Manual No. 100E
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HARTZELL

HYDRO-SELECTIVE PROPELLER OVERHAUL MANUAL

HC-D2V20-3
HC-D3V20-6L
HC-D2V20-7
HC-D2V20-8
HC-D2MV20-3
HC-D3MV20-6L
HC-D2MV20-7
HC-D2MV20-8
HC-D3MV20-8D

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REVISION 41 HIGHLIGHTS

Where applicable, changed "Hartzell" to "Hartzell Propeller Inc."

COVER
- Revised to match the manual revision

REVISION HIGHLIGHTS
- Revised to match the manual revision

RECORD OF TEMPORARY REVISIONS
- Revised to match manual revision
- Made other language/format changes

SERVICE DOCUMENT LIST
- Added HC-SB-61-241 to the list
- Made other language/format changes

AIRWORTHINESS LIMITATIONS
- Removed the airworthiness limitations and added a reference to guide the reader to the new location for the airworthiness limitations in the applicable owner's manual

LIST OF EFFECTIVE PAGES
- Revised to match manual revision

TABLE OF CONTENTS
- Made language/format changes

INTRODUCTION
- Revised the sections, "Statement of Purpose", "Required Publications", "Personnel Requirements", "Calendar Limits and Long Term Storage", "Component Life and Service", "Definitions", and "Abbreviations"
- Added the section, "Safe Handling of Paints and Chemicals"
- Made other language/format changes

DESCRIPTION AND OPERATION
- Made language/format changes

TESTING AND FAULT ISOLATION
- Added the section, "Lightning Strike on Hub or Blade"
- Made other language/format changes

AUTOMATIC TEST REQUIREMENTS
- Changed the NOTE to reference "ATA iSpec 2200 specification"

DISASSEMBLY
- Revised the section, "Propeller Disassembly"
- Made other language/format changes

CLEANING
- Revised the sections, "General Procedures for Cleaning Parts" and "Specific Cleaning Procedures"
- Made other language/format changes

REVISION 41 HIGHLIGHTS - CONTINUED

CHECK
- Revised the sections, "Inspection Interval Requirements", "Inspection Requirements", "Replacement Requirements", and "Repair"
- Removed the section, "Mandatory Inspection Requirements"
- Added the section, "Specific Inspection Requirements"
- Moved the information from the sections, "Hub Unit Inspection", "Blade Clamp Inspection", and "Blade Inspection" into the section "Specific Inspection Requirements"
- Specified the material used for polishing
- Made other language/format changes

REPAIR
- Revised the section, "General Repair Requirements"
- Corrected the part number for the hub lug bushing
- Revised the section, "Hub Lug Repair"
- Made other language/format changes

ASSEMBLY
- Revised the section, "General"
- Corrected the part number A-165( ) that was C-165( )
- Revised the section, "Jack Plate and Hydraulic Piston Assembly"
- Incorporated TR-002 that clarified instructions for installation of the B-120 outer diaphragm ring
- Removed the section, "Installing the Propeller Assembly on the Aircraft"
- Made other language/format changes

FITS AND CLEARANCES
- Revised Figure 801, "Determining the Torque Value of a Standard Torque Wrench with Adapter"
- Revised the section, "Torque Values"
- Revised Table 801, "Torque Values"
- Added the section, "Blade Tolerances"
- Revised Table 802, "Blade Tolerances"
- Made other language/format changes

SPECIAL TOOLS, FIXTURES, AND EQUIPMENT
- Revised the sections, "Minimum Facility and Tooling Requirements" and "Special Tools"
- Made other language/format changes

ILLUSTRATED PARTS LIST
- Revised the section, "Vendors"
- Corrected the part number of item 40, Bushing
- Corrected the description of item 420, Socket Screw
- Corrected the part number of item 520, Bushing
- Corrected the part number of item 680, Inner Ring
- Corrected the part number of item 800, Push Rod
- Made other language/format changes

REVISION 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
New Issue	Mar/98	New
Revision 1	Apr/00	Minor Revision
Revision 2	Jun/01	Minor Revision
Revision 3	Jul/03	Minor Revision
Revision 4	Nov/03	Minor Revision
Revision 5	Apr/14	Minor Revision

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RECORD OF REVISIONS

This is a permanent historical record of revisions inserted into this manual.

Revision Number	Issue Date	Date Inserted	Inserted By
Original	Mar/98	Mar/98	HPI
1	Apr/00	Apr/00	HPI
2	Jun/01	Jun/01	HPI
3	Jul/03	Jul/03	HPI
4	Nov/03	Nov/03	HPI
5	Apr/14	Apr/14	HPI

Revision Number	Issue Date	Date Inserted	Inserted By

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Revision Number	Issue Date	Date Inserted	Inserted By

Revision Number	Issue Date	Date Inserted	Inserted By

RECORD OF TEMPORARY REVISIONS

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

Temporary Revision No.	Section/ Page	Issue Date	Date Inserted	Inserted By	Date Removed	Removed By
TR-001	743	Sep/00	Sep/00	HPI	Jun/01	HPI
TR-002	767	Dec/05	Dec/05	HPI	Apr/14	HPI
TR-003	605	Aug/16	Aug/16	HPI		

RECORD OF TEMPORARY REVISIONS

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

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

SERVICE DOCUMENT LIST

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

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

Service Document Number	Incorporation Rev./Date
SL 61T	Original Mar/98
SL 177	Original Mar/98
HC-SL-61-206	Rev. 2 Jun/01
HC-SL-61-211	Rev. 2 Jun/01
HC-SB-61-241	Rev. 5 Apr/14

Service Document Number	Incorporation Rev./Date

SERVICE DOCUMENT LIST

Service Document Number	Incorporation Rev./Date

Service Document Number	Incorporation Rev./Date

AIRWORTHINESS LIMITATIONS

1. Airworthiness Limitations Information

   A. For airworthiness limitations information, refer to Hartzell Propeller Inc. Owner's Manual 140 (61-00-40).

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Service Document List	1 and 2	Rev. 5	Apr/14
Airworthiness Limitations	1 and 2	Rev. 5	Apr/14
List of Effective Pages	1 thru 4	Rev. 5	Apr/14
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Testing and Fault Isolation	101 and 102	Rev. 5	Apr/14
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Testing and Fault Isolation	104	Rev. 5	Apr/14
Testing and Fault Isolation	105	Rev. 1	Apr/00
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Assembly	723	Rev. 2	Jun/01
Assembly	724 and 725	Rev. 1	Apr/00
Assembly	726	Rev. 5	Apr/14
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Assembly	732 and 733	Rev. 5	Apr/14
Assembly	734	Rev. 1	Apr/00
Assembly	735	Rev. 5	Apr/14
Assembly	736	Rev. 1	Apr/00
Assembly	737	Rev. 5	Apr/14
Assembly	738	Rev. 2	Jun/01
Assembly	739	Rev. 5	Apr/14
Assembly	740	Rev. 2	Jun/01
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Assembly	742 and 743	Rev. 5	Apr/14
Assembly	743.1 and 743.2	Rev. 2	Jun/01
Assembly	744	Rev. 1	Apr/00
Assembly	745	Rev. 5	Apr/14
Assembly	746	Rev. 1	Apr/00
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INTRODUCTION - CONTENTS

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1. Statement of Purpose

A. General

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

(2) This manual provides overhaul procedures for two- and three-bladed steel hub Hydro-Selective propellers manufactured by Hartzell Propeller Inc.

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

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

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

(b) Hartzell Propeller Inc. Product Support can also be reached by fax at (937) 778-4391, and by e-mail at techsupport@hartzellprop.com.

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

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

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

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

(5) This manual is intended to be the primary source of overhaul information for two- and three-bladed steel hub Hydro-Selective propellers. This manual no longer contains blade overhaul procedures. Refer to the appropriate Hartzell manual for blade overhaul.

(a) Information published in Service Bulletins, Service Letters, Service Advisories, and Service Instructions may supersede information published in this manual. The reader must consult active Service Bulletins, Service Letters, Service Advisories, and Service Instructions for information that may have not yet been incorporated into the latest revision of this manual.

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

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

2. Required Publications

A. Hartzell Propeller Inc. Publications

(1) In addition to this manual, one or more of the following publications are required for information regarding specific recommendations and procedures to maintain propeller assemblies.

(2) Information published in Service Bulletins, Service Letters, Service Advisories, and Service Instructions may supersede information published in this manual. The reader must consult active Service Bulletins, Service Letters, Service Advisories, and Service Instructions for information that may have not yet been incorporated into the latest revision of this manual.

Manual No.	ATA No.	Title
n/a	n/a	Active Hartzell Propeller Inc. Service Bulletins, Service Letters, Service Instructions, and Service Advisories
127	61-16-27	Spinner Assembly Maintenance Guide
133C	61-13-33	Aluminum Blade Overhaul Manual
140	61-00-40	Hartzell Propeller Inc. Owner's Manual
159	61-02-59	Hartzell Propeller Inc. Application Guide
165A	61-00-65	Illustrated Tool and Equipment Manual
202A	61-01-02	Standard Practices Manual Volumes 1 thru 11

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

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

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

Selected information is also available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

B. References to Hartzell Propeller Inc. Publications

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

(a) A part may be superseded, replaced, or obsoleted by another part. For example, the self locking nut (A-2043) that is item 20 was superseded by the self locking nut (A-2043-1) that is item 20A.

(b) An Illustrated Parts List may contain multiple configurations. Effectivity codes are used to distinguish different part numbers within the same list. For example, one configuration may use a propeller mounting bolt (B-3339-1) that is item 30, yet another configuration uses a propeller mounting bolt (B-3347) that is item 30A. Effectivity codes are very important in the determination of parts in a given configuration.

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

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

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

(a) The reference number for consumable materials appear with the prefix “CM” directly following the material to which they apply. For example, an adhesive that is reference number 16 will appear as: adhesive CM16. Only those items specified may be used.

C. Vendor Publications

None.

3. Personnel Requirements

A. Inspection, Repair, and Overhaul

(1) Compliance to the applicable regulatory requirements established by the Federal Aviation Administration (FAA) or international equivalent, is mandatory for anyone performing or accepting responsibility for any inspection and/or repair and/or overhaul of any Hartzell Propeller Inc. product.

(2) Personnel inspecting, repairing, and overhauling Hartzell Propeller Inc. aluminum hub propellers must have adequate training and experience.

(3) Inspection and repair of propeller parts require a high degree of skill; therefore, personnel with inspection and supervisory responsibility are expected to have all of the following:

(a) An FAA Propeller Repairman's Certificate or international equivalent

(b) A minimum of 18 months practical experience with Hartzell Propeller Inc. steel hub propeller overhaul.

(4) Participation in Hartzell Propeller Inc. training classes is strongly recommended.

4. Safe Handling of Paints and Chemicals

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

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

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

5. Calendar Limits and Long Term Storage

A. Calendar Limits

(1) The effects of exposure to the environment over a period of time create a need for propeller overhaul regardless of flight time.

(2) A calendar limit between overhauls is specified in Hartzell Propeller Inc. Service Letter HC-SL-61-61Y and in the propeller owner's manual.

(3) Experience has shown that special care, such as keeping an aircraft in a hangar, is not sufficient to permit extension of the calendar limit.

(4) The start date for the calendar limit is when the propeller is first installed on an engine.

(5) The calendar limit is not interrupted by subsequent removal and/or storage.

(6) The start date for the calendar limit must not be confused with the warranty start date that is, with certain exceptions, the date of installation by the first retail customer.

