finish ingredients, flashpoints and shelf life.

9-1. Special Instructions and Recommendations

CAUTION: DO NOT FASTEN AN AIRTIGHT PLASTIC BAG OVER A BLADE WITH UNCURED PAINT, BECAUSE THIS WILL RETARD THE PAINT CURING PROCESS.

A. All mixtures are measured by volume only.

B. Various volumes of paint and primers can be mixed, however the ratio of components must be kept constant.

C. When pouring mixture into paint cup, pour through a paint filter.

D. Test each batch of paint on a sample (perhaps a flat piece of cardboard) for thickness to assure consistency of coatings. Spray the flat sample in the same manner as the blade to be painted, check the wet thickness and make any adjustments in speed of movements to obtain the required thickness.

E. Measuring Film Thickness

NOTE: Use Sherwin-Williams wet film/mil gauge standard.

1) Gently place the mil gauge into wet finish coating.

2) Carefully pull the gauge toward you with a slight motion just sufficient enough to gauge the thickness of the wet finish coating.

3) 5 mil wet coat = 2 mils dry coat

F. Application environment - Temperature 50° - 100° F (10° C - 38° C). (Do not apply below 50° F as this could cause improper curing.) The higher the relative humidity, the faster the polane paint will cure, as moisture causes the catalyst to react (cure).

G. Primer Filler (Mix #1) and Primer Sealer (Mix #2) may be heat cured in an oven at 140° F ±10° (60° C ±5.6°). Typically one hour is sufficient to allow further processing.

9-2. Primer Filler (Mix #1)

A. Mixture Proportion

1) Option A

13 parts D-61-A-23 spray fil

1 part V66V27 catalyst

2) Option B

6 parts D-61-H-75 spray fil

1 part V-66-V-44 catalyst

$^1/_3$ part R7K84 reducer

B. Recommended Film Thickness

1) Option A

a) six (6) mils wet per coat

b) three (3) mils dry per coat

2) Option B

a) three (3) to five (5) mils wet per coat

b) two (2) to three (3) mils dry per coat

C. Drying Schedule

Allow three (3) to four (4) hours drying time at room temperature (65° F to 77° F / 18° C to 25° C) for the first coat of primer.

D. Application

1) Prepare filler according to mixture proportions.

2) Roll a light coat of filler onto the entire blade surface.

NOTE: The primary purpose of this coat is to fill small depressions and gouges in the blade surface.

3) Allow to dry.

4) Use a vibratory sander and approved abrasive (Figure 2-10b, ref. no. 60) to lightly sand the entire surface area to a minimum thickness of primer. It is desirable to remove as much primer as possible.

9-3. Primer Sealer (Mix #2)

A. Mixture Proportion

13 parts E65-A-4 polane primer sealer

1 part V66V29 catalyst

*R7K69 reducer as needed to spray

*V66VB11 accelerator as needed

B. Recommended Film Thickness

Approximately two (2) coats measures two (2) mils dry.

C. Drying Schedule

Dry at least one hour.

D. Application

1) Prepare primer sealer according to mixture proportions.

2) Spray one coat of primer sealer over blade.

3) Allow to dry.

4) If any pronounced Kevlar® fibers are present, soak a clean cheese cloth with the approved solvent (Figure 2-10, ref. no. 11) and wipe the blade for smoothness.

5) Use a vibratory sander with appropriate abrasive (Figure 2-10b, ref. no. 60) to lightly dry sand the entire blade surface.

6) Add accelerator to the primer sealer mixture, and spray a light second coat over the entire blade. As necessary, thin the mixture with reducer.

7) Allow to dry.

8) Hand sand the blade surface with appropriate abrasive (Figure 2-10b, ref. no. 61) until it has the desired finish and the primer sealer is no thicker than 4 mils.

9) Inspect the finish of the blade for smoothness.

9-4. Wash Primer (Mix #3)

A. Mixture Proportion

4 parts MIL-C-8514 wash primer

4 parts T-54 reducer

1 part 120AC05 acid diluent

(let stand thirty minutes before using)

B. Drying Schedule

Allow approximately five (5) minutes to dry.

C. Application

CAUTION: WHEN APPLICABLE, APPLY "P" STATIC OR LIGHTNING GUARD PAINT TO THE BLADE SURFACE BEFORE APPLYING WASH PRIMER TO THE METAL EROSION SHIELD.

1) Prepare wash primer according to mixture proportion.
2) Spray one (1) light coat of the wash primer mixture on the sides of the metal erosion shield which are to be painted. Slight overspray on the blade is not detrimental.
3) Allow to dry.
4) Wipe area with solvent (Figure 2-10, ref. no. 11) dampened lint-free cloth.

9-5. "P" Static (Mix #7)

A. Mixture Proportion

1 part 528-J-104 anti-static

1 part 910-J-119 curing agent

(Let stand one hour before using)

B. Recommended Film Thickness

Measures approximately one (1) mil thick dry.

C. Drying Schedule

Allow one (1) hour to dry.

D. Application

1) Prepare "P" Static according to mixture proportion.
2) Spray a light coat over the entire blade surface.
3) Allow to dry.

9-6. Lightning Guard (Mix #9)

A. Mixture Proportion

1 part 599SA-A8574-1 part A

8 parts 599SA-A8574-1 part B

8 parts toluol

B. Recommended Film Thickness

Measures approximately one (1) mil dry.

C. Drying Schedule

Allow one (1) hour to dry.

D. Application

1) Prepare lightning guard according to mixture proportion.

CAUTION: APPLY LIGHTNING GUARD PAINT ONLY WITH AN AIR-PRESSURE FEED SPRAY SYSTEM. AN AGITATION SYSTEM IS REQUIRED TO KEEP THE COPPER SUSPENDED IN THE SOLUTION.

2) Spray one (1) coat over the entire blade surface.

3) Allow to dry.

9-7. Polane Paint (specified color and blade tips)

A. Mixture Proportion

NOTE: For polane paint, use the specified color for blade, or white for the stripes.

6 parts polane paint (listed below)

Polane Gray Z99AB-503 (Mix #4)

Polane Metallic Gray Z98-1973 (Mix #8)

Polane Black Z99BB-510 (Mix #5)

Polane White Z99WB-612 (Mix #6)

1 part V66V29 catalyst

3 parts R7K69 reducer

*V66VB11 accelerator as needed

B. Recommended Film Thickness

Measures approximately two (2) to four (4) mils dry.

C. Drying Schedule

1) Maximum recommended time between coats for adequate layer to layer adhesion for paint coats - 7 days.

2) Repainting after 7 days requires that the surface be sanded (roughed slightly) before painting.

3) Curing time for maximum abrasion resistance and impact strength - 7 days.

D. Pot Life

1) For polane paint mixtures - eight (8) hours at 77° F (25° C).

2) For polane paint mixtures with accelerator added - approximately four (4) hours, depending on amount of accelerator used.

E. Application

See specific process for blade model.

9-8. Specific Finish Procedures for All Hartzell Composite Blades

A. Masking of Blade Shank Area

1) Wipe blade shank area with approved solvent (Figure 2-10, ref. no. 11).

2) Mask area according to specification. Options are shown in Figure 9-1.

B. Minor Blemish Correction

WARNING: BE SURE TO WEAR RUBBER GLOVES (FIGURE 2-10, REF. NO. 6) FOR THIS PROCEDURE.

1) Apply a small amount of adhesive (Figure 2-10b, ref. no. 71) to blemish area (pitting, pin-holes, etc.).

2) Quickly wipe off excess and immediately apply small amount of talc (Figure 2-10b, ref. no. 72).

3) Allow to dry.

4) Sand area smooth using an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65).

5) Wipe blade with approved solvent (Figure 2-10a, ref. no. 22).

6) Repeat procedure as necessary to assure smoothness.

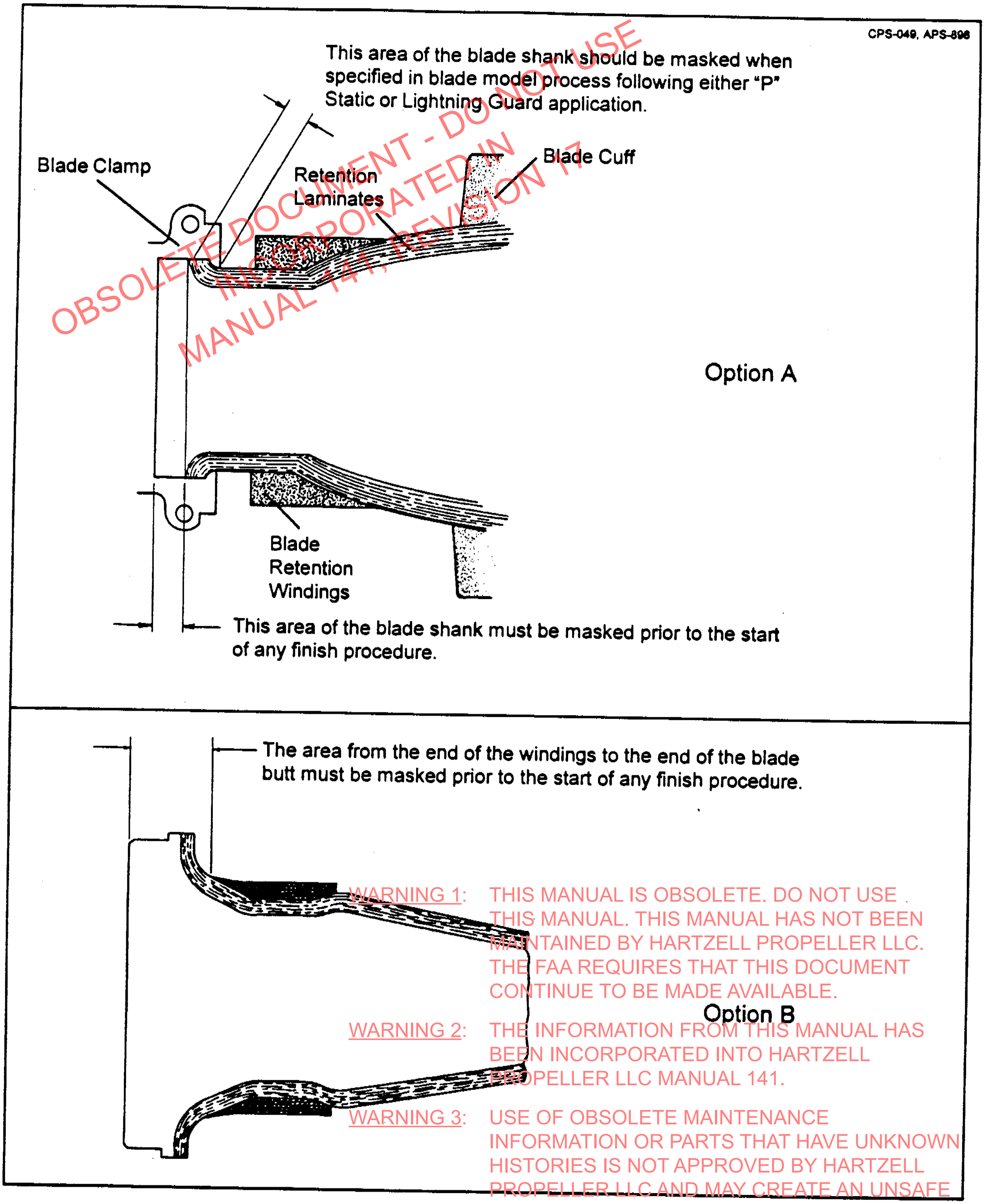
C. Placement of Ink Stamp

Stamp the following with specified opaque ink on camber side of blade. Center of stamp should be between lead and trail a specified distance from blade butt. If blade has de-icer boot, stamping should be centered between rear most edge of boot and trail edge.

DESIGN NO. ______________

SERIAL NO. ______________

HARTZELL - PIQUA, OH



Masking Options for Composite Blade Shank
Figure 9-1

D. Placement of Decals

1) Center of oval-shaped Hartzell blade decal should be centered between lead and trail a specified distance from blade butt. If blade has de-icer boot, decal should be centered between rear most edge of boot and trail edge.

2) Yellow station decals are placed on blade after propeller has been assembled.

3) Other decals are placed to the right of the stamp, one above the other, on one blade of the set.

E. Acrylic/Lacquer Spray Application

Spray a coating of the approved clear acrylic (Figure 2-10b, ref. no. 62) or lacquer (Figure 2-10b, ref. no. 73) over the ink stamping and decals.

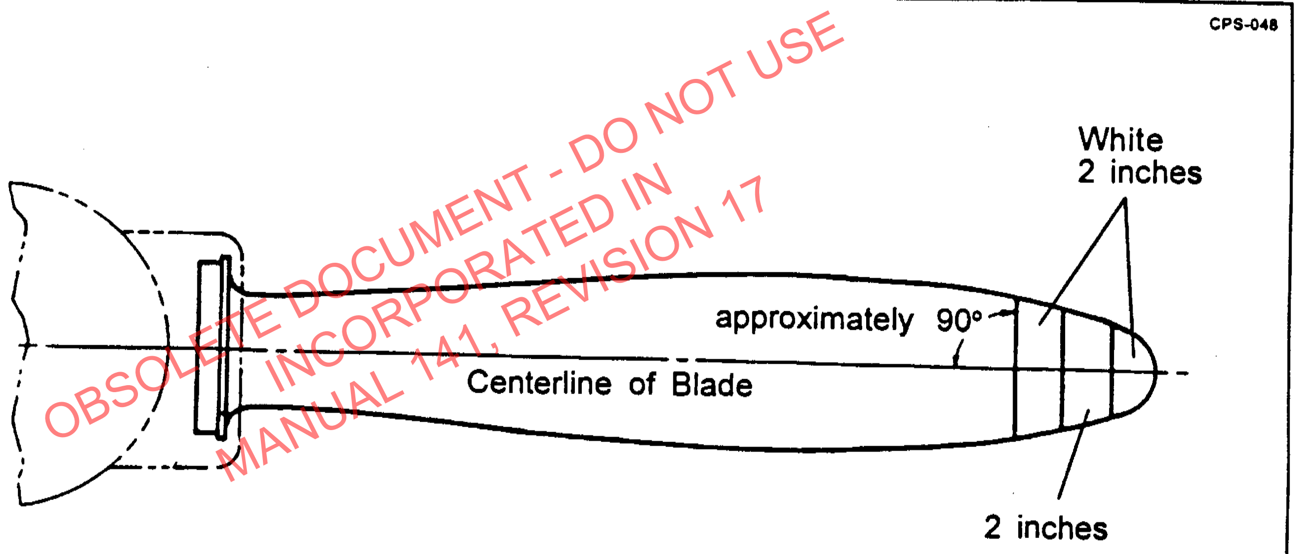
F. Striping (Figure 9-2)

1) Mask the tip of the blade for either straight or curved striping on one or both sides according to requirements.

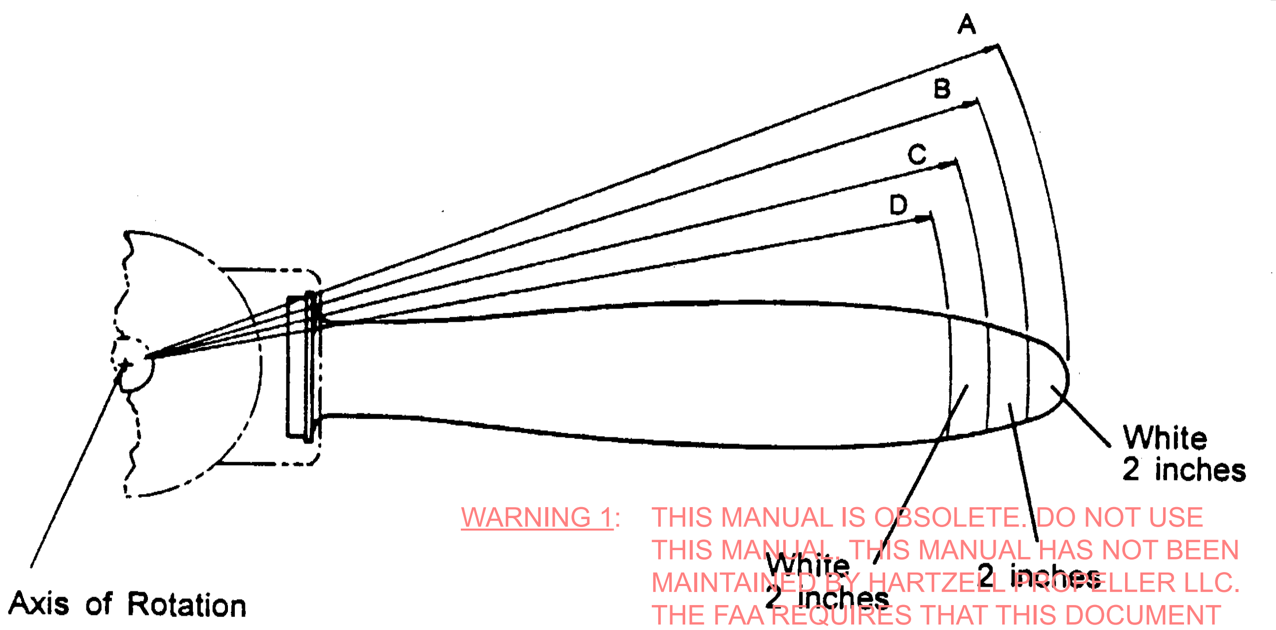
2) Prepare polane white paint (Mix #6).

3) Spray one light coat and follow with a second light coat to assure full coverage.

4) Remove all masking.



OPTION A - Straight Stripes



A - Propeller Radius
B - Radius minus 2 inches
C - Radius minus 4 inches
D - Radius minus 6 inches

Metric Equivalency

2 in.	=	5.08 cm
4 in.	=	10.16 cm
6 in.	=	15.24 cm

OPTION B - Curved Stripes

Striping Options for Composite Blade Tip
Figure 9-2

F. **Process for Blade Model B7421K (Figure 9-3)**

NOTE: Do not get paint on delrin seal ring or windings.

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
2) Mask blade shank area, option B.
3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.
4) Primer Filler (Mix #1) Application
5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)
6) Primer Sealer (Mix #2) Application
7) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
8) "P" Static (Mix #7) Application
9) Primer Sealer (Mix #2) Application
   a) Do not remove tape from lead edge or shank area.
   b) Allow to dry for one (1) hour.
10) Remove the masking from the erosion shield. Using an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.
11) Wipe entire blade with approved solvent (Figure 2-10, ref. no. 22).
12) Use fine line tape (Figure 2-10b, ref. no. 66) to mask along the trailing edge and centerline of the erosion shield. Fill between the 1/4 inch tape with masking tape. Mask only the camber side to within 1/2 inch (12.7 mm) of outboard edge of where de-icer boot will be installed.
13) Wash Primer (Mix #3) Application (to exposed leading edge only)
14) Prepare (specified color) polane gray paint (Mix #4).
    a) Spray one light coat over entire blade surface.
    b) Repeat with a second coat to assure full coverage.
    c) Allow to dry for one (1) hour.
15) Mask along the leading and trailing edge of camber side to eliminate overspray when painting face.
16) Prepare (specified color) polane black paint (Mix #5).
    a) Spray one coat over the face side of the blade surface.
    b) Repeat with a second coat to assure full coverage.
    c) Allow to dry for (1) hour.

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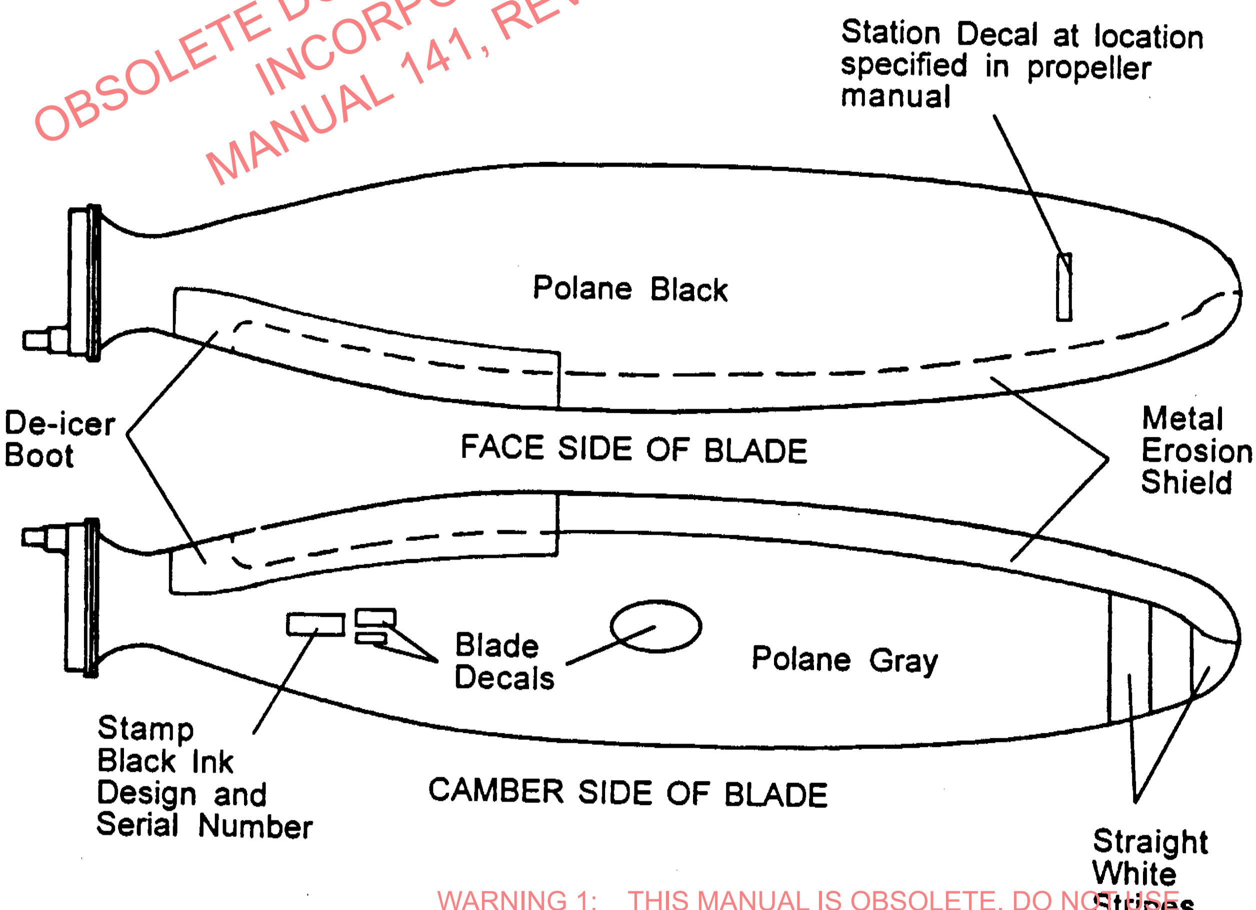


NOTE: Erosion shield is partially painted on camber side and completely painted on face side.

Final Finish for Composite Blade
Model B7421K
Figure 9-3

17) Striping Procedures, option A.

NOTE: Stripes go on the camber side only.

18) Ink Stamp Procedure (use black ink, Figure 2-10b, ref. no. 70)

NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.

19) Decals Application

NOTE: Oval Hartzell decal should be placed 17 inches (58.42 cm) from blade butt.

20) Acrylic/Lacquer Spray Application

G. Process for Blade Model B7466 (Figure 9-4)

NOTE: Do not get paint on delrin seal ring or windings.

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

2) Mask blade shank area, option B.

3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.

4) Primer Filler (Mix #1) Application

5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)

6) Primer Sealer (Mix #2) Application

7) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

8) "P" Static (Mix #7) Application

9) Primer Sealer (Mix #2) Application

a) Do not remove tape from lead edge or shank area.

b) Allow to dry for one (1) hour.

10) Remove the masking from the erosion shield. Using an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.

11) Wipe entire blade with approved solvent (Figure 2-10, ref. no. 22).

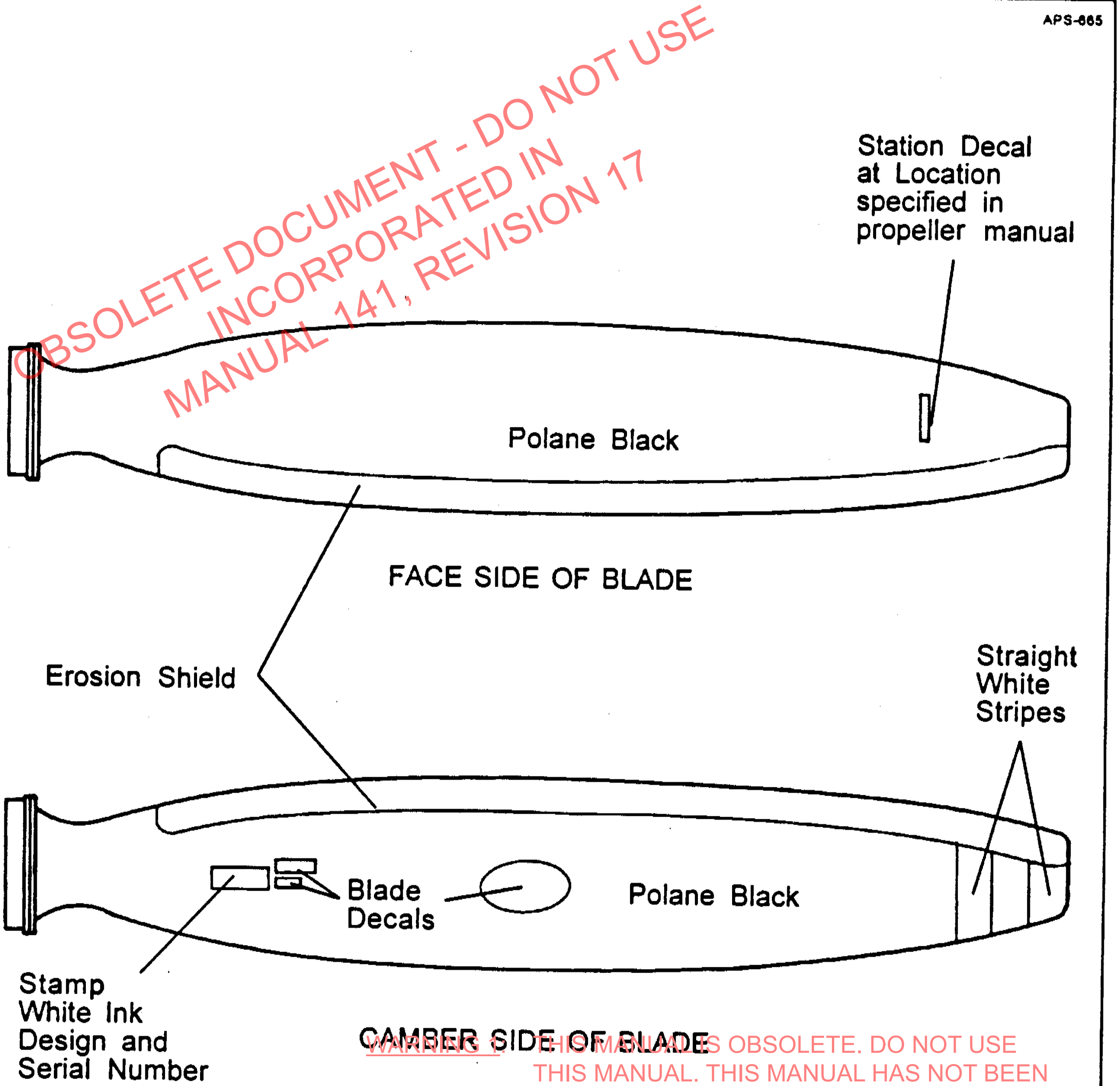
12) Use fine-line tape (Figure 2-10b, ref. no. 66) to mask along the trailing edge and centerline of the erosion shield. Fill between the 1/4 inch tape with masking tape. Mask both the face and camber sides.

13) Prepare (specified color) polane black paint (Mix #5).

a) Spray one coat over the entire blade surface.

b) Repeat with a second coat to assure full coverage.

c) Allow to dry for (1) hour.



NOTE: Erosion shield is not painted on either side.

Final Finish for Composite Blade
Model B7468
Figure 9-4

14) Striping Procedure, option A.

NOTE: Stripes go on the camber side only and do not cover erosion shield.

15) Ink Stamp Procedure (use white ink, Figure 2-10b, ref. no. 69)

NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.