B. Long Term Storage

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

6. Component Life and Service

A. Overhaul

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

(2) The overhaul interval is based on hours of service, i.e., flight time (aviation), operating time (non-aviation), or on calendar time.

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

(b) Parts that are not replaced at overhaul must be inspected in accordance with the Check chapter of this manual.

1 Parts that must be replaced at overhaul are identified by a "Y" in the O/H column of the Illustrated Parts List chapter of this manual.

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

(3) Overhaul must be completed in accordance with the latest revision of the applicable component maintenance manual and other publications applicable to, or referenced in, the component maintenance manual.

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

B. Damage

(1) Airworthy Damage

(a) Airworthy damage is a specific condition to a propeller component or blade identified in the Check chapter 5 of this manual that does not affect the safety or flight characteristics of the propeller or blade and conforms to its type design by meeting the condition inspection criteria limitations found in this manual.

1 The maximum limits of airworthy damage are specified in the Check chapter 5 of this manual.

a The Check chapter 5 in this manual specifies inspection criteria and instructions for evaluating damage to determine continued airworthiness.

b Although a propeller or blade may continue in service with airworthy damage, this type of damage should be repaired at the earliest practical time to prevent the damage from progressing to a condition that could require a more extensive repair.

(2) Unairworthy Damage

(a) Unairworthy damage is damage that exceeds the airworthy damage limits as specified in the Check chapter 5 of this manual.

1 Unairworthy damage can affect the safety or flight characteristics of the propeller or blade and does not conform to its type design.

2 This condition deems the component unairworthy, requiring appropriate corrective action to repair or remove it from service, as applicable.

C. Repair

(1) Minor Repair

(a) Minor repair is that which may be done safely in the field by a certified aircraft mechanic.

(b) For information about repair criteria for aluminum blades, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

(2) Major Repair

(a) Major repair is correction of damage that cannot be done by elementary operations.

(b) Major repair work must be accepted by an individual that is certified by the Federal Aviation Administration (FAA) or international equivalent.

1 Preferably the individual who accepts the work also holds a Factory Training Certificate from Hartzell Propeller Inc.

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

D. Component Life

(1) Certain components, or in some cases an entire propeller, may be life limited.

(a) It is a regulatory requirement that a record of the time since new be maintained for all life limited parts.

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

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

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

(3) Both TSN and TSO are necessary for defining the life of the component. Some parts are "life limited," which means that they must be replaced after a specified period of use (TSN).

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

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

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

(5) Time Since New (TSN) and Time Since Overhaul (TSO) records must be maintained in the propeller logbook.

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

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

(b) Other propeller components do not require time tracking unless specified in Hartzell Propeller Inc. service publications.

(c) Hub replacement

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

2 The propeller will assume the serial number of the replacement hub.

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

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

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

7. Definitions

Term	Definition
Annealed	softening of material caused by overexposure to heat
Blade Station	refers to a location on an individual blade for blade inspection purposes. It is a measurement from the blade "zero" station to a location on a blade, used to apply blade specification data in blade overhaul manuals (Note: do not confuse blade station with reference blade radius; they may not originate at the same location.)
Brinelling	a depression caused by failure of the material in compression
Corrosion	gradual wearing away or deterioration caused by chemical action
Crack	irregularly shaped separation within a material, usually visible as a narrow opening at the surface
Depression	surface area where the material has been compressed but not removed
Distortion	alteration of the original shape or size of a component
Erosion	gradual wearing away or deterioration caused by action of the elements

Exposure .....leaving material open to action of the elements

Fretting .....damage that develops when relative motion of small displacement takes place between contacting parts, wearing away the surface

Gauge (Bearing Ball) .....a term to describe an amount by which the mean diameter may differ from the nominal diameter.

Gouge .....surface area where material has been removed

Horizontal Balance .....balance between the tip and the butt of the blade

Impact Damage .....damage that occurs when the propeller blade or hub assembly strikes, or is struck by, an object while in flight or on the ground

Nick .....removal of paint and possibly a small amount of material, not exceeding one layer

Onspeed .....condition in which the RPM selected by the pilot through the propeller condition lever and the actual engine (propeller) RPM are equal

Overhaul (MPI) .....the periodic disassembly, inspection, repair, refinish, and reassembly of a propeller assembly

Overspeed .....condition in which the RPM of the propeller or engine exceeds predetermined maximum limits; the condition in which the engine (propeller) RPM is higher than the RPM selected by the pilot through the condition lever

Overspeed Damage .....damage that occurs when the propeller hub assembly rotates at a speed greater than the maximum limit for which it is designed

Pitting .....formation of a number of small, irregularly shaped cavities in surface material caused by corrosion or wear

Porosity .....an aggregation of microvoids; see "Voids"

Reference Blade Radius .....refers to the propeller reference blade radius in an assembled propeller; e.g., 30-inch radius. A measurement from the propeller hub centerline to a point on a blade, used for blade angle measurement in an assembled propeller. A yellow adhesive stripe (blade angle reference tape CM160) is usually located at the reference blade radius location. (Note: do not confuse reference blade radius with blade station; they may not originate at the same point).

Rolling .....compressive rolling process for the retention area of single shoulder blades, that provides improved strength and resistance to fatigue

Scratch .....same as "Nick"

Shot Peening.....process where steel shot is impinged on a surface to create compressive surface stress, which provides improved strength and resistance to fatigue

Synchrophasing .....a form of propeller sychronization in which not only the RPM of the engines (propellers) are held constant, but also the position of the propellers in relation to each other

Track .....in an assembled propeller, a measurement of the location of the blade tip with respect to the plane of rotation, used to verify face alignment and to compare blade tip location with respect to the locations of the other blades in the assembly.

Underspeed.....the condition in which the actual engine (propeller) RPM is lower than the RPM selected by the pilot through the condition lever

Vertical Balance .....balance between the leading and trailing edges; this cannot be changed on composite blades

Voids .....air or gas that has been trapped and cured into a laminate

Windmilling.....the rotation of an aircraft propeller caused by air flowing over it while it is not operating

8. Abbreviations

Abbreviation	Term
AN	Army-Navy
AOG	Aircraft On Ground
ATA	Air Transport Association
FAA	Federal Aviation Administration
Ft-Lb	Foot-Pound
ID	Inside Diameter
In-Lb	Inch-Pound
IPL	Illustrated Parts List
Lbs	Pounds
MIL-X-XXX	Military Specification
MPI	Major Periodic Inspection
MS	Military Standard
MSDS	Material Safety Data Sheet
OD	Outside Diameter
NAS	National Aircraft Standards
N•m	Newton-Meter
PSI	Pounds per Square Inch
RPM	Revolutions per Minute
STC	Supplemental Type Certificate
TBO	Time Between Overhaul
TC	Type Certificate
TSN	Time Since New
TSO	Time Since Overhaul

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DESCRIPTION AND OPERATION - CONTENTS

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1. Description of Propeller and Systems

   A. General Description (Construction)

      (1) The propellers covered in this manual are capable of either constant speed operation or attaining a blade angle through manual selection by the pilot while in flight. All of these propellers use aluminum blades and are intended for use with reciprocating engines.

      (2) Hartzell Propeller Inc. Hydro-Selective propellers change blade pitch through hydraulic actuation that is controlled manually. Manual control allows the pilot to select a blade angle by moving a cockpit control to result in a desired RPM setting.

      (3) Hartzell Propeller Inc. Constant Speed propellers use a device called a governor to sense engine RPM and will change blade angle automatically to maintain an RPM selected by the pilot.

      (4) Blade angles range from a low positive blade angle to a high positive blade angle or from a high positive blade angle to a negative blade angle. Feathering is not possible with these propellers.

      (5) Hartzell Propeller Inc. Hydro-Selective propellers consist primarily of a propeller assembly, a hydraulic unit, and a valve assembly.

      (6) Hartzell Propeller Inc. Constant Speed propellers have a governor, a T-drive unit, and hydraulic hose connecting the governor and the hydraulic unit.

      (7) A manually controlled propeller assembly consists of a central steel hub that mounts on the engine splined shaft. Blades are attached to the hub and are retained by two piece blade clamps and thrust bearing assemblies. A hydraulic unit consisting of a cylinder, piston, and pitch change linkage is attached to the face of the engine case encircling the splined engine shaft and propeller. A valve assembly is attached to the hydraulic unit and supplies oil to the piston and cylinder. Oil supplied from the engine or governor through the valve assembly is pumped into a cavity defined by the engine mounted cylinder and piston. The piston and cylinder do not rotate with the propeller, but remain fixed to the engine although the piston will move linearly in response to the changing volume of oil. This linear movement is transmitted through a thrust bearing to a jack plate unit that is also part of the hydraulic unit. The thrust bearing allows the nonrotating piston to be linked to the jack plate unit that rotates with the propeller. The jack plate unit acts as the linkage between piston linear movement and blade pitch change. The jack plate unit is attached to link screws on the inboard side of each blade retention clamp and translates the linear piston motion into rotational movement of the blade clamp and blade to result in blade pitch change while the propeller assembly is rotating.

(8) A constant speed propeller also is constructed and configured as described for the manually controlled propeller assembly with the following additions. Many engines on which a constant speed propeller is mounted are not designed with an accessory drive pad for attachment of a governor. A device identified as a T-drive unit is installed between the engine and the fuel pump. The T-drive unit drives the subject accessory and provides an additional accessory drive pad for the attachment of a governor. Governor control oil is supplied through external high pressure hosing to a valve attached to the hydraulic cylinder and piston to cause a blade angle change and maintain a constant engine RPM as selected by the pilot.

(9) Blade retention on early propeller models is designated with a "V" in the propeller model. This blade retention type used two shoulders on the blade shank outside diameter. The blade shank shoulders are engaged by a two shoulder blade clamp that encircles the blade root and retains the blade onto a thrust bearing and blade arm of the central hub. Blade retention on later propeller models is designated with an "MV" in the propeller model. This blade retention type uses a single shoulder on the blade shank outside diameter. A single shoulder blade clamp encircles the blade shank and retains the blade onto a thrust bearing and blade arm of the central hub.

B. General Description (Forces)

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

C. General Description (Control)

(1) The summation of the propeller forces is toward higher pitch (low RPM) and is opposed by a variable force toward lower pitch (high RPM). The variable force is oil under pressure from a governor or is engine oil that is pilot controlled through a valve. The variable oil force (oil supply) is supplied to the hydraulic cylinder and piston on the face of the engine case encircling the splined engine shaft and propeller. Increasing the volume of oil within the piston and cylinder will decrease the blade angle and increase propeller RPM. Decreasing the volume of oil will increase blade angle and decrease propeller RPM. Changing blade angle will vary the load on the engine and result in a change of engine and propeller RPM. On constant speed installations the governor will maintain a constant RPM (within limits) independent of where the throttle is set. On manually controlled propellers the pilot selects a blade angle through a cable attached to a valve on the hydraulic cylinder and piston to select a higher or lower RPM, as desired. The manually controlled valve will allow engine oil under pressure to enter the piston and cylinder cavity, or will allow oil to leave the piston and cylinder cavity and return to engine drain.

(2) Reverse blade angle operation is only available on manually controlled propeller models. The constant speed propeller models covered in this manual are not reversible.

D. Detailed Propeller Description

(1) Propeller Model HC-D2(V,MV)20-3( )

(a) This propeller model uses manual control and is reversing. The basic components of this propeller assembly consist of a propeller, a hydraulic unit and a valve assembly.