16) Decals Application

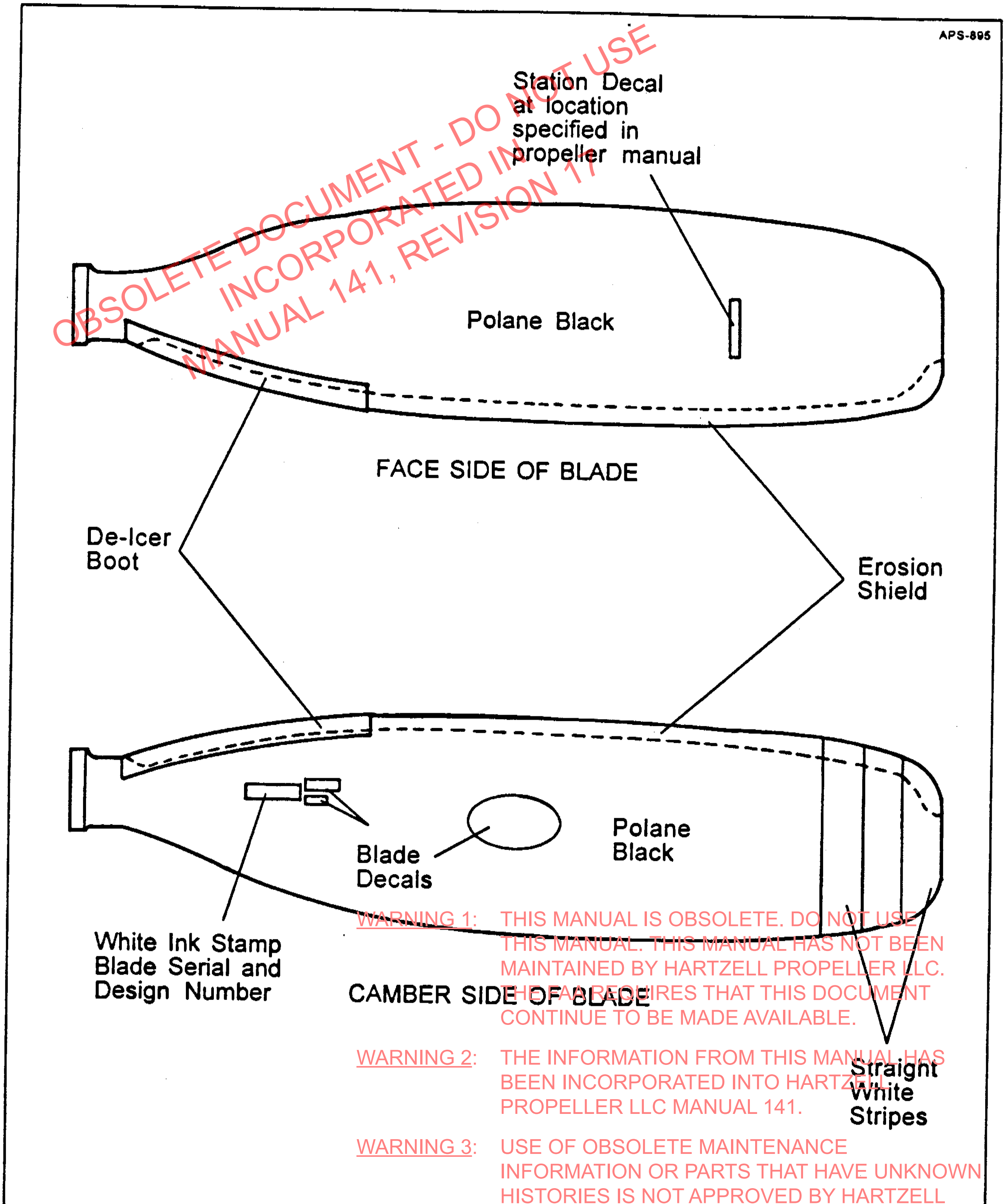
NOTE: Oval Hartzell decal should be placed 17 inches (43.18 cm) from blade butt.

17) Acrylic/Lacquer Spray Application

H. **Process for Blade Model M10083K (Figure 9-5)**

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
2) Mask blade shank area, option A.
3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.
4) Primer Filler (Mix #1) Application
5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)
6) Primer Sealer (Mix #2) Application
7) Wipe entire blade with approved solvent (Figure 2-10, ref. no. 22).
8) Lightning Guard (Mix #9) Application
9) Remove the masking from the erosion shield. Using an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.
10) Lightly hand sand entire blade with appropriate abrasive (Figure 2-10b, ref. no. 61).
11) Lightly wipe off blade with clean cloth.
12) Mask blade shank area, option A.
13) Wash Primer (Mix #3) Application (to exposed leading edge only)
14) Primer Sealer (Mix #2) Application
15) Prepare (specified color) polane black paint (Mix #5).
    a) Spray one coat over the entire blade surface.
    b) Repeat with a second light coat to assure full coverage.
    c) Allow to dry for one (1) hour.
16) Striping Procedure, option A.

NOTE: Stripes go on the camber side only.



Final Finish for Composite Blade
Model M10083K
Figure 9-5

17) Ink Stamp Procedure (use white ink, Figure 2-10b, ref. no. 69).

NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.

18) Decals Application

NOTE: Oval Hartzell decal should be placed 21.5 inches (54.61 cm) from blade butt.

19) Acrylic/Lacquer Spray Application

I. Process for Blade Model A10460( ) (Figure 9-6)

NOTE: Do not get paint on delrin seal ring or windings.

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

2) Mask blade shank area, option B.

3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.

4) Primer Filler (Mix #1) Application

5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)

6) Primer Sealer (Mix #2) Application

7) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

NOTE: For blades with external boots, do not mask area of erosion shield to be booted and apply wash primer (Mix #3).

8) "P" Static (Mix #7) Application

9) Primer Sealer (Mix #2) Application

a) Do not remove tape from lead edge or shank area.

b) Allow to dry for one (1) hour.

10) Remove all masking from the leading edge. Using an air oscillating rotary sander with approved abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.

11) Wipe entire blade with approved solvent (Figure 2-10, ref. no. 22).

12) Use fine-line tape (Figure 2-10b, ref. no. 66) to mask along the edges of erosion shield. Fill between the 1/4 inch tape with masking tape.

NOTE: For blades with external boots, do not mask area of erosion shield to be booted.

13) Prepare (specified color) polane black paint (Mix #5).

a) Spray one coat over the entire blade surface.

b) Repeat with a second coat to assure full coverage.

c) Allow to dry for one (1) hour.

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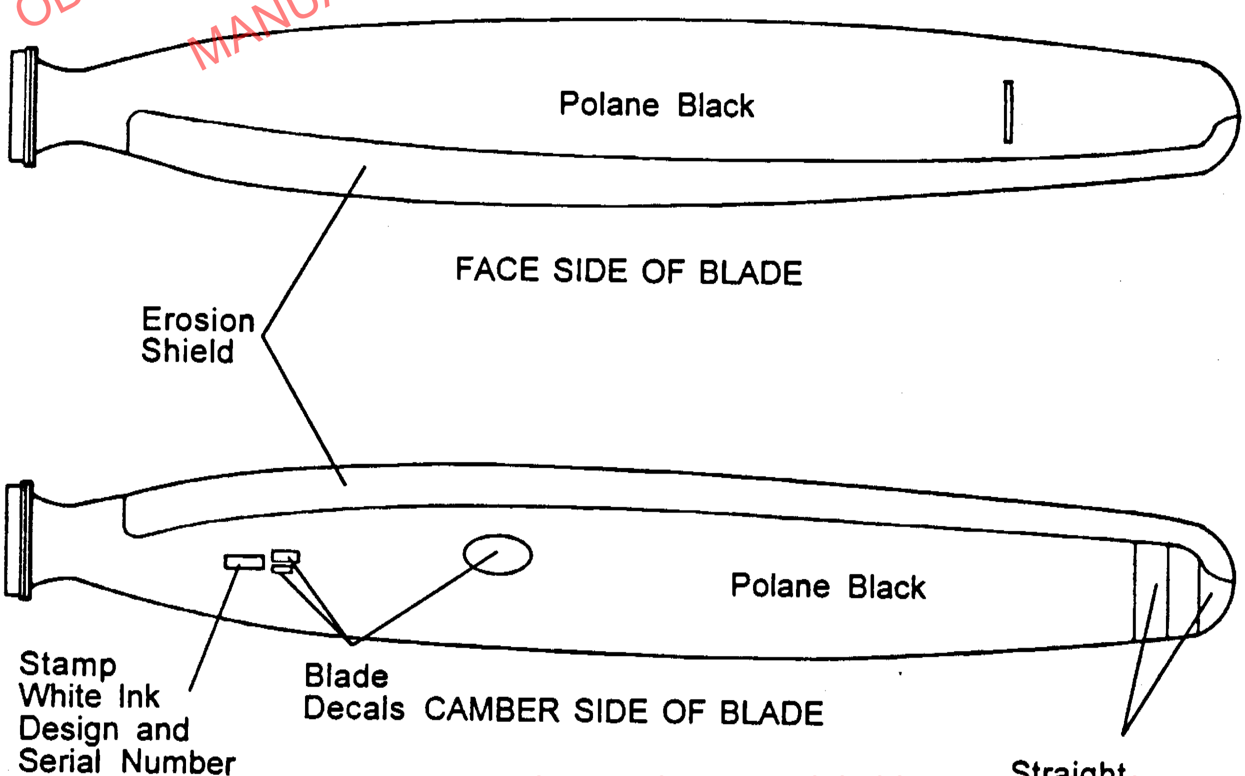


NOTE: Erosion shield is not painted on blades with an internal heating element. For those with an external boot, the area of the erosion to be booted should be painted.

Final Finish for Composite Blade
Model A10460
Figure 9-6

14) Striping Procedure, option A.

NOTE: Stripes go on the camber side only.

15) Ink Stamp Procedure (use white ink, Figure 2-10b, ref. no. 69)

NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.

16) Decals Application

NOTE: Oval Hartzell decal should be placed 21.5 inches (58.42 cm) from blade butt.

17) Acrylic/Lacquer Spray Application

J. **Process for Blade Model LM10585ANK+4 (Figure 9-7)**

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

2) Mask blade shank area, option A.

3) Primer Filler (Mix #1) Application

4) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)

5) Primer Sealer (Mix #2) Application

6) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

7) Using an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.

8) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

9) Wash Primer (Mix #3) Application (to exposed leading edge only)

10) Prepare (specified color) polane gray paint (Mix #4).

a) Spray three (3) light coats over the entire blade surface.

b) Allow paint to dry completely.

11) Mask the blade plug shank and the inboard area of gray as shown in Figure 9-7.

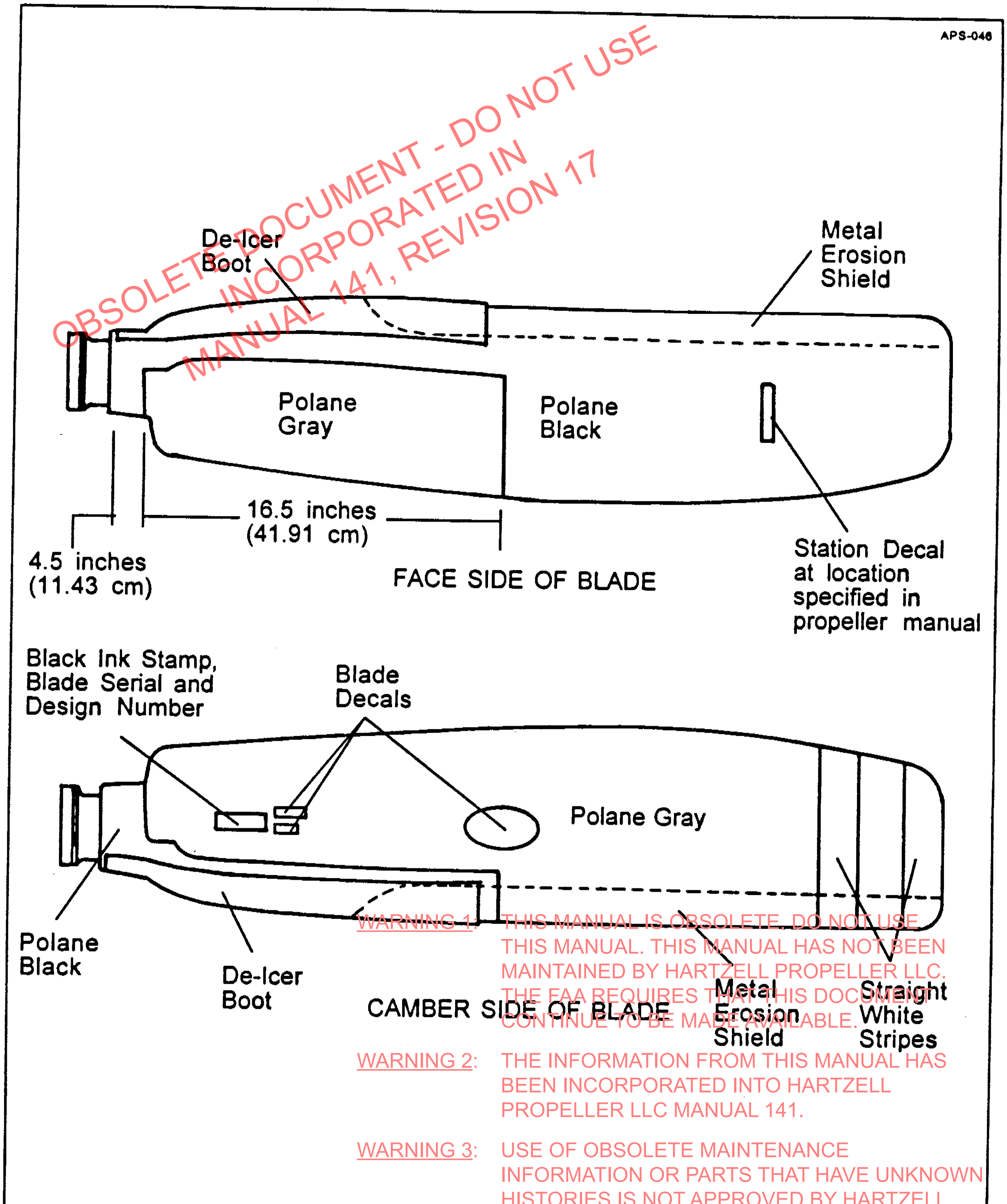
NOTE: The masked area of gray starts 4.5 inches (11.43 cm) from the shank end of the aluminum blade plug and extends outboard 16.5 inches (41.91 cm).

12) Prepare (specified color) black polane paint (Mix #5).

a) Spray one coat over the entire face side of the blade.

b) Spray one coat over the entire circular area of the composite material inboard of the blade cuff.

c) Allow paint to dry completely.



Final Finish for Composite Blade
Model LM10585ANK+4 (CASA)
Figure 9-7

13) Striping Procedure, option A.

NOTE: Stripes go on the camber side only.

14) Remove all masking.

15) Ink Stamp Procedure (use black ink, Figure 2-10b, ref. no. 70)

NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.

16) Decal Application

NOTE: Oval Hartzell decal should be placed 21.5 inches (54.61 cm) from blade butt.

17) Acrylic/Lacquer Spray Application

K. **Process for Blade Model LM10585(A)B+4 - (Figure 9-8)**

NOTE: This procedure is an optional paint scheme for CASA 212.

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
2) Mask blade shank area, option A.
3) Primer Filler (Mix #1) Application
4) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)
5) Primer Sealer (Mix #2) Application
6) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
7) Using an air oscillating rotary sander with approved abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.
8) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
9) Wash Primer (Mix #3) Application (to exposed leading edge only)
10) Prepare (specified color) polane gray metallic (Mix #8).
    a) Spray three (3) coats over the entire blade surface.
    b) Allow to dry for one (1) hour
11) Striping Procedure, option A.

    NOTE: Stripes go on both sides.

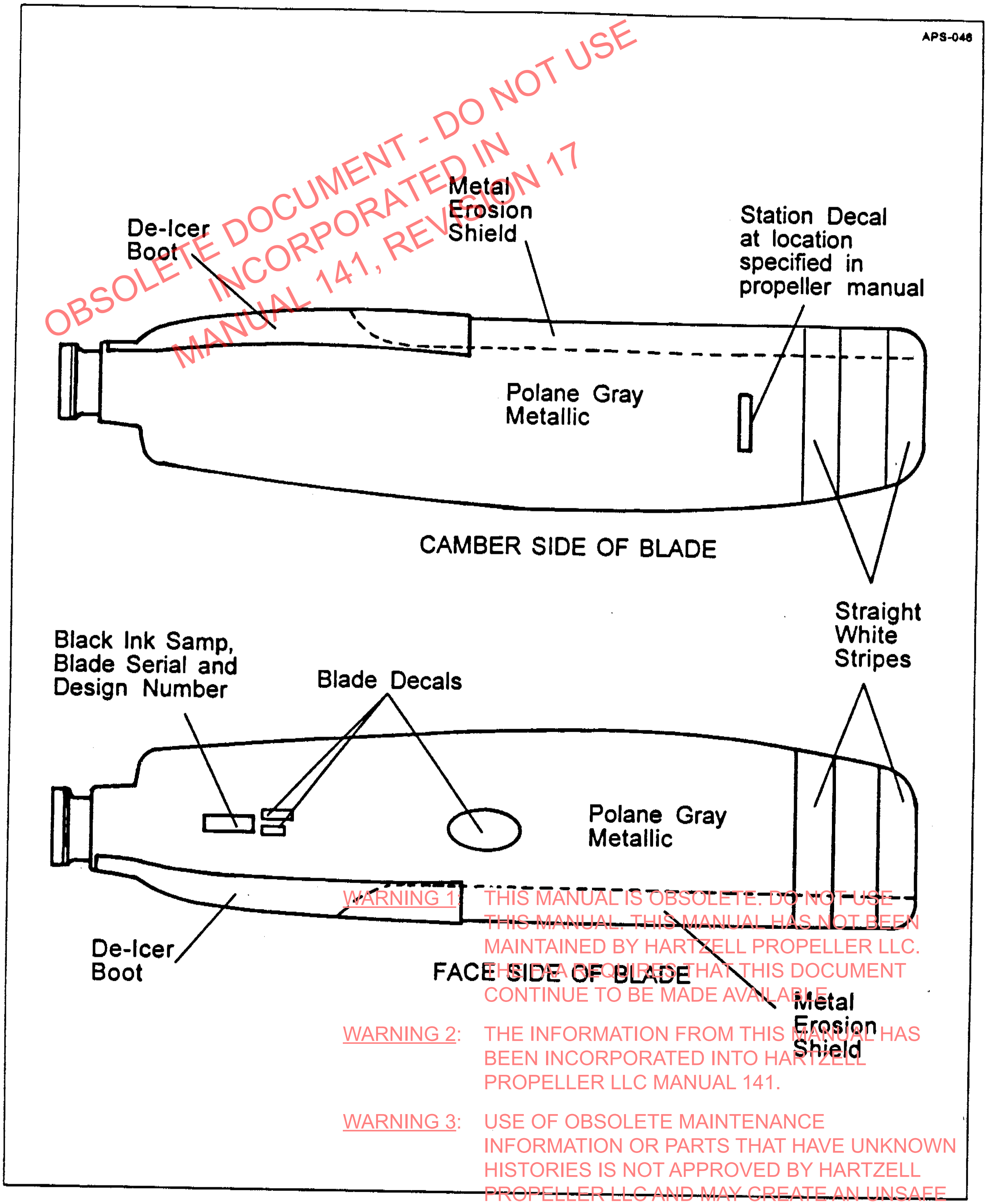
12) Ink Stamp Procedure (use black ink, Figure 2-10b, ref. no 70)

    NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.

13) Decals Application

    NOTE: Oval Hartzell decal should be placed 21.5 inches (54.61 cm) from blade butt.

14) Acrylic/Lacquer Spray Application



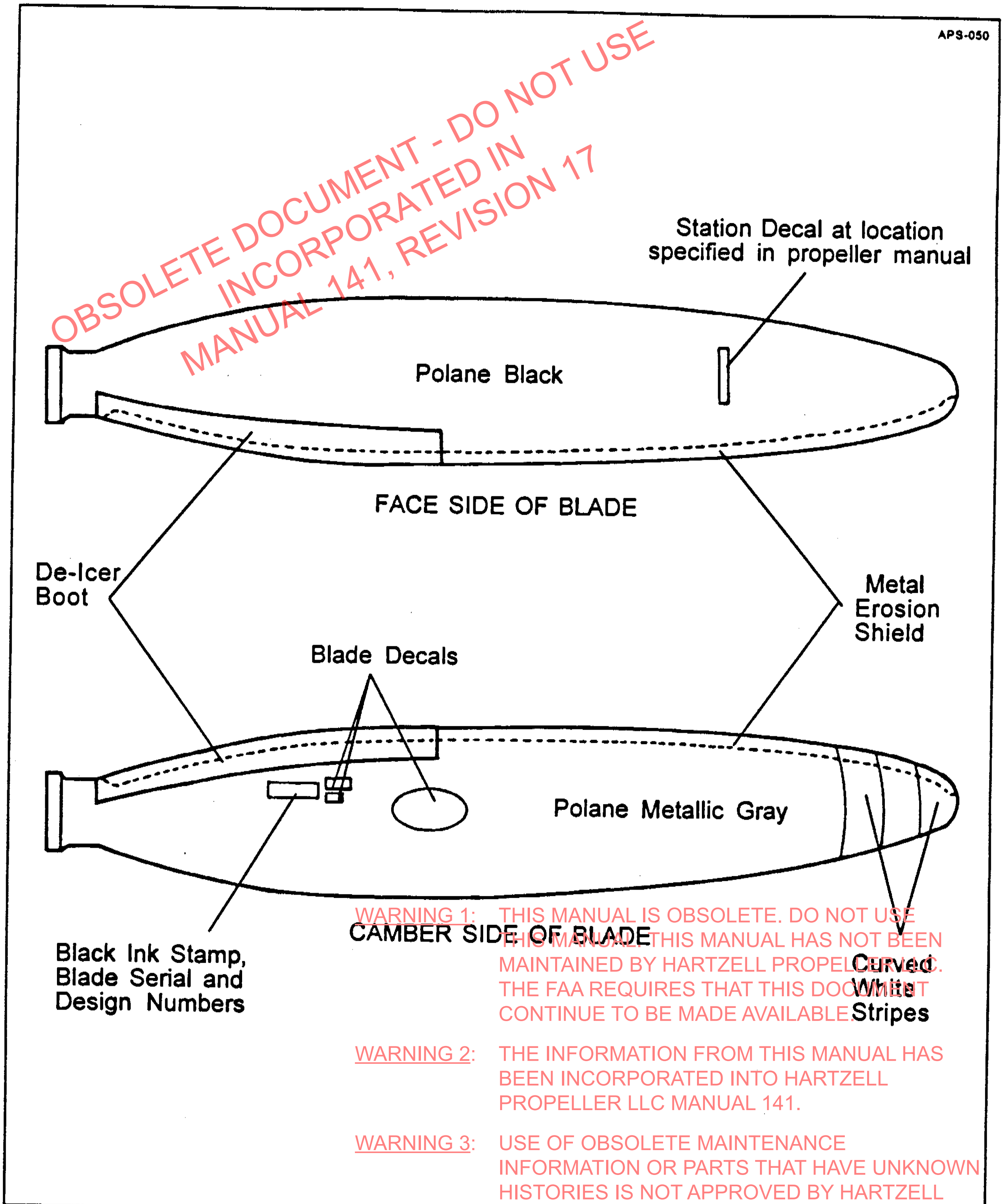
Final Finish for Composite Blade
Model LM10585(A)B+4
Figure 9-8

L. **Process for Blade Model M10877K (Figure 9-9)**

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
2) Mask blade shank area, option A.
3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.
4) Primer Filler (Mix #1) Application
5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)
6) Primer Sealer (Mix #2) Application
7) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
8) "P" Static (Mix #7) Application
9) Remove the masking from the erosion shield. Using an air oscillating rotary sander with appropriate abrasive (Figure 2-10, ref. no. 65), feather the edge of the paint line and expose full lead edge.
10) Lightly wipe blade with clean cloth.
11) Mask blade shank area, option A.
12) Wash Primer (Mix #3) Application (to exposed leading edge only)
13) Primer Sealer (Mix #2) Application
14) Prepare (specified color) polane metallic gray (Mix #8).
    a) Spray one coat over the entire blade surface.
    b) Repeat with a second coat to assure full coverage.
    c) Allow to dry completely.
15) Mask along the leading and trailing edge of camber side to eliminate overspray when painting face.
16) Prepare (specified color) polane black (Mix #5).
    a) Spray one coat over the face side only of the blade surface.
    b) Repeat with a second coat to assure full coverage.
    c) Allow to dry for one (1) hour.
17) Striping Procedure, option B.

    NOTE: Stripes go on the camber side only.
18) Ink Stamp Procedure (use black ink, Figure 2-10b, ref. no. 70)

    NOTE: Ink stamp should be placed approximately 8.5 inches (21.59 cm) from blade butt.



Final Finish for Composite Blade
Model M10877K (Beech)
Figure 9-9

19) Decals Application

NOTE: Oval Hartzell decal should be placed 21.5 inches (54.61 cm) from blade butt.

20) Acrylic/Lacquer Spray Application

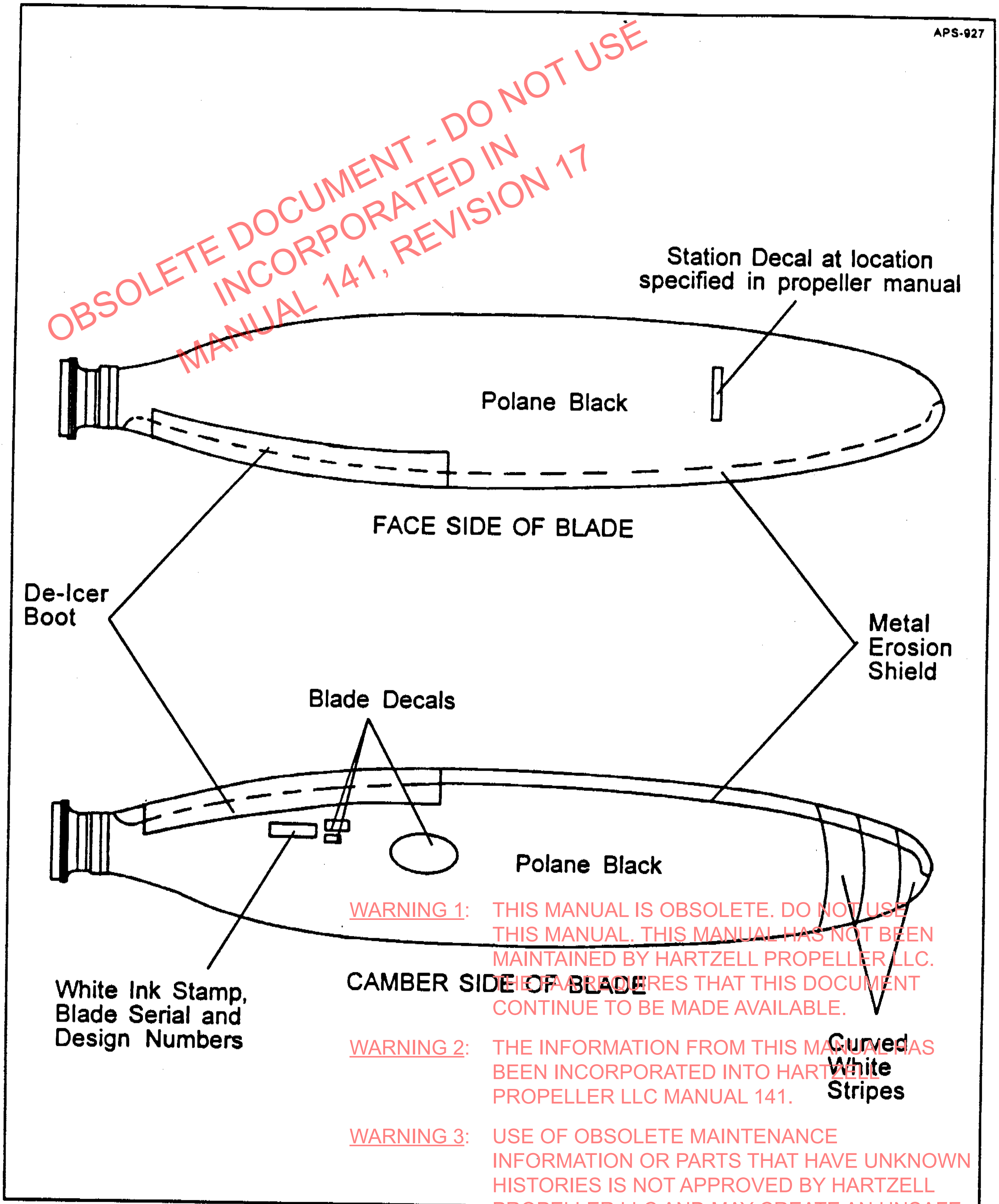
M. Process for Blade Model E10950K (Figure 9-10)

NOTE: Do not get paint on delrin seal ring or windings.

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
2) Mask blade shank blade, option B.
3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.
4) Primer Filler (Mix #1) Application
5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)
6) Primer Sealer (Mix #2) Application
7) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).
8) "P" Static (Mix #7) Application
9) Primer Sealer (Mix #2) Application
10) Remove all tape on the leading edge. Use an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65) to feather paint and expose full leading edge.
11) Clean entire blade with approved solvent (Figure 2-10a, ref. no. 22).
12) Use fine line tape (Figure 2-10b, ref. no. 66) to mask along the trailing edge and centerline of the lead edge. Fill between the 1/4 inch tape with masking tape. Mask only the camber side outboard of the 24.18 inch (61.42 cm) - 24.68 inch (62.69 cm) station. The remainder of the lead edge will receive paint.
13) Wash Primer (Mix #3) Application (to exposed leading edge only)
14) Prepare (specified color) polane black paint (Mix #5).
    a) Spray one coat over the entire blade surface.
    b) Repeat with a second coat to assure full coverage.
    c) Allow to dry for one (1) hour
15) Striping Procedure, option B

    NOTE: Stripes go on camber side only.
16) Ink stamp Procedure (use white opaque ink, Figure 2-10b, ref. no. 69)

    NOTE: Ink stamp should be placed approximately 10.75 inches (27.31 cm) from blade butt.