(b) A blade angle range up to 33 degrees enables reverse thrust operation for ground or water handling. To accommodate the blade angle range, O-rings provide the seal between the hydraulic unit piston and cylinder.

(c) The hydraulic unit is designed so the cylinder will attach to an engine with an SAE 20 splined thrust plate that uses six attachment points. This requires 6 holes in the cylinder to receive 6 studs from the engine and is secured in place with one nut on each stud.

(2) Propeller Model HC-D3(V,MV)20-6( )

(a) This propeller model uses manual control and is reversing. The basic components of this propeller assembly consist of a propeller, a hydraulic unit, and a valve assembly.

(b) A blade angle range up to 33 degrees enables reverse thrust operation for ground or water handling. To accommodate the blade angle range, O-rings provide the seal between the hydraulic unit piston and cylinder.

(c) The hydraulic unit is designed so the cylinder will attach to an engine with an SAE 20 splined thrust plate that uses six attachment points. This requires 6 holes in the cylinder to receive 6 studs from the engine and is secured in place with one nut on each stud.

(3) Propeller Model HC-D(2,3)(V,MV)20-7( ), - 8( )

(a) This propeller model may be controlled manually or by a governor, and is always non-reversing. If governing (constant speed), the basic components of this propeller assembly consist of a propeller, a hydraulic unit, a valve assembly, a governor, and a T-drive unit. If manual control is used, the basic components of this propeller assembly consist of a propeller, a hydraulic unit, and a valve assembly.

(b) This propeller model series is capable of approximately 14 degrees of blade angle range and uses a rubber plate or diaphragm to seal between the piston and the cylinder.

(c) On -7( ) models the hydraulic unit is designed so the cylinder of the hydraulic unit will attach to Continental E-185 and E-225 engines that use four attachment points. This requires 4 holes in the cylinder to receive 4 socket head cap screws that are threaded into the engine.

(d) On -8( ) models the hydraulic unit is designed so the cylinder will attach to an engine with an SAE 20 splined thrust plate that uses six attachment points. This requires 6 holes in the cylinder to receive 6 studs from the engine and is secured in place with one nut on each stud.

2. Model Designation System

A. Propeller Model Designation

(1) Hartzell Propeller Inc. uses a model number designation system to identify specific propeller and blade assemblies. An example model number would be HC-D3V20-6L/V8433, with the slash mark separating the propeller designation from the blade designation.

(2) The propeller model number is impression stamped on the propeller hub. The blade model number is impression stamped on the butt end of the blade, as well as ink stamped or identified by a label on the camber side of the blade.

(3) For additional information about the model number designation system, refer to Hartzell Propeller Inc. Application Guide Manual 159 (61-02-59) or the applicable owner's manual.

B. Blade Shank Designation

(1) Hartzell Propeller Inc. blades are often referred to as "D" shank, "Y" shank, etc. For most blades, the shank type is identified in the prefix letters of the blade model designation. For example, blade model number V8433N means the blade has a "V" shank; however, there are exceptions to this rule. For example, "Y" shank blades do not use the letter "Y" in the model designation. The same basic blade type may have more than one shank type, e.g. V8433N, MV8433N.

(2) For more information about blade shank designs, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

C. Conversion From V Shank to MV Shank

(1) "V" shank models, which have double-shoulder configuration, have additional repetitive inspections required by Airworthiness Directive AD 97-18-02.

(2) "MV" shank models, which have a single-shoulder configuration, are not affected by the AD.

(3) "V" shank blades can be converted to "MV" shank to avoid the inspections required by AD 97-18-02.

(4) Approval Basis:

(a) The MV blade and propeller designs are approved under the same FAA Propeller Type Certificate as previous V shank propellers.

(b) Many existing FAA Aircraft Type Certificate Data Sheets for the old aircraft affected by this Bulletin are unlikely to be revised to specifically reflect approval of the new MV type propellers. However, MV type propellers are approved for use on all applications that previously used X or V shank blades. There is a statement in the recently revised FAA Propeller Type Certificates for the ( )HC-(A,D)(2,3)MV( ) models that says the "MV" can be substituted for propeller models with "X" or "V" in the same location.

NOTE: Similar conditions have existed for many years where V shank blades were used to replace earlier X shank blades and A or D type hubs were used to replace earlier 1 or 8 type hubs. Applicable FAA Propeller Type Certificates have statements like: "...V may be substituted for X..." or "...A can be substituted for 8...".

For many older propeller designs, the FAA Aircraft Type Certificate was never updated and may show, for example, a HC82XK-2 propeller even though a later HC-A2VK-2 propeller is usable and approved.

Also, note that if a FAA Aircraft Type Certificate calls for a later propeller design (like A2VK), typically there is no provision to allow use of earlier designs (like 82XK).

TESTING AND FAULT ISOLATION - CONTENTS

LIST OF FIGURES

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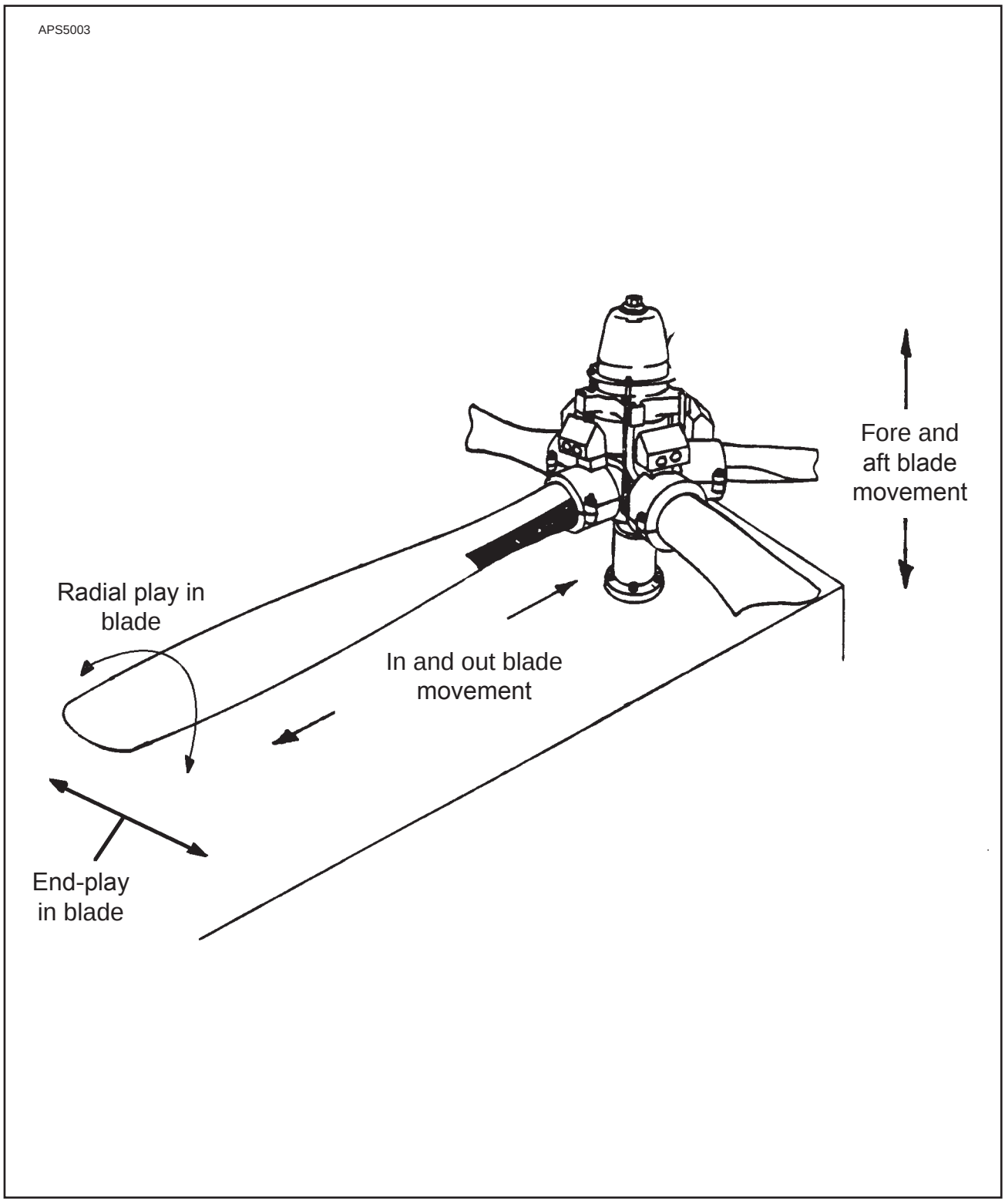
1. Troubleshooting Guide

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

	Problem	Probable Cause	Remedy
A.	Pitch changes to high pitch, but will not change to low pitch properly.	Nicked or crushed line causing low engine oil pressure.	Oil pressure for the 7.25 inch (184.1 mm) diameter cylinder should not be below 45 psi and with a 8-7/8 inch (225.4 mm) diameter cylinder, not below 30 psi.
		or Excessive friction, which minimizes the hydraulic and counterweight forces.	See 1.D. "Friction".
B.	Pitch changes to low pitch, but will not change to high pitch properly.	Drain line that is either too small or too long.	Drain line should never be less than a 3/8 inch (9.6 mm) line, and if possible it should return directly to the crankcase through a distance of not over 18 inches (457 mm).
		or Excessive friction, which minimizes the hydraulic and counterweight forces.	See 1.D. "Friction".
C.	Pitch does not change properly toward both high and low pitch.	Combination of low oil pressure and a drain line that is too small or too long.	See section A. and B. above.
		or Excessive friction, which minimizes the hydraulic and counterweight forces.	See 1.D. "Friction".
		or Failure of the A-38( ) thrust bearing.	Replace the A-38( ) thrust bearing having a riveted cage, with an A-38B thrust bearing having a bakelite cage.
		or Improper greasing of the A-38( ) thrust bearing.	Grease the thrust bearing with one tablespoon of high speed bearing grease CM139.
		or Deterioration of the rubber diaphragm.	Replace the rubber diaphragm.

Problem	Probable Cause	Remedy
D. Friction	Solidified grease.	Use recommended greases.
	or Balls in the blade split-bearing are unusually rough, corroded, or chipped.	Replace the split-bearing assembly.
	or The snap ring is wedged beneath the inboard race of the blade bearing.	Replace the snap ring.
	or Over-tightening of the blade clamps.	Disassemble the blade clamps and reassemble using new clamp gaskets. Follow assembly instructions and retorque.
	or Pilot tubes slipped out of hub.	Reposition the pilot tube. Replace the pilot tube with another that has a 0.002 inch (0.051 mm) greater diameter. Refer to Standard Practices Manual 202A (61-01-02).
	or Lack of lubrication.	Add approved grease to blade clamp lubrication fittings.
E. Blade Slippage in Blade Clamp.	Lubricant action of sealer has reduced the friction between blade and clamp.	Follow rework procedure to correct slippage.
	or There is not enough clamping action.	Increase clamping action as necessary. Refer to Clamp Overhaul section of Hartzell Propeller Inc. Manual 202A (61-01-02).