Final Finish for Composite Blade
Model E10950K (Beech 1900D)
Figure 9-10

17) Decals Application

NOTE: Oval Hartzell decal should be placed 24 inches (60.96 cm) from blade butt.

18) Acrylic/Lacquer Spray Application

N. **Process for Blade Model E11990K (Figure 9-11)**

NOTE: Do not get paint on delrin seal ring or windings.

1) Wipe entire blade with approved solvent (Figure 2-10a, ref. no. 22).

2) Mask blade shank area, option B.

3) Mask off erosion shield leaving 1/8 inch (3.175 mm) - 1/4 inch (6.35 mm) exposed on both face and camber sides.

4) Primer Filler (Mix #1) Application

5) Minor Blemish Correction (as necessary) (Paragraph 9-8, B.)

6) Primer Sealer (Mix #2) Application

7) Clean with approved solvent (Figure 2-10a, ref. no. 22).

8) Apply Aluminum Foil Tape (Figure 2-10b, ref. no. 64) in appropriate position (Figure 9-12).

   a) Roll foil tape to remove all air pockets.

   b) Clean with approved solvent (Figure 2-10, ref. no. 22).

9) "P" Static (Mix #7) Application

10) Primer Sealer (Mix #2) Application

11) Remove the masking from the erosion shield. Using an air oscillating rotary sander with appropriate abrasive (Figure 2-10b, ref. no. 65), feather the edge of the paint line and expose full lead edge.

12) Clean entire blade with approved solvent (Figure 2-10a, ref. no. 22).

13) Use fine line tape (Figure 2-10b, ref. no. 66) to mask along the trailing edge and centerline of the lead edge on camber side. Fill between the 1/4 inch tape with masking tape. Mask only the camber side outboard of the 29 5/8 inch (75.25 cm) station. The remainder of the leading edge will receive paint.

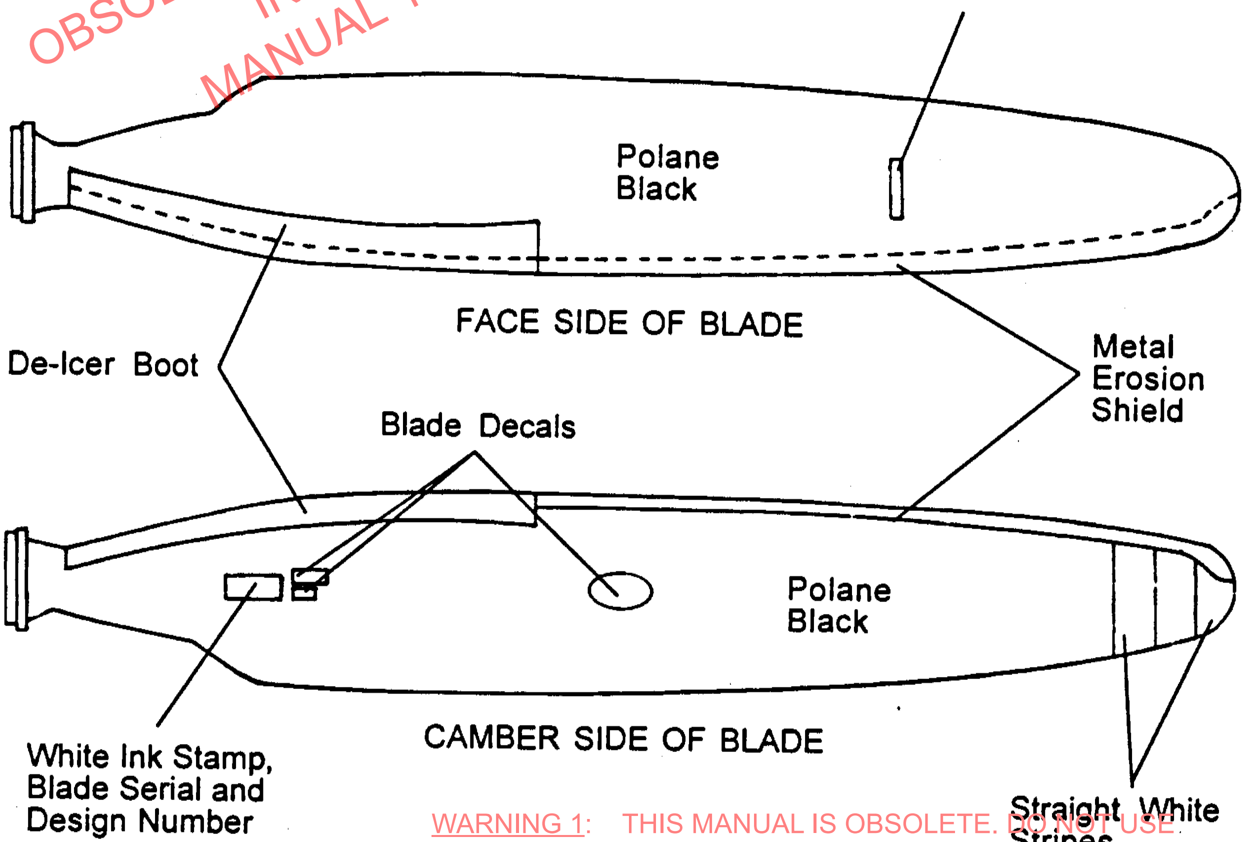
14) Wash Primer (Mix #3) Application (to exposed leading edge only)

15) Prepare (specified color) polane black paint (Mix #5).

   a) Spray one coat over the entire blade surface.

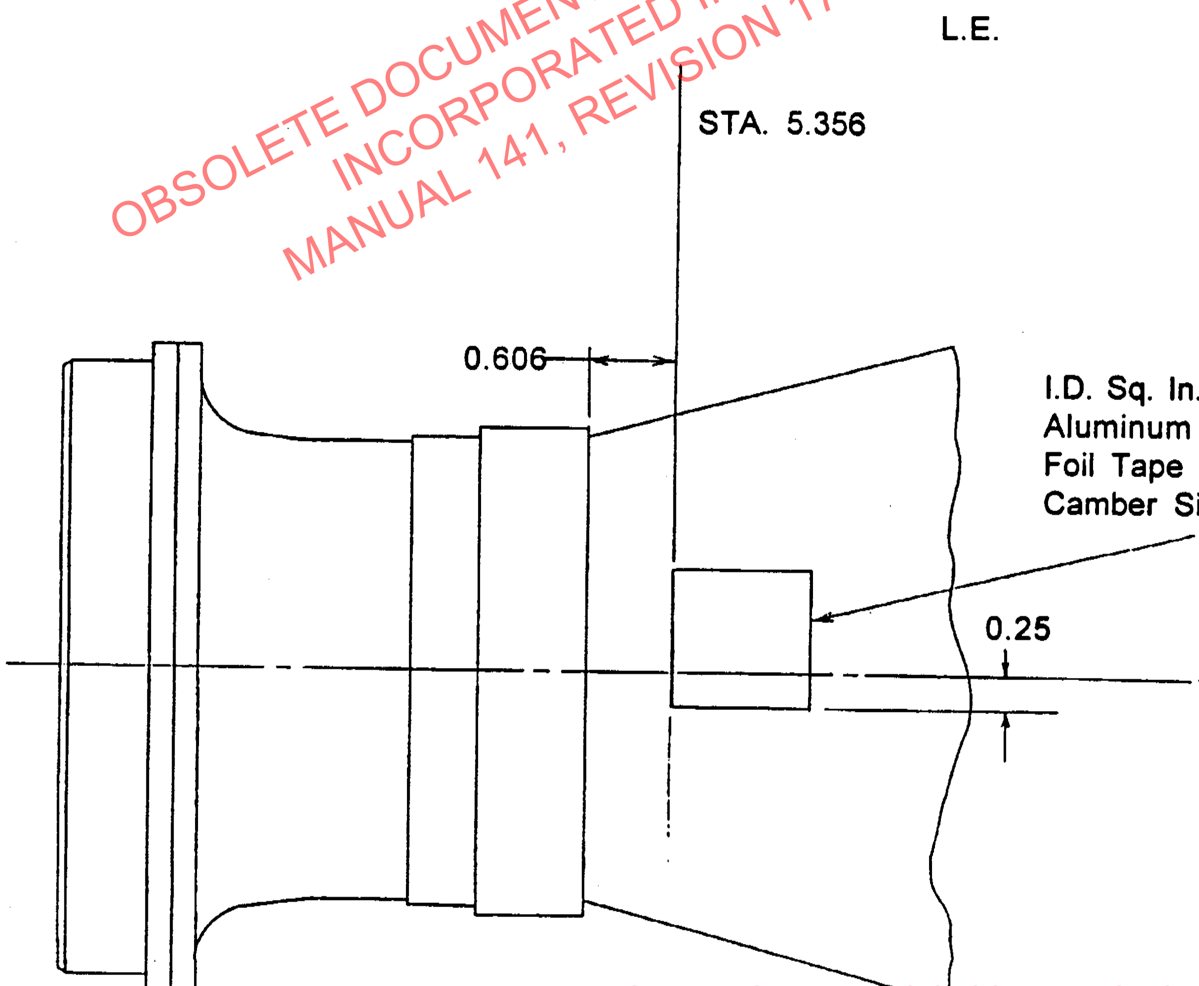
   b) Repeat with a second coat to assure full coverage.

   c) Allow to dry for one (1) hour



<u>NOTE</u>: Erosion shield is partially painted on camber side and completely painted on face side.

Final Finish for Composite Blade
Model E11990K
Figure 9-11



Metric Equivalency

0.25 in	=	6.35 mm
0.606 in	=	15.39 mm

Location of Aluminum Tape on E10990B Blade
Figure 9-12

16) Striping Procedure, option A.

NOTE: Stripes go on the camber side only.

17) Ink Stamp Procedure (use white ink, Figure 2-10b, ref. no. 69)

NOTE: Ink stamp should be placed approximately 10.75 inches (27.31 cm) from blade butt.

18) Decals Application

NOTE: Oval Hartzell decal should be placed 24 inches (60.96 cm) from blade butt.

19) Acrylic/Lacquer Spray Application

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Page

10-1. How to Use the Illustrated Parts List

A. Shank Parts List

Lists parts common to each shank. Item numbers key the parts list breakdown to the applicable illustration.

a) "*" indicates that the part listed is used on both sides of shank

b) "**" indicates that the appropriate overhaul manual should be referenced

B. Blade Model Parts List

Lists parts particular to that blade design. Figure numbers and item numbers key the parts list breakdown to the applicable illustration.

a) The number preceding a dash is the Figure Number of the illustration, and it appears at the beginning of each page or listing.

b) The number following a dash is the Item Number for a part shown in the illustration.

C. Part numbers are the computer part numbers used for ordering.

D. Parts are listed in the Description column by production part number, and noun name, followed by applicable modifiers. Component names and part names are indented to show their relationship to the next-higher unit.

E. Quantity/Size is listed per blade.

10-2. How to Order Parts, Finish Materials and Kits

A. Use written orders for parts and service. Avoid telephone and similar oral orders whenever possible.

B. Provide all the necessary information, including: complete part number and name, quantity required and complete model number of the blade assembly.

C. When ordering a replacement blade, specify aircraft type, precise model designation and serial number of the other blade(s) in the propeller assembly and the blade being replaced. The factory can then supply a blade that will suitably balance with other blades of the assembly.

D. When ordering kits, order first to set up, then restock as necessary.

799801/8x2
Station Decal (yellow strip)

HARTZELL

79980 HPILO
Blade Decal

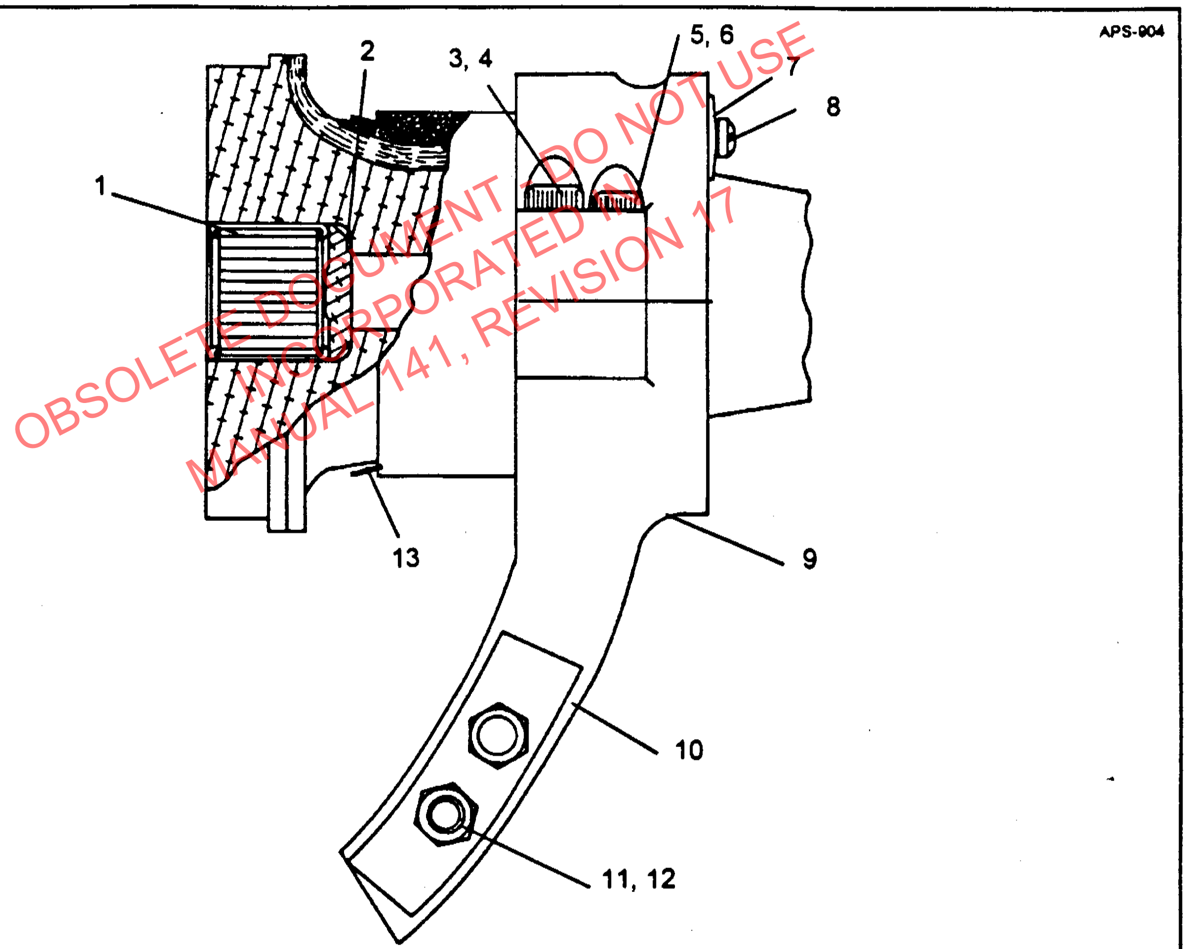
WARNING
Do not use a blade paddle on composite blades.
A-1692

79980A1692
A-1692 Composite Blade Decal

CAUTION
DO NOT
PUSH OR PULL AIRCRAFT USING PROPELLER BLADES.
CAU-112

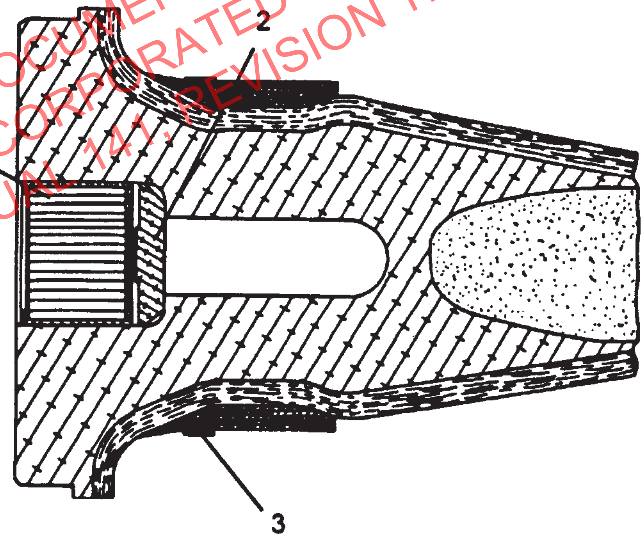
79980CAU112
CAU-112 Blade Decal

Composite Blade Decals
Figure 10-1



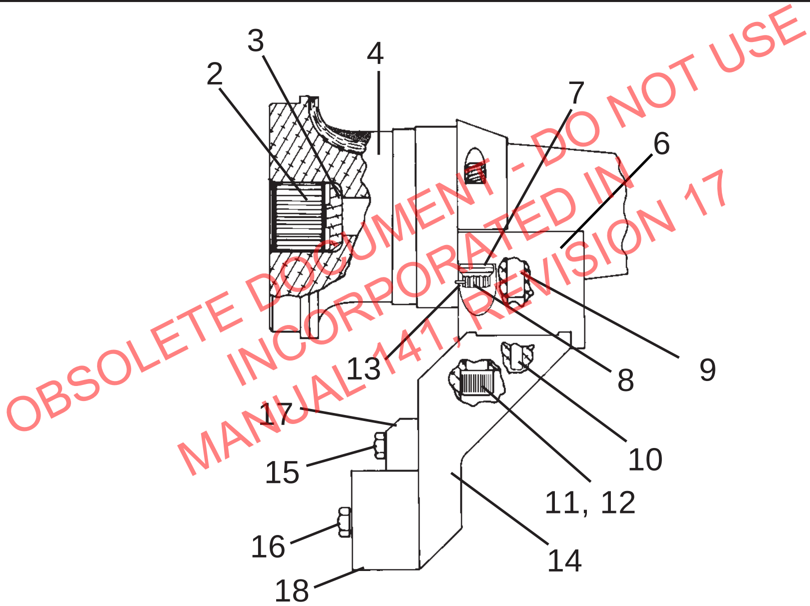
ITEM	PART NO.	DESCRIPTION	QTY.
1	57A1271	A-1271 Needle Roller Bearing	1
2	57A0665	A-665 End Plug	1
3	57B3810	B-3810 Screw	2*
4	362005160	AN960-516 Washer	2*
5	57B3812	B-3812 Screw	2*
6	362006160	AN960-616 Washer	2*
7	57A1929	A-1929 Balance Weights	**
8	360002( )	AN501A10 ( ) Balance Screw	**
9	57D1209	D-1209 Counterweight Arm	1
10	57B1933	B-1933 Slug	2*
11	57A1712	A-1712 Bolt	2
12	57A2043-1	A-2043-1 Nut	2
13	57A1198	A-1198 Delrin Seal Ring	0.933 ft
optional	57A4554	A-4554 Balance Tube	1

"A" Shank Illustrated Parts List
(Blade Model: A10460)
Figure 10-2



ITEM	PART NO.	DESCRIPTION	QTY.
1	57A1271	A-1271 Needle Roller Bearing	1
2	57A0665	A-665 End Plug	1
3	57A2074	A-2074 Delrin Seal Ring	0.868 ft
optional	57A4554	A-4554 Balance Tube	1

"B" Shank Illustrated Parts List
(Blade Models: B7421K, B7466)
Figure 10-3



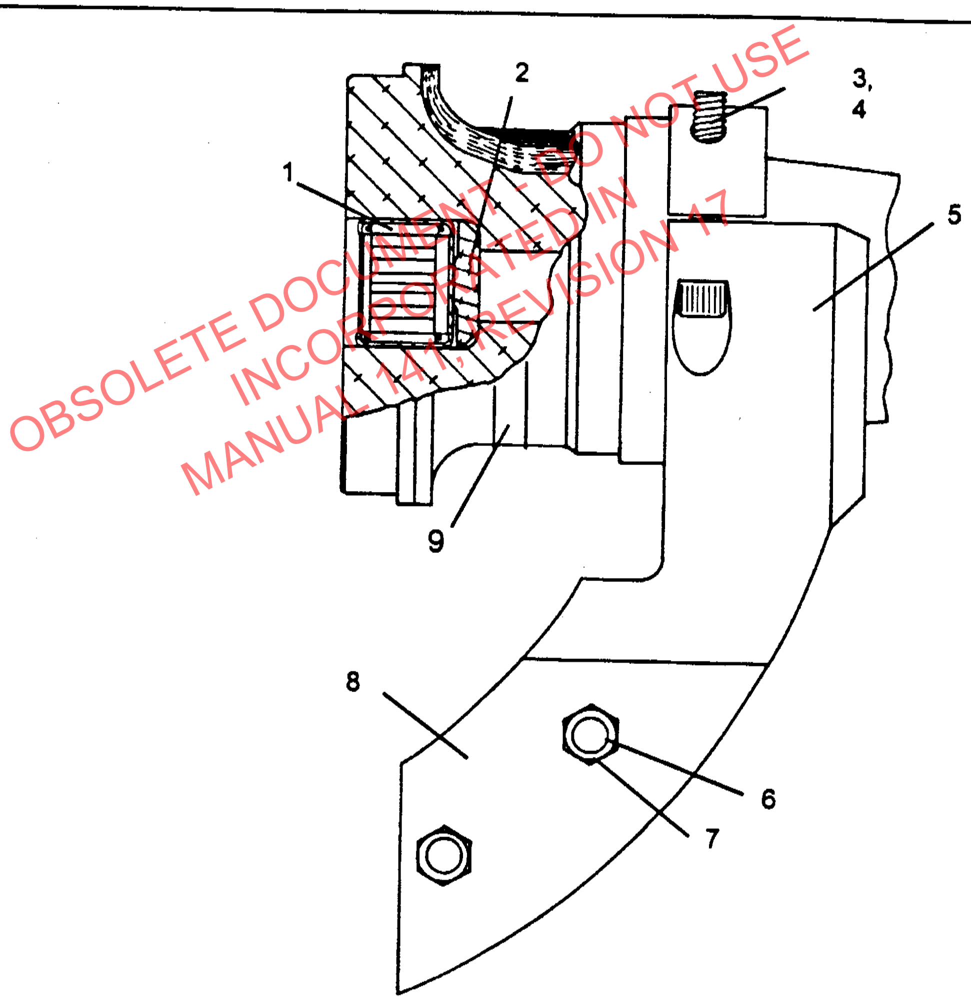
Blade Model E11990K
Figure 10-4

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-4 -1	E11990K		• **COMPOSITE BLADE ASSEMBLY**		1	
2	A-1271		• • BEARING, NEEDLE, CLOSED END		4	Y
3	A-665		• • PLUG, BLADE		4	Y
4	A-2074-2		• • BLADE SEAL RING		4	Y
-5	A-4554-( )		• • TUBE, BALANCE, COMPOSITE BLADE (OPTIONAL)		AR	
			• **COUNTERWEIGHT CLAMP ASSEMBLY**			
6	D-698-2		• • CLAMP, COUNTERWEIGHT		4	
7	B-6473		• • WASHER		8	
8	C-6474		• • BOLT, 12 POINT, INCONEL		8	Y
9	B-6138-6-8		• • DOWEL PIN		4	
10	A-65		• • DOWEL PIN		4	Y
11	B-3842-0500		• • SPRING PIN, CRES		8	Y
12	A-2036-12		• • SCREW, CAP, MODIFIED		8	Y
13	B-3838-3-2		• • COTTER PIN		8	Y
14	C-706		• • COUNTERWEIGHT		4	
15	B-3384-9H		• • BOLT, HEXHEAD		8	Y
16	B-3386-28H		• • BOLT, HEXHEAD		8	Y
17	A-890-13		• • SLUG, COUNTERWEIGHT		4	
18	A-745-4		• • SLUG, COUNTERWEIGHT		4	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

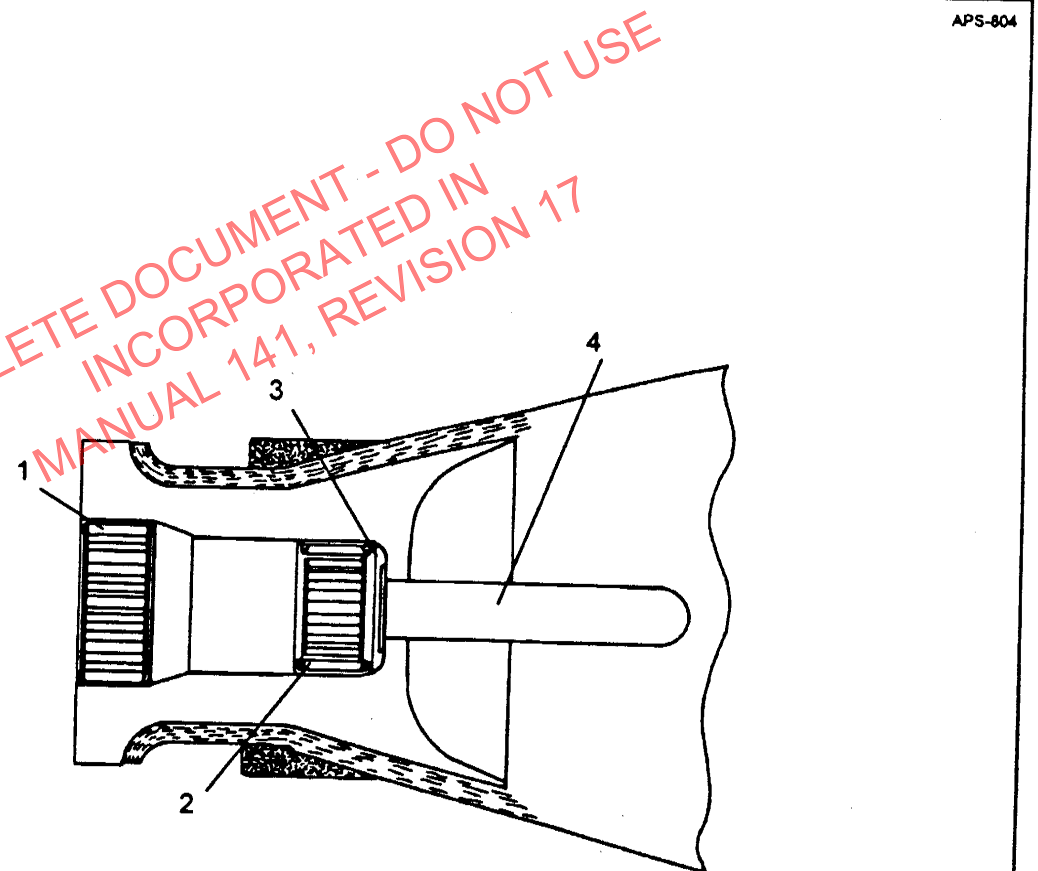
-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E



ITEM	PART NO.	DESCRIPTION	QTY.
1	57A1271	A-1271 Needle Roller Bearing	1
2	57A0665	A-665 End Plug	1
3	362006160	AN960-616 Washer	2*
4	57B3810	B-3810 Screw	2
5	57D5117-1	D-5117-1 Counterweight Clamp	1
6	57A1744	A-1744 Bolt	2
7	57A2043-1	A-2043-1 Nut	2
8	57B5128	B-5128 Slug	1
9	57A2074	A-2074 Delrin Seal Ring	0.866 ft
optional	57A4554	A-4554 Balance Tube	1

"E" Shank Illustrated Parts List
(Blade Model: E10950K)
Figure 10-5



ITEM	PART NO.	DESCRIPTION	QTY.
1	329702816	J-2816 Roller Bearing	1
2	329732216	SCH-2216 Roller Bearing	1
3	57A1349	A-1349 Spacer	1
4	57A4554	A-4554 Balance Tube	1
or	57A4554-1	A-4554-1 Balance Tube	1

"M" Shank Illustrated Parts List
(Blade Models: M10083K, LM10585, M10877K)
Figure 10-6

Blade Model B7421K
Figure 10-7

Blade Model B7421K

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-7	56B7421K	**B7421K Composite Blade Assembly**	
-1	57D5069	D-5069 Erosion Shield	1
-2	7931-4E2200-3	De-Icer Boot	1
-3	57A2413-2	A-2413-2 Bushing	1