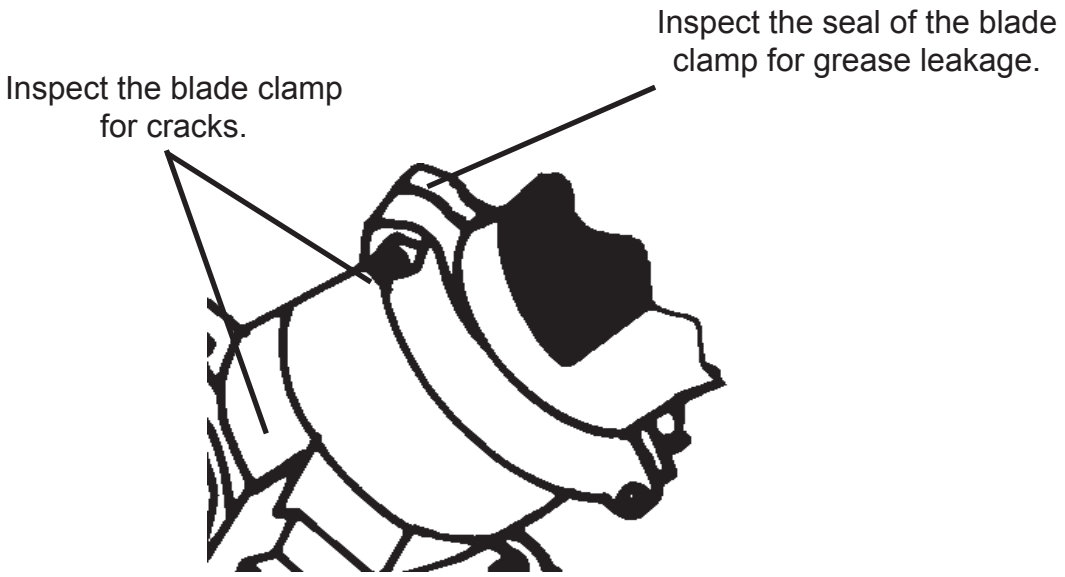
Problem	Probable Cause	Remedy
F. Oil Leakage	O-ring deterioration.	Replace O-ring.
	or Piston O-ring grooves nicked or rough.	Polish out nicks with fine emery cloth.
	or Surface of cylinder is rough or scratched.	Polish out nicks with fine emery cloth.
	or Servo valve O-rings.	Replace with double O-rings.
	or Valve gasket leaking.	Replace soft paper gasket between valve and piston with an A-71-2. Also use thin gasket compound.
	or Hydraulic lines leaking.	Tighten or replace hydraulic lines.
	or Engine crankshaft seal leaking.	Replace engine crankshaft seal.
	Note: Oil is thrown by centrifugal force into the propeller hydraulic element and works out through the thust bearing, appearing to come from the smaller O-rings. This is a common source, but difficult to recognize. Replace the engine seal if oil continues to come from the hydraulic unit after following the steps above.	
G. Grease Leakage Blade Split Bearing	Improperly torqued or loose/missing lubrication fitting.	Replace missing lubrication caps. Torque lubrication fitting to 50 in-lb (5.6 N•m).
	or Defective lubrication fittings.	Replace defective lubrication fittings.
	or Grease leaks past blade clamp seal and gaskets.	Loosen blade clamp bolts and replace gaskets.
	or Grease leaks from between blade and clamp.	Remove blade and clamp. Add approved gasket compound in radius of blade. Reassemble blade and clamp.
H. Grease Leakage Piston to Jack Plate Bearing Source is from between jack plate and cover plate	Excess grease.	None. Leak stops when excess grease is thrown off. Add only designated amount of grease.



Checking Blade Movement
Figure 101

	Problem	Probable Cause	Remedy
I.	Blades Not Tracking	Ground strike damage.	Refer to appropriate blade overhaul manual for repair procedure.
		or Hub pilot tube(s) distorted.	Follow pilot tube replacement procedure.
		or Blade face(s) out of alignment.	Refer to applicable blade overhaul manual for blade face alignment procedure.
J.	End-Play Movement of Blades Refer to Figure 101	Buildup of wear or repair tolerances.	Total 0.100-in. (2.54-mm) end-play is permissible.
K.	In-and-Out Movement of Blades Refer to Figure 101	Buildup of wear or repair tolerances.	Without grease in blade clamps and split bearings, maximum allowable fore-and-aft movement is 0.100 inch (2.54 mm). With grease in blade clamps and split bearings, there should be no fore-and-aft movement in the blades.
L.	Fore-and-Aft Movement of Blades Refer to Figure 101	Buildup of wear or repair tolerances.	Total 0.100 inch (2.54 mm) fore-and-aft movement is permissible.
M.	Radial Movement of Blades Refer to Figure 101	Buildup of wear or repair tolerances.	Radial movement of 0.5 degree is permissible.

Problem	Probable Cause	Remedy
N. Excessive Propeller Vibration Refer to Figure 102	Blade slipped in clamp.	Inspect blade-to-blade angles and reset angles.
	or Cracked blade clamp.	Magnetic particle inspect blade clamp and replace defective part.
	or Bent, cracked, or damaged blade.	See appropriate Hartzell Propeller Inc. Blade Overhaul manual.
	or Cracked or damaged hub.	See Steel Hub Overhaul section of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).



Abnormal Vibration
Figure 102

2. Lightning Strike on Hub or Blade

A. In the event of a propeller lightning strike, an inspection is required before further flight/operation.

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

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

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AUTOMATIC TEST REQUIREMENTS (NOT APPLICABLE)

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

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DISASSEMBLY - CONTENTS

LIST OF FIGURES

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1. Removal of the Propeller Assembly from the Engine

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

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

A. General

The following propeller removal instructions are to be used as a reference when removing a propeller in accordance with the airframe manufacturer's maintenance manual.

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

B. Spinner Removal

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

(1) Remove and discard fasteners that attach the spinner dome to the bulkhead.

(2) Remove the spinner dome and store it with care.

C. Propeller Removal

WARNING: MAKE SURE THE SLING IS RATED UP TO 500 POUNDS (227KG) TO SUPPORT THE WEIGHT OF THE PROPELLER ASSEMBLY DURING INSTALLATION.

(1) Support the propeller assembly using a suitable sling and mobile hoist.

(2) Remove the hub lock safety pin (190).

(3) Completely loosen the hub nut (180) and unthread from the engine shaft threads.

NOTE: Because the hub nut is pulling the propeller hub off the tapered rear cone (200), there will be significant resistance to the loosening of the hub nut.

D. HC-D2(V,MV)20-3 PROPELLER MODELS ONLY

CAUTION: VALVE MUST BE IN HIGH PITCH POSITION TO BLEED AIR INTO THE CYLINDER.

(1) Twist the counterweights (340) toward high pitch so the push rods back out of the hub lugs.

NOTE: Push rods will move toward the engine

(2) Slide the hub on the engine shaft far enough to allow the jack assembly push rods (800) to completely slide out of the hub lugs.

(3) Turn the jack plate unit (770) until the pitch change forks (810) disengage from the pitch change blocks (220).

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

(4) Reference the blocks (220), if reusable, to the forks (810) to insure reassembly with the same fork.

(5) Remove the blocks (220) from the forks (810).

(6) Pull the hub (10) with blades from the engine shaft.

(7) Place the propeller on a propeller cart for transport.

(8) Disconnect the reverse pitch control cable from the hydraulic valve lever (the short end extending from the valve spool).

(9) Disconnect the reverse pitch control cable from the hydraulic valve lever (the long end extending from the valve spool).

WARNING: OIL WILL BE RELEASED FROM THE CYLINDER AND PISTON CAVITY WHEN THE PISTON IS REMOVED FROM THE CYLINDER. PLACE A PAN UNDER THE HYDRAULIC UNIT TO CATCH THE RELEASED OIL.

(10) Remove the hydraulic oil supply and drain lines from the hydraulic valve mounted on the propeller piston.

(11) Pull the jack plate unit (770), hydraulic piston (510), and all accompanying parts out of hydraulic cylinder (540).

NOTE: The valve assembly (1000) is still attached to the hydraulic piston (510) and the hydraulic cylinder is still attached to the engine.

CAUTION: THE EXACT COMBINATION OF REAR CONE AND SPACERS MUST BE REUSED OR PROPELLER MAY NOT REACH LOW PITCH (COULD UNDERSPEED) OR HIGH PITCH (COULD OVERSPEED).

(12) Remove the rear cone (200) and spacers (210).

NOTE: The spacers are used to adjust the position of the propeller with the engine and hydraulic unit. The positioning assures that the blade pitch movement of the propeller is within the movement range of the hydraulic piston.

(13) Remove the six nuts holding the cylinder (540) to the engine mounted studs.

(14) Remove the cylinder (540) and gasket (650) from the engine.

I

(15) Remove the two screws (1250) and disassemble the valve assembly (1000) from the hydraulic piston (510).

(16) Remove the gasket (1010).

NOTE: The gasket may need to be scraped off of the valve body (1040) or the hydraulic piston (510).

E. HC-D3(V,MV)20-6L PROPELLER MODELS ONLY

(1) Remove the nuts (315) and washers (314) from the ends of the three push rods protruding from the jack assembly (770).

NOTE: Keep the nuts (315) and washers (314) with the propeller and jack assembly.

CAUTION: VALVE MUST BE IN HIGH PITCH POSITION TO BLEED AIR INTO THE CYLINDER.

(2) Twist the counterweights (340) toward high pitch so the push rods back out of the guide collar bushings in the guide collar (300).

NOTE: Push rods will move toward the engine

(3) Slide the hub on the engine shaft far enough to allow the jack assembly push rods (800) to completely slide out of the guide collar (300).

(4) Turn the jack plate unit (770) until the pitch change forks (810) disengage from the pitch change blocks (220).

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

(5) Reference the blocks (220), if reusable, to the forks (810) to insure reassembly with the same fork.

(6) Remove the blocks (220) from the forks (810).

(7) Pull the hub (10) with blades from the engine shaft.

(8) Place the propeller on a propeller cart for transport.

(9) Remove the reverse stops (313) and sleeves (312) from the ends of the three push rods protruding from the jack assembly (770).

NOTE: Keep the reverse stops (313) and sleeves (312) with the propeller and jack assembly (770).

(10) Disconnect the reverse pitch control cable from the hydraulic valve lever (the short end extending from the valve spool).

(11) Disconnect the reverse pitch control cable from the hydraulic valve lever (the long end extending from the valve spool).

WARNING: OIL WILL BE RELEASED FROM THE CYLINDER AND PISTON CAVITY WHEN THE PISTON IS REMOVED FROM THE CYLINDER. PLACE A PAN UNDER THE HYDRAULIC UNIT TO CATCH THE RELEASED OIL.

(12) Remove the hydraulic oil supply and drain lines from the hydraulic valve mounted on the propeller piston.

(13) Pull the jack plate unit (770), hydraulic piston (510), and all accompanying parts out of hydraulic cylinder (540).

NOTE: The valve assembly (1000) is still attached to the hydraulic piston (510) and the hydraulic cylinder is still attached to the engine.

CAUTION: THE EXACT COMBINATION OF REAR CONE AND SPACERS MUST BE REUSED OR THE PROPELLER MAY NOT REACH LOW PITCH (COULD UNDERSPEED) OR HIGH PITCH (COULD OVERSPEED).

(14) Remove the rear cone (200) and spacers (210).

NOTE: The spacers are used to adjust the position of the propeller with the engine and hydraulic unit. The positioning assures that the blade pitch movement of the propeller is within the movement range of the hydraulic piston.

(15) Remove the six nuts holding the cylinder (540) to the engine mounted studs.

(16) Remove the cylinder (540) and gasket (650) from the engine.

(17) Remove the two screws (1250) and disassemble the valve assembly (1000) from the hydraulic piston (510).