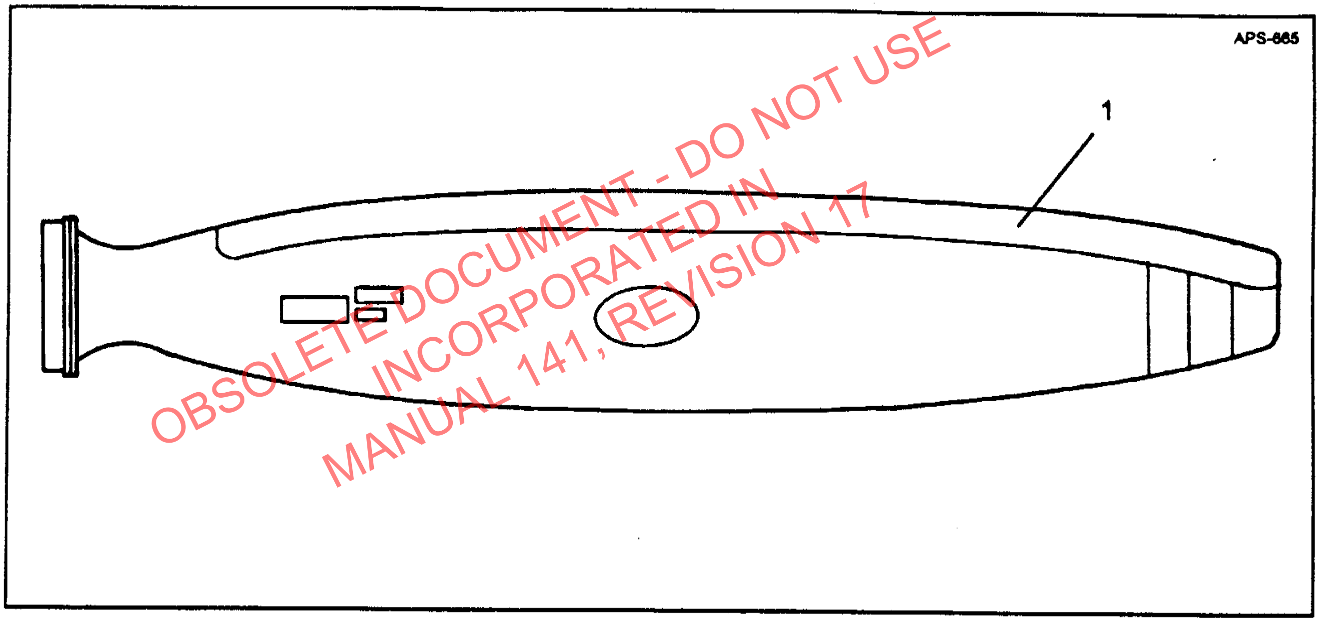
AVAILABLE KITS

A-2333-3 **Erosion Shield Replacement Kit**

CST-2988-3 **Erosion Shield Replacement Tool Kit**

CST-3000-3 **Erosion Shield Replacement Kit For Samples**

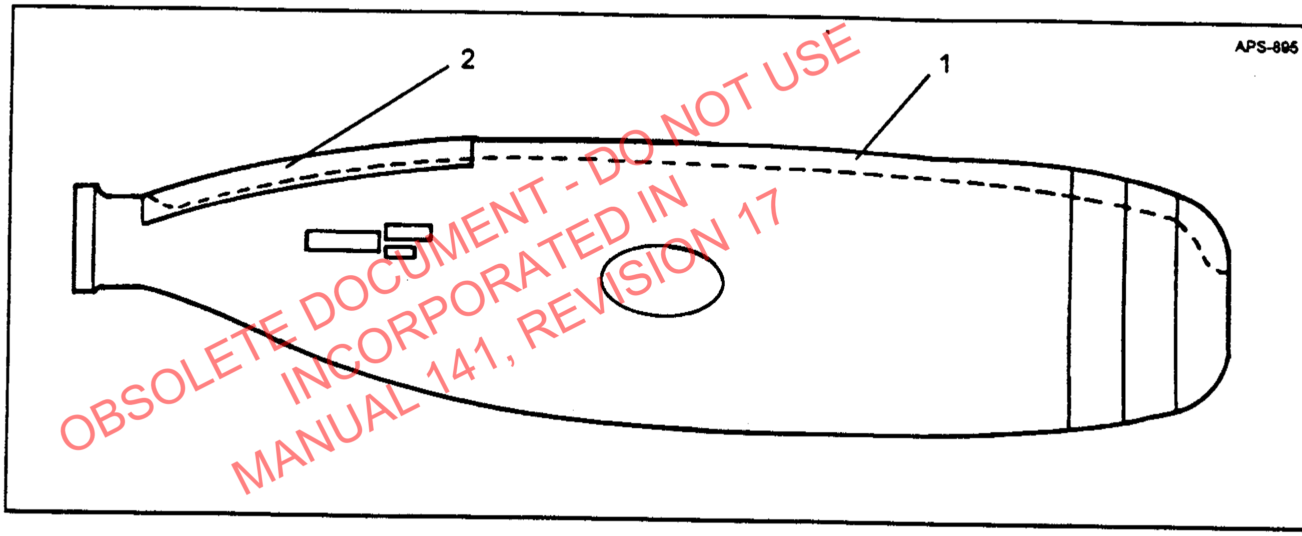
A-2328-23 **Complete Repair Kit**



Blade Model B7466
Figure 10-8

Blade Model B7466

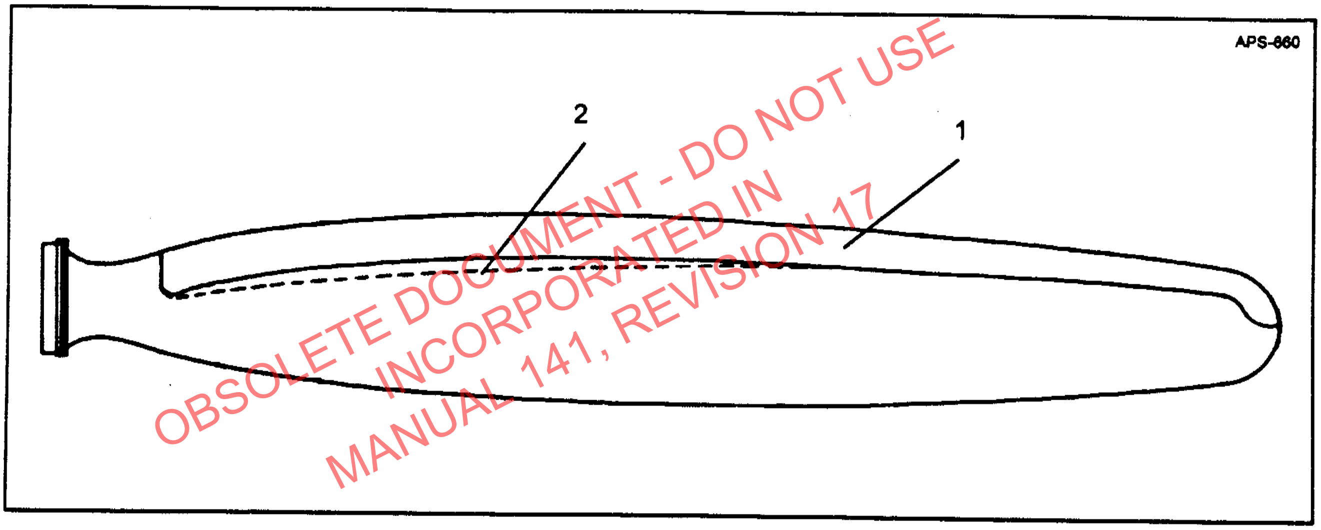
Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-8	56B7466	**B7466 Composite Blade Assembly**	
-1	57D5066	D-5066 Erosion Shield	1
		<u>AVAILABLE KITS</u>	
		A-2333-5 **Erosion Shield Replacement Kit**	
		CST-2988-5 **Erosion Shield Replacement Tool Kit**	
		CST-3000-5 **Erosion Shield Replacement Kit For Samples**	
		A-2328-22 **Complete Repair Kit**	



Blade Model M10083K
Figure 10-9

Blade Model M10083K

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-9	56M10083K	M10083K **Composite Blade Assembly**	
-1	57D5013	D-5013 Erosion Shield	1
-2	7931-4E2336-12	4E2336-12 De-Icer Boot	1
		<u>AVAILABLE KITS</u>	
	57A2333-2	A-2333-2 **Erosion Shield Replacement Kit**	
		CST-2988-2 **Erosion Shield Replacement Tool Kit**	
		CST-3000-2 **Erosion Shield Replacement Kit for Samples**	
		A-2328-3 **Complete Repair Kit**	



Blade Model A10460(E)(K)
Figure 10-10

Blade Model A10460(E)(K)

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-10	56A10460(E)(K)	A10460(E)(K) **Composite Blade Assembly**	
-1	57D5059	D-5059 Erosion Shield	1
-2	7931-5E2233-1	5E2233-1 Element, De-Icer, Internal	1
	7931-4E2890-07	De-Icer Boot, External	1

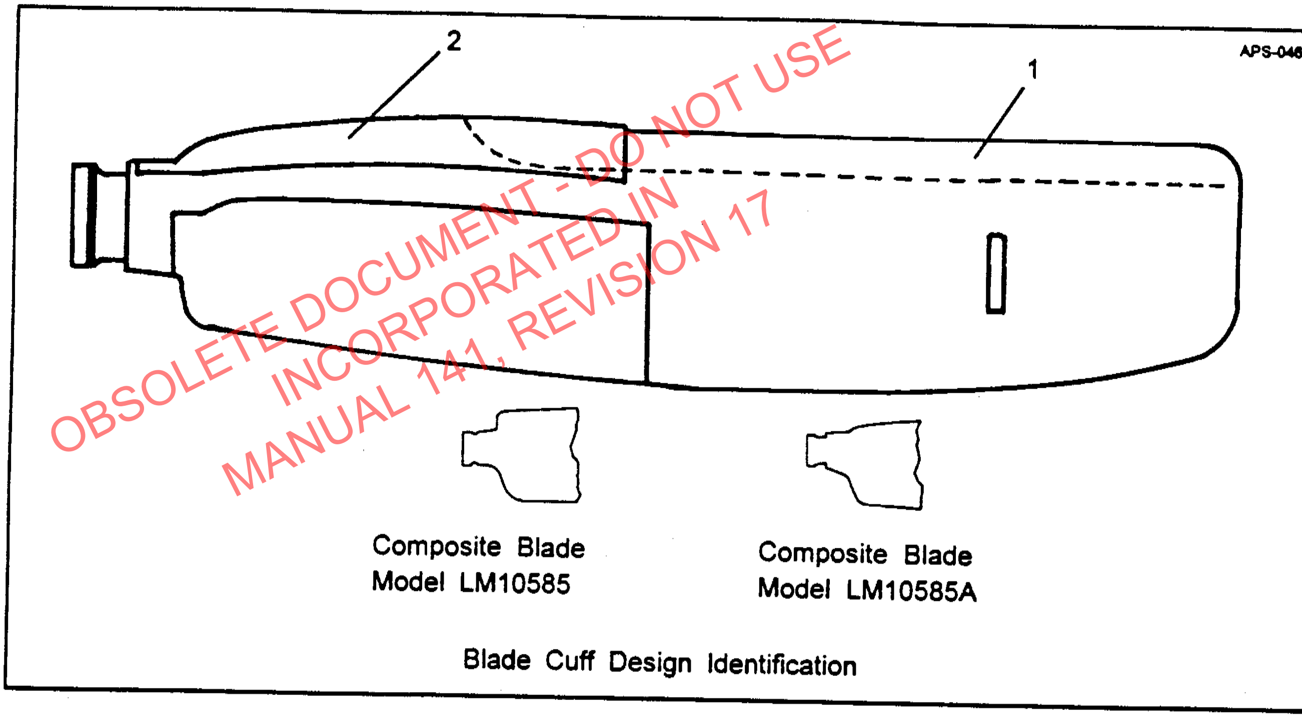
<u>AVAILABLE KITS</u>

A-2333-4 Erosion Shield Replacement Kit

CST-2988-4 Erosion Shield Replacement Tool Kit

CST-3000-4 Erosion Shield Replacement Kit for Samples

A-2328-22 Complete Repair Kit



Blade Model LM10585ANK+4
Figure 10-11

Blade Model LM10585ANK+4

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-12	56LM10585ANK+4	LM10585ANK+4 **Composite Blade Assembly**	
-1	57C4552	C-4552 Erosion Shield	1
-2	7931-4E2336-12	De-Icer Boot	1