(18) Remove the gasket (1010).

NOTE: The gasket may need to be scraped off the valve body (1040) or the hydraulic piston (510).

F. HC-D(2,3)(V,MV)20-7 and -8( ) PROPELLER MODELS ONLY

(1) Rotate the blades to high pitch by gripping the blade counterweight on each blade clamp.

(2) Rotate the blades until the push rods protruding from the jack plate unit slide out of each of the two hub lug bushings.

NOTE: On HC-D3MV20-8D propeller models only, the three push rods protruding from the jack plate unit will slide out of each of three guide collar mounted bushings.

(3) Rotate the jack plate unit to allow each fork to disengage each pitch change block.

(4) For 2-bladed propellers, remove the pitch change block from each blade clamp link screw.

NOTE: For 3-bladed propellers, the pitch change block is removed with the blade clamps.

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

(5) If reusable, reference the blocks (220) to the forks (810) to insure reassembly with the same fork.

(6) Remove the blocks (220) from the forks (810).

(7) Using the support sling, slide the propeller from the engine splined shaft and lift the propeller from the engine.

(8) Place the propeller and the associated parts on a suitable cart for transportation.

(9) On non-governing installations, disconnect the airplane's push-pull pitch control from the hydraulic valve link (1140).

NOTE: On governing installations the cockpit control is for RPM control and connects to the governor. On nongoverning installations the cockpit control is to the valve attached to the cylinder (510) and provides for direct pitch control only.

(10) Remove the screw (950) that attaches the hydraulic valve link (1130) to the hydraulic piston (530).

CAUTION: OIL WILL COME OUT OF THE CYLINDER AND PISTON CAVITY WHEN THE PISTON IS REMOVED FROM THE CYLINDER. PLACE A PAN UNDER THE HYDRAULIC UNIT TO CATCH THE ENGINE OIL.

(11) Disconnect the hydraulic oil supply and the drain lines from the hydraulic valve that is mounted on the cylinder (510).

(12) Pull the jack plate unit (770), hydraulic piston (510), and all related parts off the guide pins of the hydraulic cylinder (540).

NOTE: The valve assembly (1000) is still attached to the hydraulic piston (510) and the hydraulic cylinder (540) is still attached to the engine.

CAUTION: THE EXACT COMBINATION OF REAR CONE AND SPACERS MUST BE REUSED OR THE PROPELLER MAY NOT REACH LOW PITCH (UNDERSPEED) OR HIGH PITCH.

(13) Remove the rear cone (200) and spacers (210).

NOTE: The spacers are used to adjust the position of the propeller with the engine and hydraulic unit so that the blade pitch movement of the propeller is within the movement range of the hydraulic piston.

(14) Remove the screws (700) from the inner ring (680).

(15) Remove the inner ring (680) from the diaphragm (660).

(16) Remove the screws (600) and washers (590) from the outer ring (610).

(17) Remove the outer ring from the diaphragm (660).

(18) Remove the rubber diaphragm (660) from the cylinder (540).

(19) Remove the six nuts holding the cylinder (540) to the engine-mounted studs.

(20) Remove the cylinder (540) and gasket (650) from the engine.

(21) Remove the two screws (1250) and disassemble the valve assembly (1000) from the hydraulic cylinder (510).

(22) Remove the gasket (1010).

NOTE: The gasket may need to be scraped off the valve body (1040) or the cylinder (510).

2. Marking Before Disassembly

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

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

(2) Keep parts with their respective assemblies and note the locations of these parts to minimize reassembly problems with propeller balance and blade angle setting.

CAUTION: USE CRAYON OR SOFT NON-GRAPHITE PENCIL CM162 TO MARK PARTS.

(3) Number blades counterclockwise from the serial number of the propeller hub (as viewed from the front, or side opposite the engine).

(4) Reinstall each blade on the hub arm from which it was removed, if possible.

(5) Record on paper each blade serial number and its matching hub arm and clamp.

3. Propeller Disassembly

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

CAUTION: DO NOT EXCEED A PRESSURE OF 100 PSI (6.89 BARS) WHEN ACTUATING PROPELLERS COVERED IN THIS MANUAL.

A. Preparation for Disassembly

Install the propeller assembly on the rotatable fixture on the assembly table, as shown in Figure 701.

B. Clamp and Counterweight Disassembly

NOTE: Refer to the Blade Clamp Overhaul chapter of Hartzell Standard Practices Manual 202A (61-01-02), for information on clamp disassembly, inspection, and repair.

(1) Remove the clamp-halves (440) from each hub arm.

NOTE: Remove the blocks (220) for 3-bladed propellers now.

(2) Remove and discard the outboard clamp bolts (450), nuts (470) and washers (460) from each clamp.

NOTE: If there was interference between the spinner and the clamp bolt, the outboard leading edge bolt in the clamp may have been installed with the head of the bolt positioned on the counterweight side of the clamp.

(3) Remove and discard the inboard clamp socket screws (420) and cotter pins (410) or safety wire from each clamp.

(4) Refer to the Blade Clamp Overhaul chapter of Hartzell Standard Practices Manual 202A (61-01-02), for counterweight removal instructions.

(5) Remove and discard the clamp gasket (430) from each clamp.

CAUTION: RECORD THE LOCATION AND NUMBER OF BALANCE WEIGHTS ON THE PROPELLER BEFORE DISASSEMBLY. AFTER OVERHAUL ASSEMBLY, USE THIS INFORMATION TO HELP STATIC BALANCE THE PROPELLER.

(6) Remove all balance weights and attaching screws, where applicable. Discard the screws.

(7) Remove and discard all lubrication fittings (400, 405) and lubrication fitting caps (480).

NOTE: On Republic Seabee installations a clamp lubrication fitting (400) may interfere with the piston-mounted valve. These lubrication fittings were cut down to the hex and silver soldered. At overhaul after lubrication, these modified fittings are replaced with a lubrication plug in the clamp hole facing the engine.

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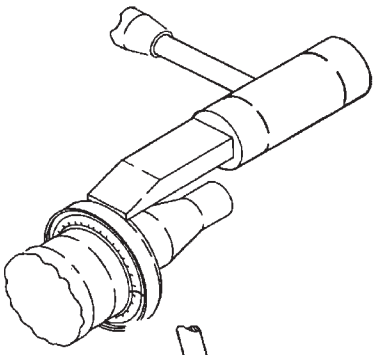
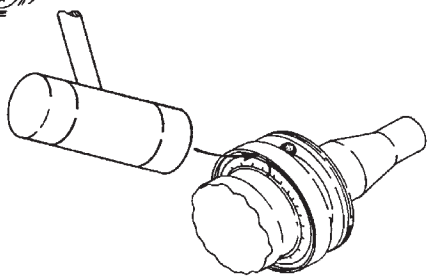
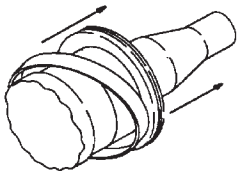


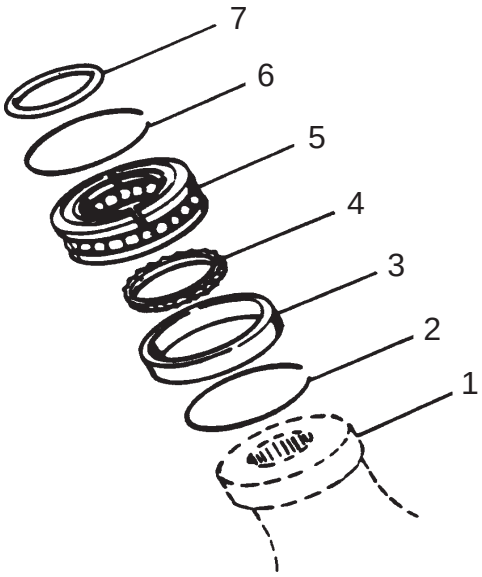
STEP ONE



STEP TWO



STEP THREE



Legend:

1. Blade
2. Wire Retention Ring
3. Guide Ring
4. Ball Spacer
5. Bearing Balls
6. Bearing Retention Ring
7. O-ring

Removing Bearing Retention Ring
Figure 301

CAUTION: REINSTALL EACH BLADE ON THE SAME HUB ARM FROM WHICH IT WAS REMOVED, TO HELP ASSURE STATIC BALANCE. RECORD ON PAPER EACH BLADE SERIAL NUMBER AND ITS MATCHING HUB ARM AND CLAMP.

(8) Remove each blade assembly from the hub (10).

C. Blade and Mounting Parts Disassembly

NOTE: Item numbers are from Figure 301.

(1) Beginning with blade position number one, remove the bearing retention ring (6) from its groove in the inboard race of the blade retention split bearing.

(2) Remove the two halves of the inboard bearing race.

(3) Remove and discard the ball spacer (4) and bearing balls (5).

(4) Clip, remove, and discard the blade O-ring (7).

(5) Use a mallet and soft punch at several places on the outboard edge of the guide ring (3) to drive the ring inboard over the shoulder of the hub arm. Refer to Figure 301, Step One.

(6) Remove the wire retention ring (2) that had been covered by the guide ring. Discard the wire retention ring if it is sprung.

(7) Turn the halves of the inboard bearing race so the split is at the top. Refer to Figure 301, Step Two.

(8) At the split, place one of the bearing balls between the outboard split-bearing race and inboard shoulder of the hub arm.

(9) Using a soft mallet, lightly tap the inboard top edge of the guide ring to dislodge the split outboard race from the guide ring.

(10) Remove the halves of the race as they become separated from the retention ring.

(11) Tilt the guide ring inboard approximately 45 degrees and remove the ring by sliding it outboard over the shoulder of the hub arm. Refer to Figure 301, Step Three.

D. Hub Disassembly

(1) HC-D2(V,MV)20-3, HC-D2(V,MV)20-7 AND HC-D2(V,MV)20-8 PROPELLER MODELS ONLY

(a) Remove the snap ring (170) to release the puller ring (160) and hub nut (180) from the hub unit (10).

(b) Remove the puller ring (160) and hub nut (180).

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

(c) Remove the bushing (50) if the hub is to be cadmium plated. Refer to the instructions, "Removal of A-155, A-218 or A-1817 Bushings", in the Steel Hub Overhaul chapter of Hartzell Standard Practices Manual 202A (61-01-02).

(d) Remove and discard the two bushings (40) if the hub is to be cadmium plated. Refer to the instructions, "Removal of Hub Tab Bushings", in the Steel Hub Overhaul chapter of Hartzell Standard Practices Manual 202A (61-01-02).

(e) Removal instructions for the pilot tube may be found in the Steel Hub Overhaul chapter of Hartzell Standard Practices Manual 202A (61-01-02).

(2) HC-D3(V,MV)20-6L AND HC-D3MV20-8D PROPELLER MODELS ONLY

(a) Loosen and remove the guide collar nut (310).

NOTE: The guide collar is still firmly clamped to the guide collar nut (310).

(b) Remove and discard the O-ring (290) from the hub (10).

(c) Loosen the socket head cap screw in the guide collar (300) and remove the guide collar.

(d) Remove the puller ring (160) and hub nut (180).

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

(e) Remove the bushing (50) if the hub is to be cadmium plated. The bushing may be removed using a soft drift. The bushing must be clocked to the hub to assure the same orientation and proper centering of the hub on the engine shaft at reinstallation. If a new bushing is required, the hub must be returned Hartzell Propeller Inc. for installation of the bushing.

(f) Removal instructions for the pilot tube may be found in the Steel Hub Overhaul chapter of Hartzell Standard Practices Manual 202A.

E. Jack Plate and Hydraulic Piston Disassembly

(1) HC-D2(V,MV)20-3 and HC-D3(V,MV)20-6L PROPELLER MODELS ONLY

(a) Support the outside of diameter of the piston (510) facing the jack plate unit (770). Place a round plate (simple tool) on the inboard edge of the jack plate unit on the side opposite the forks. Push on the round plate to drive the jack plate unit and attached bearing (670) off the hydraulic piston.

NOTE: The press fit between the hydraulic piston and the bearing (670) is released in this operation.

(b) Remove the screws (760) and washers (750).

(c) Remove the cover plate (720) and cover plate gasket (710) from the piston (510).

(d) Reach into the center bore of the jack plate unit (770) with a pair of diagonal cutters, grab the tang of the wire ring (930) and gradually work the ring out of the groove between the bearing inner race and the jack plate casting (780).

(e) Using appropriate fixturing, remove the bearing (670) from the jack plate unit (770).

NOTE: The bearing (670) is pressed onto the jack plate unit (770) and must be pressed off or driven off with a soft drift.

(2) HC-D(2,3)(V,MV)20-7 AND -8( ) PROPELLER MODELS ONLY

(a) Support the outside diameter of the piston (510) facing the jack plate unit (770). Place a round plate (simple tool) on the inboard edge of the jack plate unit on the side opposite the forks. Push on the plate to drive the jack plate unit off the hydraulic piston.

NOTE: The press fit between the hydraulic piston and the bearing (670) is released in this operation.

(b) Remove the screws (760) and washers (750).

(c) Remove the cover plate (720) and cover plate gasket (710) from the hydraulic piston (510).

(d) Using appropriate fixturing, remove the bearing (670) from the hydraulic piston (510).

NOTE: The bearing (670) is pressed into the hydraulic piston (510) and must be pressed off or driven off with a soft drift.

F. B-93-D Valve Disassembly - HC-D2(V,MV)20-3 and HC-D3(V,MV)20-6L Propellers

(1) Lift the loop of the spring (1180) off the groove in the guide pin (1200).

(2) Remove the cotter pin (1170) that holds the other end of the spring (1180) to the valve body.

(3) Remove the cotter pin (1220) from the end of the guide rod (1210).

(4) Slide the valve spool (1050) and the guide pin (1200) out of the valve body (1040).

(5) Remove the guide pin (1200) that connects the valve link (1240) and valve spool (1050).

(6) Remove the valve link (1240) from the valve spool (1050).

(7) Remove the O-ring (1230) from the valve body (1040). Discard the O-ring.

G. B-93-A, -B, -C Valve Disassembly - HC-D2(V,MV)20-7 and -8 Propellers

(1) Remove the cotter pin (1070) and clevis pin (1080).

(2) Remove the cotter pin (1075) and clevis pin (1100). Disassemble the links (1140) and (1130), and the spacer (1090).

(3) Remove the stop nut (1110) and stop screw (1120) from the link (1130).

(4) Slide the valve spool (1050) out of the valve body (1040).

(5) Remove the O-rings (1060) from the valve body (1040). Discard the O-rings.

H. B-93-AG, -BG, -CG Valve Disassembly - HC-D2(V,MV)20-7 and -8 Propellers

(1) Remove the cotter pin (1070) and clevis pin (1080). Disassemble the link (1130) from the valve spool (1050).

(2) Slide the valve spool (1050) out of the valve body (1040).

(3) Remove the O-rings (1060) from the valve body (1040). Discard the O-rings.

I. B-93-E Valve Disassembly - HC-D3MV20-8D Propellers

(1) Remove the cotter pin (1070) and clevis pin (1080).

(2) Remove the cotter pin (1075) and clevis pin (1100). Disassemble the links (1140) and (1130), and the spacer (1090).

(3) Remove the stop nut (1110) and stop screw (1120) from the link (1130).

(4) Slide the valve spool (1050) out of the valve body (1040).

(5) Remove the O-rings (1060) from the valve body (1040). Discard the O-rings.

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CLEANING - CONTENTS

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1. General Procedures for Cleaning Parts

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

2. Specific Cleaning Procedures

   A. Cleaning Steel Parts for Magnetic Particle Inspection

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

   B. Cleaning Steel Parts for Cadmium Replating Procedures

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

   C. Cleaning Steel Parts for Penetrant Procedures

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

   D. Cleaning Aluminum Parts for Penetrant Procedures

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

   E. Cleaning Aluminum Parts for Chromic Acid Anodizing Procedures

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

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CHECK - CONTENTS

LIST OF FIGURES

LIST OF TABLES

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1. Inspection Interval Requirements

   A. For information about life limited components refer to the Airworthiness Limitations chapter of Hartzell Propeller Inc. Owner's Manual 140.

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

      (1) Hartzell Propeller Inc. Service Letter HC-SL-61-61Y is available on the Hartzell Propeller Inc. website at www.hartzellprop.com.

2. Inspection Requirements

   A. Inspect the specified parts to determine if they meet the specifications in this chapter.

      (1) Retire any serial-numbered part found unairworthy in accordance with the Mandatory Parts Retirement Procedure chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

   B. Visual Inspection

      (1) Visually examine all parts.

         (a) A part that has obvious defects or damage that would affect form, fit, or function must be removed from service.

      (2) Definitions

         (a) Corrosion is active electrochemical deterioration, such as rust, that can result in pitting.

         (b) Linear pitting is the configuration of the majority of pits forming a pattern in the shape of a line.

   C. Penetrant Inspection

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

   D. Magnetic Particle Inspection

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

E. Dimensional Inspection

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

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

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

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

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

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

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

3. Replacement Requirements

A. If the component has corrosion, wear, obvious defects, or damage that is less than the permitted serviceable limits, no further action is required.

B. If the component has cracks, corrosion, wear, obvious defectss, or damage that is greater than the permitted serviceable limits, the component must be repaired or replaced in accordance with Corrective Action in this chapter.

4. Repair

A. Parts that can be repaired are specified in the Corrective Action section of Table 501, Component Inspection Criteria, in this chapter.

B. Repair procedures are found in the Repair chapter of this manual, unless specified differently.

5. Specific Inspection Requirements

   A. For daily inspection procedures of a propeller, refer to Hartzell Propeller Inc. Manual 140 (61-00-40), Propeller Owner's Manual and Logbook.

   B. For requirements and procedures for inspecting steel hubs, refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

   C. For requirements and procedures for inspecting aluminum blades, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

   D. For requirements and procedures for inspecting blade clamps, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

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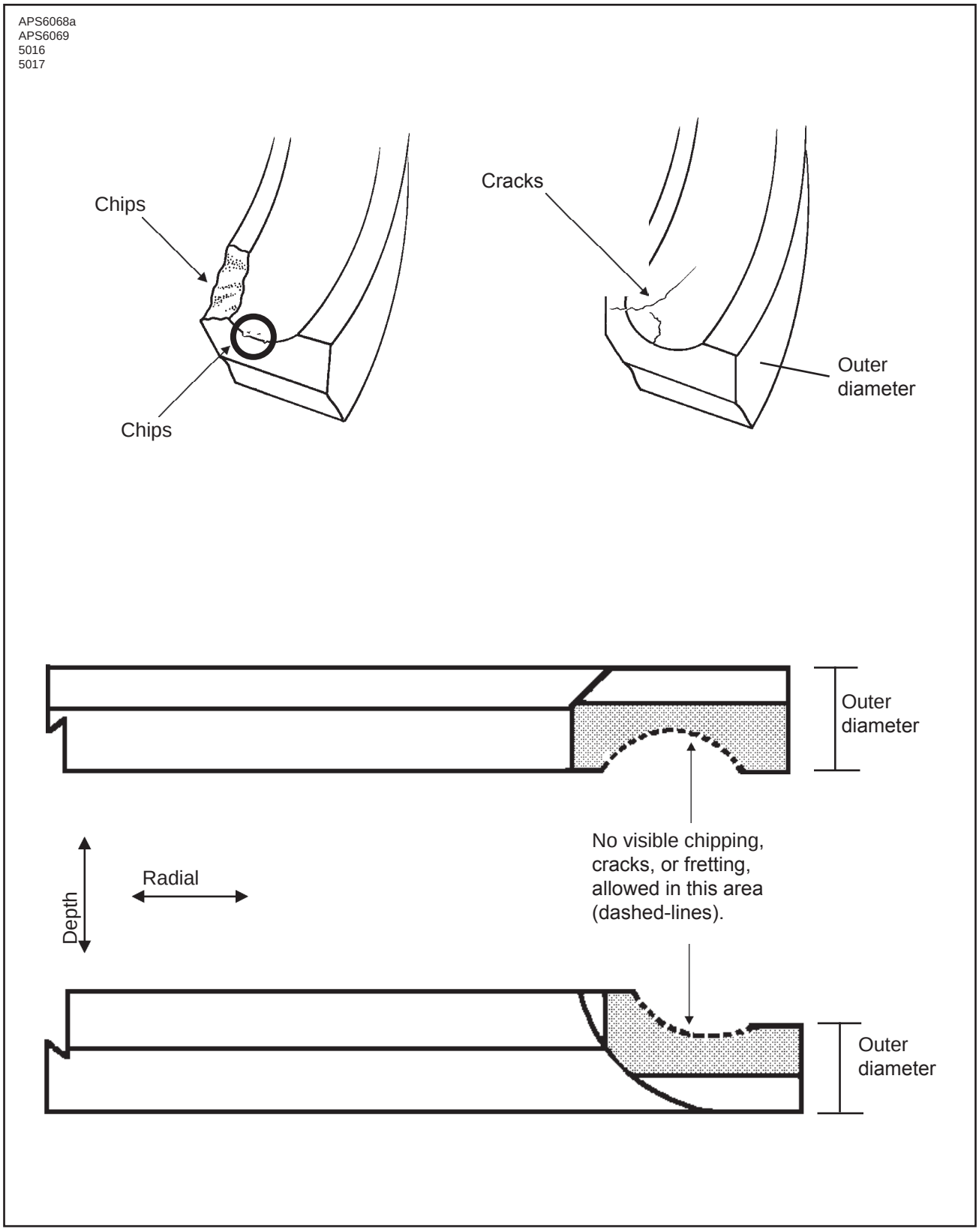

Blade Split Bearing
Figure 501

Component Inspection Criteria
Table 501

Inspect	Serviceable Limits	Corrective Action
6. BLADE SPLIT BEARING INSPECTION		
A. Visually inspect the outer diameter of all bearing races for indications of fretting damage.	All indications of fretting must be removed.	Remove fretting indications with a Scotch Brite™ pad.
B. Visually inspect the ball track of each bearing race for indications of fretting (refer to Figure 501).	No indications of fretting are allowed.	None. Retire the bearing races.
C. Visually inspect the split lines of all bearing races for chipping or cracks (refer to Figure 501).	No chips or cracks are allowed.	None. Retire the bearing races.
D. Dimensionally inspect the depth of pitting or damage in the ball track of each bearing race.	0.005 inch (0.12 mm) depth of pits or damage is allowed.	None. Retire the bearing races.
E. Blade split bearing races must be inspected using the magnetic particle method at each overhaul	No cracks are allowed.	None. Retire the bearing races.
7. BEARING GUIDE RING		
A. Magnetic particle inspect and re-cad plate.	No cracks are allowed.	None. Retire the ring.