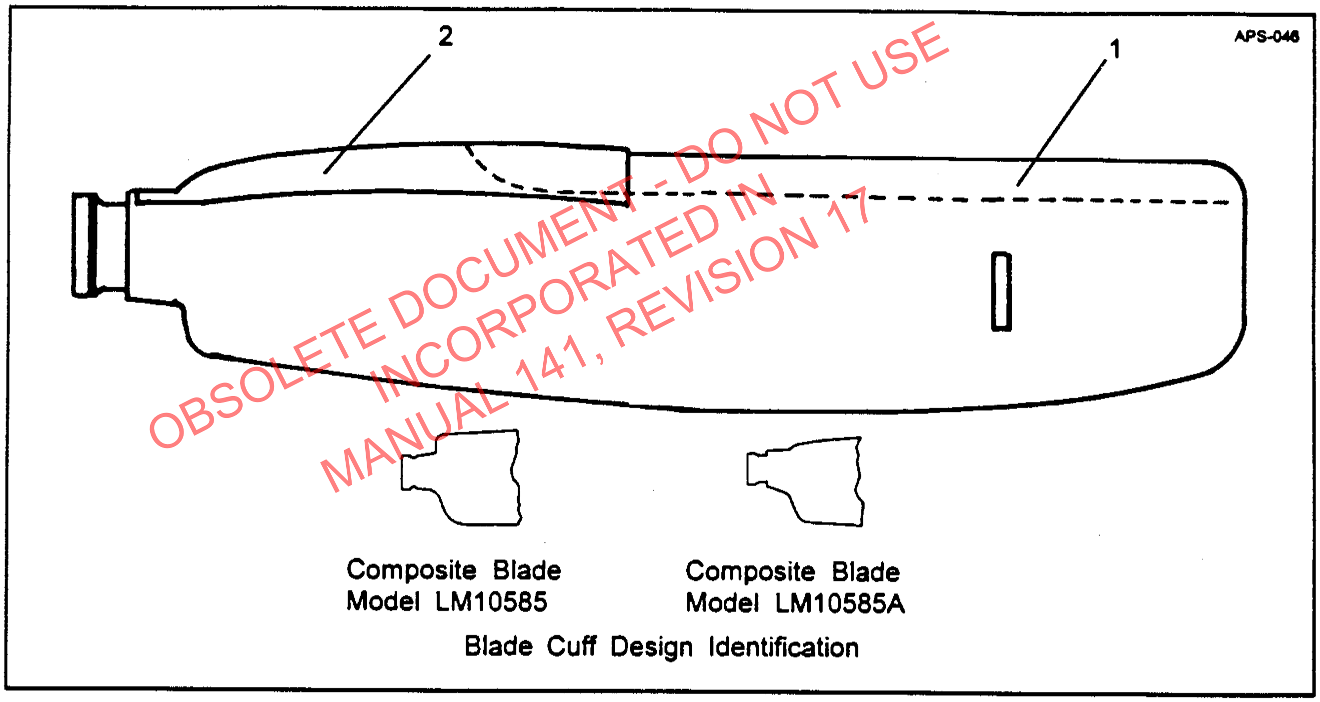
<u>AVAILABLE KITS</u>

A-2333 Erosion Shield Replacement Kit

CST-2988 Erosion Shield Replacement Tool Kit

CST-3000 Erosion Shield Replacement Kit For Samples

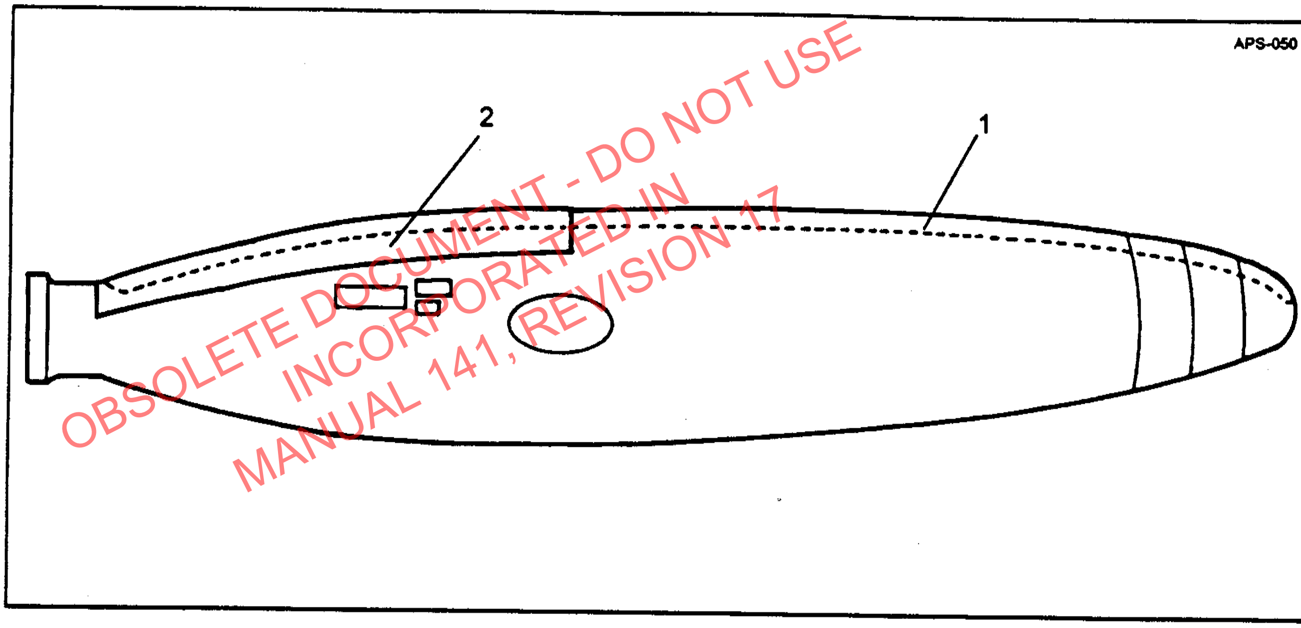
A-2328-1 Complete Repair Kit



Blade Model LM10585(A)B+4
Figure 10-12

Blade Model LM10585(A)B+4

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-11	56LM10585(A)B+4	LM10585(A)B+4 **Composite Blade Assembly**	
-1	57C4552	C-4552 Erosion Shield	1
-2	7931-4E2336-10	4E2336-12 De-Icer Boot	1
		AVAILABLE KITS	
	57A-2333	A-2333 **Erosion Shield Replacement Kit**	
		CST-2988 **Erosion Shield Replacement Tool Kit**	
		CST-3000 **Erosion Shield Replacement Kit for Samples**	
		A-2328-1 **Complete Repair Kit**	



Blade Model M10877K
Figure 10-13

Blade Model M10877K

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-13	56M10877K	**M10877K Composite Blade Assembly**	
-1	57D5003	D-5003 Erosion Shield	1
-2	7931-4E2560-10	4E560-10 De-Icer Boot	1

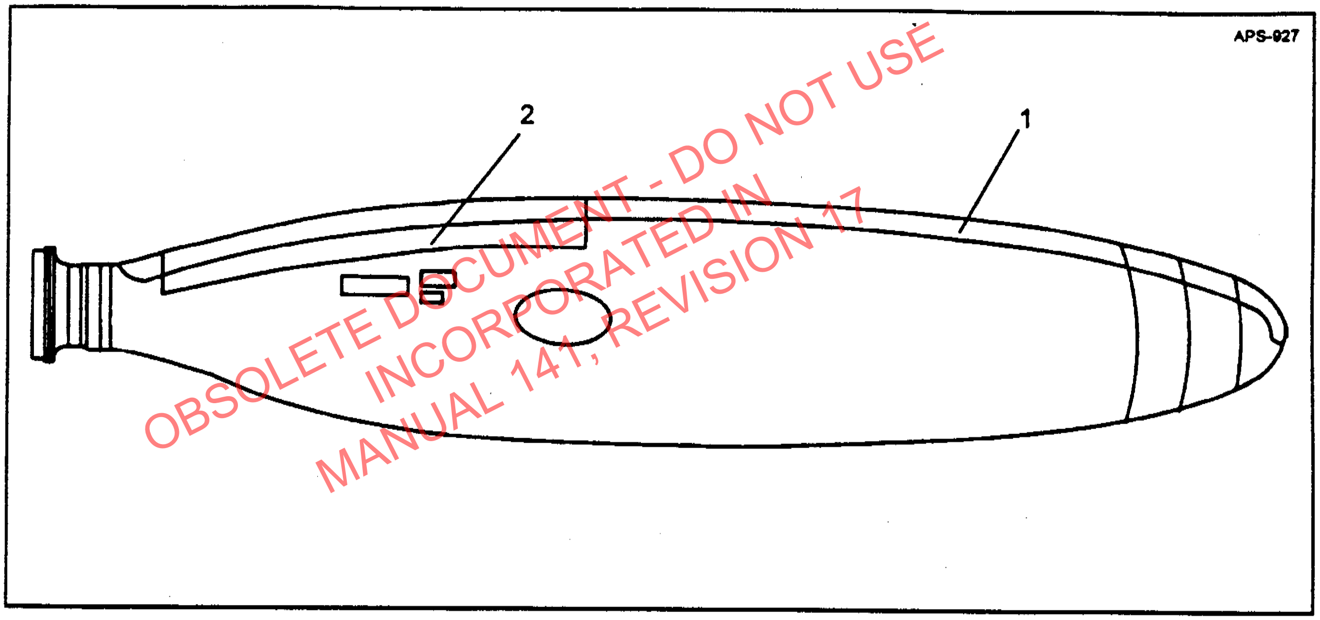
AVAILABLE KITS

A-2333-1 Erosion Shield Replacement Kit

CST-2988-1 Erosion Shield Replacement Tool Kit

CST-3000-1 Erosion Shield Replacement Kit for Samples

A-2328 Complete Repair Kit



Blade Model E10950K
Figure 10-14

Blade Model E10950K

Figure/Item Number	Part Number	Nomenclature	Quantity/ Size
10-14	56E10950K	E10950K **Composite Blade Assembly**	
-1	57D5133	D-5133 Erosion Shield	1
-2	7931-4E3017	4E3017 De-Icer Boot	1

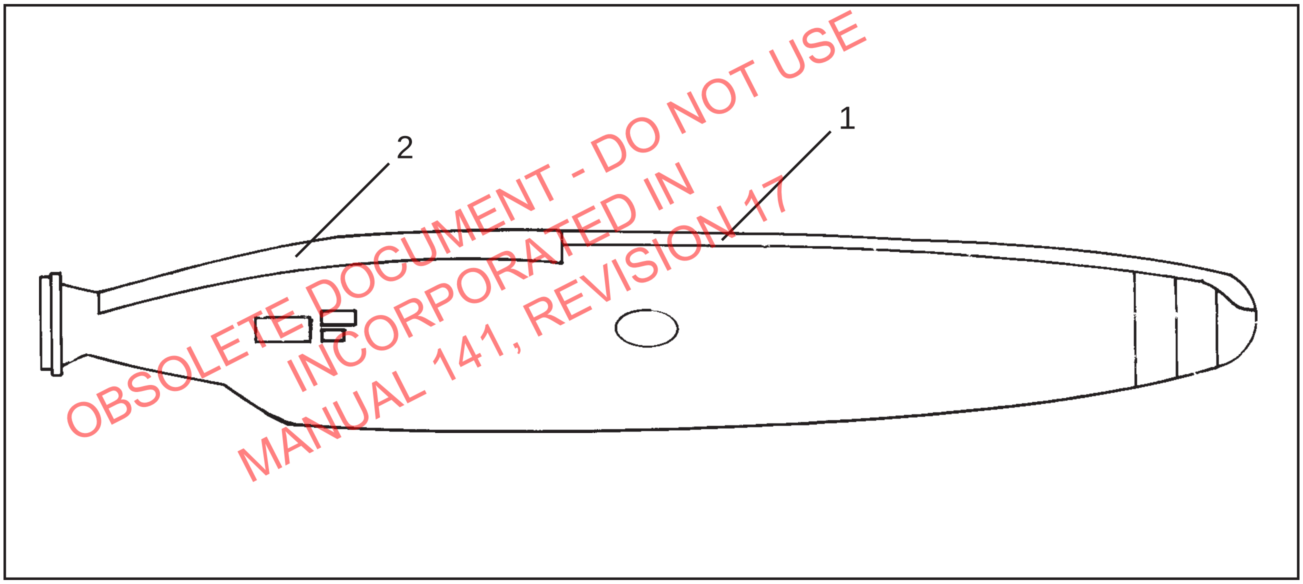
<u>AVAILABLE KITS</u>

A-2333-7 **Erosion Shield Replacement Kit**

CST-2988-7 **Erosion Shield Replacement Tool Kit**

CST-3000-7 **Erosion Shield Replacement Kit for Samples**

A-2328-22 **Complete Repair Kit**



Blade Model E11990K
Figure 10-15

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NUMBER	DESCRIPTION 1 2 3 4 5 6 7	EFF. CODE	UPA	O/H
10-15	E11990K		• **BLADE ASSEMBLY, COMPOSITE**		1	
1	D-5072		• • EROSION SHIELD		1	
2	7931-4E2839-1		• • DE-ICE BOOT		1	Y
			WINDING ADDITION (UNDER BLADE SEAL)			
-10	0204000S2		• 449AA-250 S2 FIBERGLASS ROVING (FT.)		12	
-20	A-2328-21		• REPAIR/PAINT KIT/ADHESIVE KIT		1	
			SAMPLE PROGRAM KITS			
-30	CST- 3000-6		• EROSION SHIELD, SAMPLE PROGRAM, INITIAL KIT		1	
-30A	CST- 3000-6A		• EROSION SHIELD, SAMPLE PROGRAM, SUPPLEMENTAL KIT		1	
			SPECIAL TOOLS			
-50	BST-2975-6		• E11990K EROSION SHIELD FIT CHECK TOOL		1	
-60	BST-3004-6A		• FACE TEMPLATE, 42 INCH STATION		1	
-60A	BST-3004-6B		• FACE TEMPLATE, 54 INCH STATION		1	
			ADDITIONAL AVAILABLE KITS			
-70	A-2333-6		• STRIP, LEADING EDGE REPLACEMENT KIT		1	
-80	CST-2988-6		• REPLACEMENT TOOL KIT E11990		1	
-90	A-2328-22		• PAINT KIT		1	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

-ITEM NOT ILLUSTRATED

HC-E4P-5, HC-E4P-5E

10-3. Mandatory Parts Retirement Procedures

Serialized parts and accessories manufactured by Hartzell Propeller Inc. which are no longer airworthy must be retired from service in the following manner to prevent the possibility of a part being returned to service (either in a certificated or an experimental type aircraft) after the part no longer meets Hartzell airworthiness standards.

A. Attach a scrap tag to the part.

B. Stamp or etch a line through the serial number.

C. Stamp a letter "S" over the "TC" (Type Certificate) number.

D. Use the three-part Hartzell Retirement Form 101DA (Figure 10-16) to record and report all required information about a part that is retired.

NOTE: Every Hartzell authorized distributor is required to use Form 101DA for serialized parts found not airworthy. Every certified propeller repair facility is requested to institute the use of the Mandatory Parts Retirement Procedures.

NOTE: Supplies of Form 101DA are available from the factory.

1) Once a month, forward to the factory the original (white) copies of completed Form 101DA (Figure 10-16).

   a) Original copies of the form will be kept on file at the factory for quality assurance, FAA, and insurance record purposes.

2) Retain the yellow copies of completed Form 101DA in distributor or repair facility files.

3) Give the pink copies of the completed form to customers.

E. Record the serial number(s) of retired part(s) on customer and in-house copies of the work order involved.

F. Record disposition of the part(s) on customer and in-house copies of the work order involved.

HARTZELL PROPELLER INC.
One Propeller Place
Piqua, OH 45356 U.S.A.

HARTZELL

PART RETIREMENT FORM 181DA

Date 1/2/92 Month of January Year 1992

Name of Operation Hartzell Propeller Inc.

Address One Propeller Place
Piqua, OH 45356-2634 Phone (513) 778-4200

Repair Station Number MHP-105-10

P/N	Nomenclature	S/N	Reason For Retirement*	Disposition*
T10282NB-5.3R	Blade	F00000	4	SH
C3-1A	Clamp	E000	3	SC
D2201-16	Hub Unit	CH00000	2	S

*Abbreviated responses are acceptable as follows:

Reason for Retirement
1 - below minimum dimensions
2 - ground strike damage
3 - corrosion
4 - blade bearing bore (SB136)
5 - blade shank diameter
- other - write in reason or list Service Bulletin/Instruction number

Disposition
S - scrap at prop shop
SC - scrap, return to customer
SH - scrap, returned to Hartzell
- other - write in disposition

Signature Larry Freeman

Title Product Support Rep./Warranty Administration

White Copy - To Hartzell, Yellow Copy - Prop Shop Records

Properly Completed
Part Retirement Form 180DA
Figure 10-16

PARTIAL LIST OF SUPPLIERS

Adhesives, Sealants

3M Industrial Specialties Division
P.O. Box 145404
Cincinnati, OH 45250-5404
Phone 612/733-4813
Message Center 800/242-4100
Fax 612/736-5805

Lightning Guard

Spraylat Corporation
716 South Columbus Avenue
Mt. Vernon, NY 10550
Phone 914/699-3030

3465 South LaCienega Boulevard
Los Angeles CA 90016
Phone 213/535-2335

"P" Static

DeSoto
1608 Fourth Street
Berkeley, CA 94710
Phone 415/526-1525

Painting Equipment

The DeVilbiss Company
P.O. Box 913
Toledo, OH 43692
Phone 419/470-2169

Paint Products

Randolph Products Company
92 North 12th Street
Carlstadt, NJ 07072
Phone 201/438-3700

The Sherwin-Williams Company
101 Prospect Avenue
Cleveland, OH 44115
Phone 800/321-8194
(in Ohio, 800/362-0903)

Vacuum Oil

Duoseal
Sargent-Welch
7400 North Linder Ave.
P.O. Box 1026
Skokie, IL 60077-1026
Phone 312/677-0600
Fax 312/677-4869

Tools

Kell-Strom Tool Company, Inc.
214 Church Street
Box 4047
Wethersfield, CT 06109
Phone 203/529-6851
Telex 994426

Snap-On Tools Corporation
Kenosha, WI 53141-1410
Phone 414/656-5200
TWX 910-274-2369
Fax 414/656-5577