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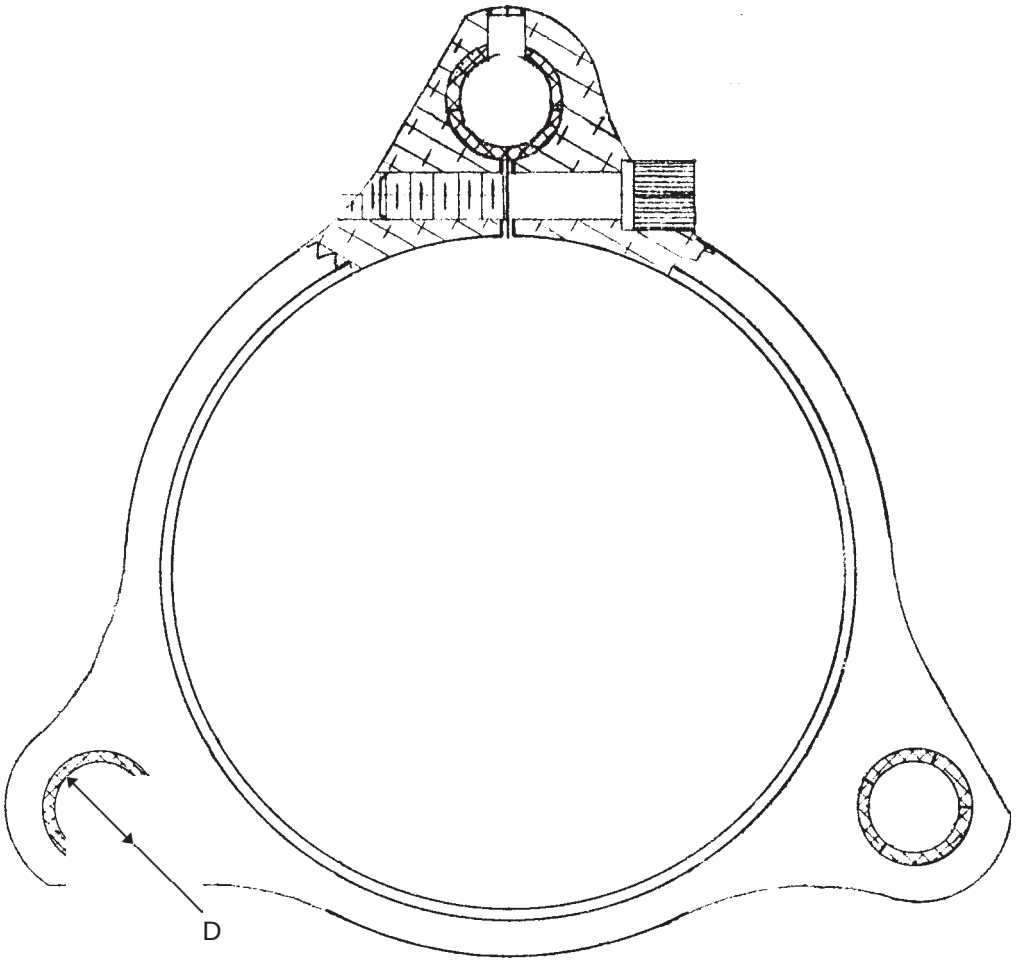
Cracks typically occur in the area near the socket head cap screw opening



Guide Collar
Figure 502

Component Inspection Criteria
Table 501

Inspect	Serviceable Limits	Corrective Action
8. GUIDE COLLAR INSPECTION		
A. Visually inspect the guide collar for cracks. Refer to Figure 502 for typical crack locations.	No cracks are allowed.	None. Retire the guide collar.
B. Visually inspect the guide collar for nicks, gouges, or other damage.	Maximum depth of damage may not exceed 0.020 inch (0.50 mm).	Using an abrasive pad CM47 or equivalent, polish the damaged area, if less than 0.020 inch (0.50 mm), and Alodine coat.
C. Inspect the guide collar using the dye penetrant method.	No cracks are allowed.	None. Retire the guide collar.
D. Dimensionally inspect the ID of the guide collar bushings. See Figure 502, Item D.	If the bushing is worn more than 0.008 inch (0.20 mm) ovality, replace it. Refer to Figure 502 for bushing ID requirements.	Bushings that have an ID greater than 0.511 (12.97 mm) inch must be removed and replaced. Refer to the Repair chapter of this manual for replacement procedures.

Component Inspection Criteria
Table 501

Inspect	Serviceable Limits	Corrective Action
9. SPACER		
A. Visually inspect the spacer for wear or damage.	No indications of wear or damage are permitted.	None. Retire the spacer.
10. A-38B(G) THRUST BEARING		
A. Visually inspect the external surfaces for corrosion or nicks.	Maximum permissible depth of damage is 0.005 inch (0.12 mm)	Using an abrasive pad CM47 or equivalent, polish the damaged area if 0.005 inch (0.12 mm) deep or less. Retire the bearing if it does not fit tightly in the piston and jackplate after polish. Retire the bearing if the damaged area exceeds 0.005 inch (0.12 mm) deep.
B. Rotational freedom.	Bearing races must rotate smoothly on cage supported balls with no perceptible catch or roughness.	None. Retire the thrust bearing.
C. Visually inspect the ball track surface of each race.	No indications of corrosion or damage are permitted.	None. Retire the thrust bearing.
11. BALANCE WEIGHT		
A. Visually inspect the balance weight for indications of corrosion and pitting.	No corrosion is permitted. Maximum permitted depth of pitting is 0.005 inch (0.13 mm).	Light corrosion must be removed by glass bead cleaning. Replace the balance weight if depth of pitting exceeds 0.005 inch (0.13 mm).
B. Visually inspect for cadmium plate coverage.	A few scratches are acceptable; otherwise, cadmium plate must completely cover the balance weight.	Replate the balance weight in accordance with the Cadmium Replating chapter of Standard Practices Manual 202A (61-01-02).

REPAIR - CONTENTS

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

1. General Repair Requirements

A. Shot Peening

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

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

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

(a) Re-shot peening must be performed only by a repair station that is certified by Hartzell Propeller Inc.

1 A list of the repair stations that are formally certified to perform shot peening and the expiration dates of the sample approvals may be found by:

(a) Referring to Sample Program Approvals on the Hartzell Propeller Inc. website at www.hartzellprop.com

(b) Contacting Hartzell Propeller Inc. Product Support by telephone at (937) 778-4379, or at (800) 942-7767 toll free from the United States and Canada

(c) E-mail request to techsupport@hartzellprop.com

B. Minor Damage to Metal Parts

(1) Eliminate all evidence of scratches, nicks, burrs, and other minor damage by using a fine emery cloth or abrasive pad, such as CM47.

(a) Make sure to blend the polished area in with the surrounding area.

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

(2) Make sure that the part is still within tolerance after any type of repair. Refer to the Check chapter and the Fits and Clearances chapter of this manual.

2. Blade Repair

   A. For aluminum blade repair, replacement, and modification instructions, refer to Hartzell Propeller Inc. Aluminum Blade Overhaul Manual 133C (61-13-33).

3. Hub Repair

   A. For requirements and procedures for repairing steel hubs, refer to the Steel Hub Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

4. Blade Clamp Repair

   A. For requirements and procedures for repairing blade clamps, refer to the Blade Clamp Overhaul chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

5. Spinner Assembly Repair/Modification

   A. For requirements and procedures for repairing or modifying spinner assemblies, refer to Hartzell Propeller Inc. Metal Spinner Maintenance Assembly Manual 127 (61-16-27).

6. Guide Collar Repair

   A. Replacement of Guide Collar Bushings

      (1) Using care not to damage the guide collar, drill out the oversized bushing(s) (303).

      (2) If the bushing(s) (303) being replaced is located at the split, drill out the staking pin.

      (3) Install A-116D-1 bushing(s) (303). Refer to the Special Adhesive and Bonding Procedures chapter of Hartzell Standard Practices Manual 202A (61-01-02) for guide collar bushing replacement procedures.

      (4) Install a new A-114-C staking pin (307) if the bushing(s) (303) at the split was replaced. Peen the end of the staking pin.

      (5) Ream the bushing(s) (303) to 0.508 - 0.510 inch (12.90 - 12.95 mm) in diameter.

      (6) Replace the A-2038-12 socket head cap screw (305), if necessary.

TEMPORARY REVISION NO. 003

To Manual 61-10-00

This Temporary Revision is now considered a part
of Hartzell Propeller Inc. Propeller Maintenance Manual 100E.

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

Insert this Temporary Revision in the REPAIR chapter with this transmittal page facing page 604 (Rev. 5 Apr/14).

Reason for issue: To revise the section, "Hub Lug Repair".

NOTE: See page 1 of this Temporary Revision.

7. Hub Lug Repair

A. For replacement of the A-116-A1 hub lug bushing, refer to the section, "Bonding of A-116A( ) Bushing Into the Guide Lug of a Steel Hub" in the Special Adhesive and Bonding Procedures chapter of Standard Practices Manual 202A (61-01-02).

7. Hub Lug Repair

A. Replacement of the A-116-A1 Hub Lug Bushing

CAUTION: DO NOT DAMAGE HUB LUG.

(1) Drill out the bushing(s) (40), using care not to damage the hub lug.

CAUTION: DO NOT USE AN OIL-BASED CLEANING AGENT ON THE PARTS BEFORE BONDING.

(3) Materials - Refer to Hartzell Standard Practices Manual 202A (61-01-02) Consumable Materials, Table 301:

(a) Adhesive CM96

(b) Solvent, CM11, CM22, CM41, CM44, CM106 or equivalent

(4) Preparation

(a) Remove (or verify the lack of) plating from the steel surface to be bonded.

(b) Dip the hub lug in the approved solvent to remove oil, grease and other contaminates.

CAUTION: DO NOT DIP THE BUSHING DIRECTLY INTO THE SOLVENT.

(c) Clean the bushing (40), if necessary, by wiping with a clean rag dipped in the approved solvent.

(5) Installation

(a) Check the adhesive CM96 for expiration before use.

WARNING: THE APPROVED ADHESIVE IS AN EYE IRRITANT, AND BONDS SKIN IN SECONDS. IN CASE OF EYE OR MOUTH CONTACT, HOLD EYE LID OR MOUTH OPEN AND FLUSH WITH WATER. IF FINGERS BECOME BONDED, APPLY SOLVENT (ACETONE OR NAIL POLISH REMOVER) TO CONTACT AREA AND CAREFULLY PRY SKIN APART.

WARNING: AVOID PROLONGED BREATHING OF VAPORS. USE WITH ADEQUATE VENTILATION.

(a) Pour a small amount of adhesive CM96 into a suitable container. The container must be deep enough to ensure that a minimum of 50 percent of the bushing length is covered with adhesive.

(b) Place one end of bushing (40) into the adhesive, coating at least one half of the bushing length. Immediately press the bushing into the hub lug bore using a bushing application tool and a suitable press. A spindle of a drill press works well for this application.

(c) Press the bushing (40) into the hub lug with one continuous motion. Intermittent movement of the bushing can cause the adhesive to fail.

(d) Remove excess adhesive with a clean, dry rag.

(6) Cure

(a) Adhesive CM96 attains fixture strength (20 percent of maximum strength) in 30 - 60 seconds.

(b) Full bond strength is achieved in 24 hours.

(7) Inspection

(a) Following the cure time, test the bushing (40) to 300 pounds (1334 N).

(8) Ream the ID of the bushing(s) (40) to a diameter of 0.5020 - 0.5030 inch (12.750 - 12.776 mm).

ASSEMBLY - CONTENTS

A. The procedures for installing the propeller assembly onto the aircraft that were previously part of this manual have been relocated to Hartzell Propeller Inc. Owner's Manual 140 (61-00-40).

LIST OF FIGURES

1. General

A. Unless instructed otherwise, lubricate all O-rings with lubricant CM12 before installing them in the propeller assembly.

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

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

D. Refer to Hartzell Manual 202A (61-01-02), Standard Practices, for steel hub assembly procedures.

E. Refer to Hartzell Manual 133C (61-13-33), Aluminum Blade Overhaul, for blade bore plug and blade bore bearing installation procedures.

F. Refer to Hartzell Manual 202A (61-01-02), Standard Practices, for blade clamp assembly procedures.

G. Read all assembly instructions before beginning the assembly procedures.

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

CAUTION 1: USE COMPRESSED AIR THAT HAS BEEN FILTERED FOR MOISTURE, OR NITROGEN TO ACTUATE THE PROPELLERS.

CAUTION 2: DO NOT EXCEED A PRESSURE OF 100 PSI (6.89 BARS) WHEN ACTUATING PROPELLERS COVERED IN THIS MANUAL.

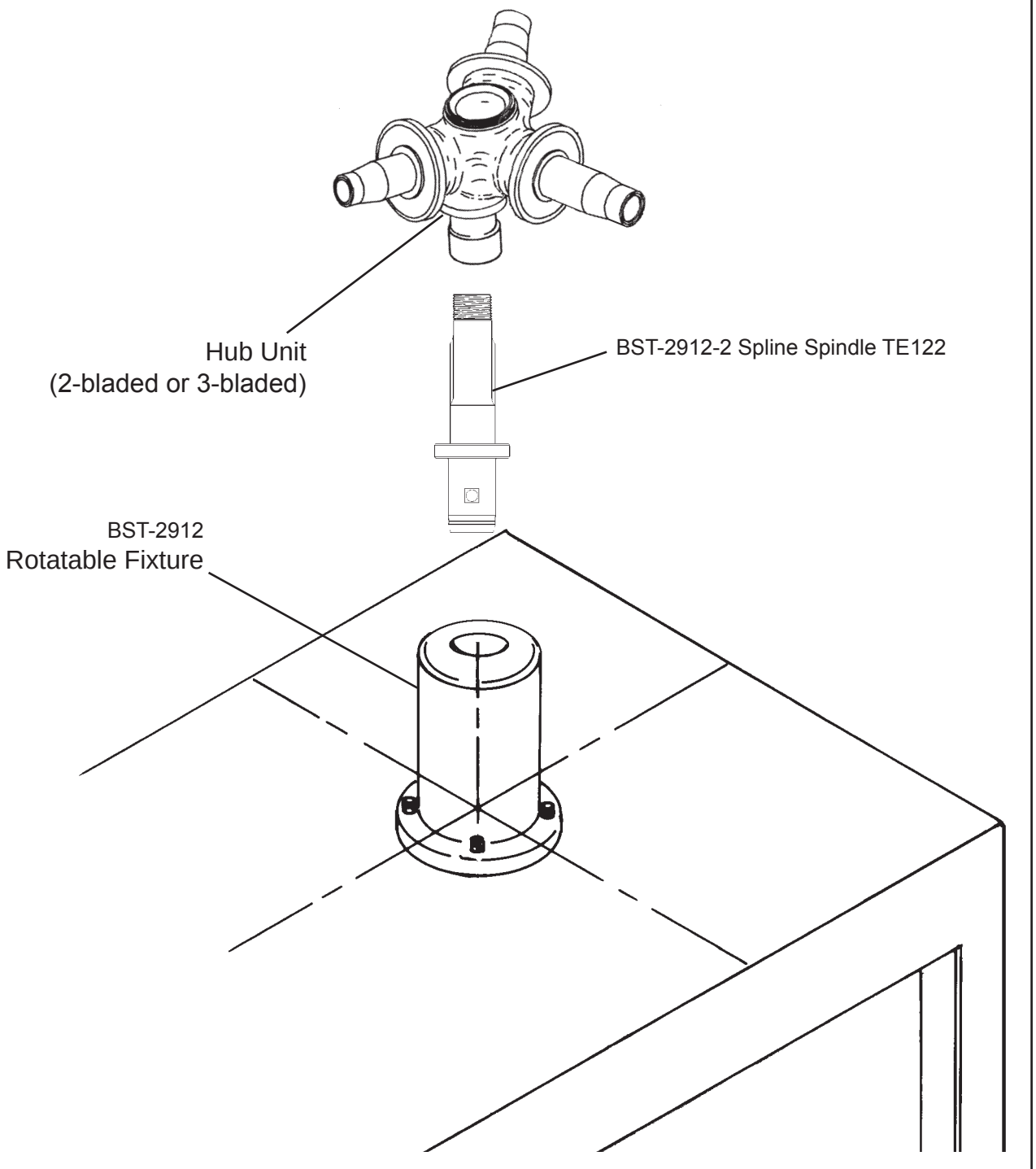
H. Make sure propeller is removed before engine is removed from or installed in the airframe.

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

I. Follow the airframe manufacturer's instructions for installing and removing the propeller. If such instructions are not in the airframe manufacturer's manual, then follow the instructions in the appropriate Hartzell Propeller Owner's Manual. However, mechanics must consider that the propeller owner's manual does not describe important procedures that are beyond Hartzell's control. In addition to propeller installation procedures, items such as rigging, installation and adjustment of de-ice equipment and propeller synchronization devices are normally found in the airframe manufacturer's manuals.

APS0184a
ASP6004
APS6003a

NOTE: Centerline of base of Rotatable Fixture establishes station reference for setting blade angle.



Hub Onto Rotatable Fixture
Figure 701

2. Specific Assembly and Installation Procedures

A. Observe the following procedures for assembly and reinstallation of specific units and assemblies.

NOTE: All item references are to Figures 1001 through 1025, unless otherwise noted.

B. Blade and Spline Mounting Parts Assembly

(1) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701. Tighten the shaft nut.

3. Blade and Mounting Parts Assembly

A. Assembly for all models.

CAUTION: BE SURE THE INTERNAL RECESS OF THE BEARING GUIDE RING FACES OUTBOARD WHEN THE GUIDE RING IS SLIPPED OVER THE BLADE ARM FLANGE OF THE HUB UNIT.

(1) Use a light mallet and special tool TE309 (Figure 702) to drive a blade retention split-bearing guide ring (80) onto one blade arm flange of the hub unit (10).

NOTE: Drive the guide ring far enough onto the blade arm flange that the ring forms a narrow channel on the inboard surface of the flange.

(2) Repeat this guide ring installation procedure for the other blade arm flanges on the hub.

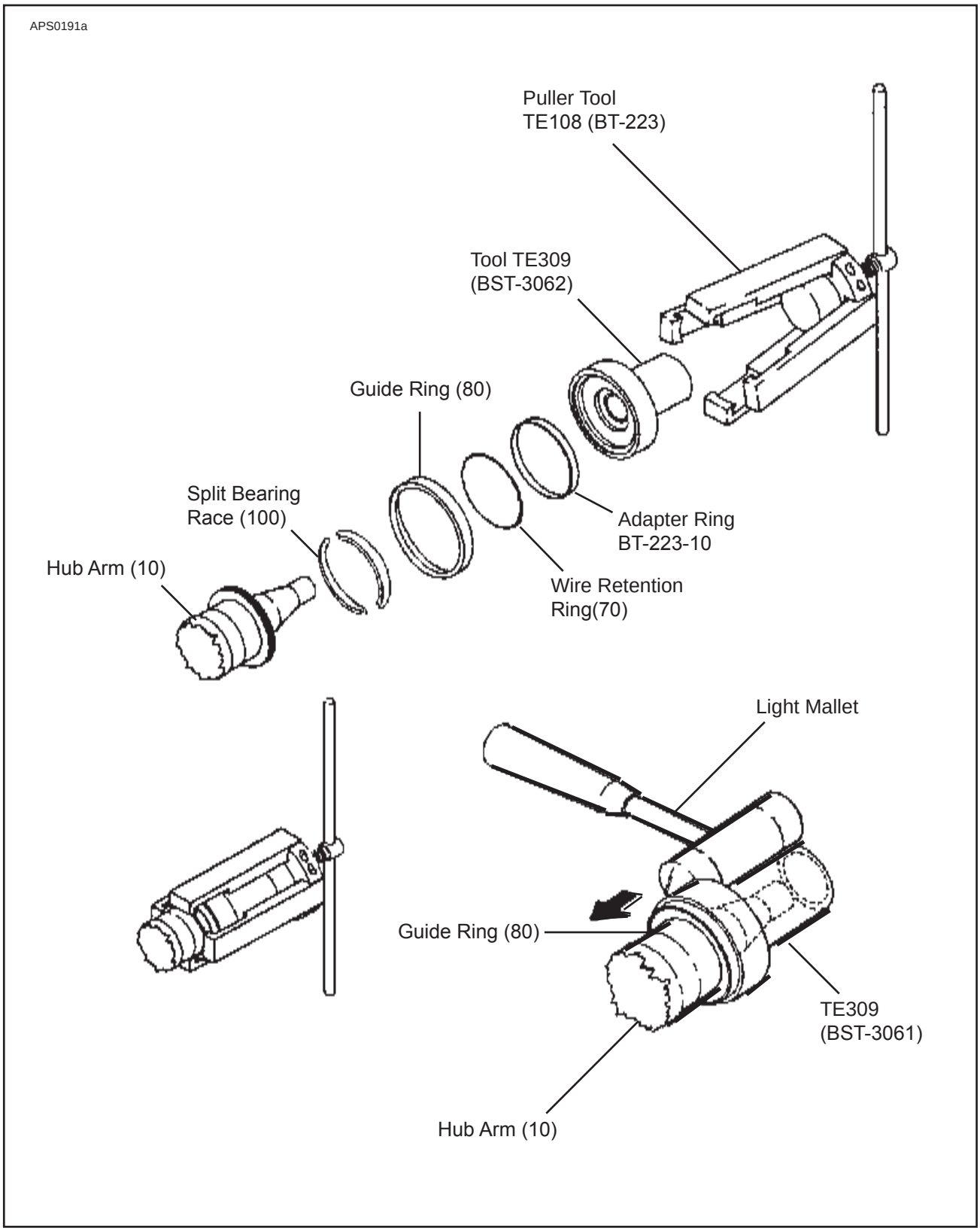
(3) Use lubricant CM12 to lightly grease the inboard surface of each blade arm flange.

(4) Place the halves of an outboard bearing race (matched set) in position over one hub arm.

NOTE: The break-line for the bearing race halves should be perpendicular to the table top.

(5) Use a combination of tools TE309 and TE108 to press the guide ring far enough onto the outboard bearing race to allow insertion of the wire retention ring (70) into the groove in the blade arm flange (Figure 702).

(6) Install the wire retention ring.



Hub Arm Build-Up
Figure 702

(7) Use tools TE309 and TE108 (Figure 702) to pull the bearing guide ring (80) outboard far enough to allow the wire retention ring (70) and the guide ring (80) to contact each other. The wire retention ring will fit in the recess of the guide ring.

CAUTION: THE WIRE RETENTION RING MUST BE FULLY ENCLOSED TO ENSURE IT IS NOT PINCHED.

(8) Check to make sure the wire retention ring is fully enclosed.

(9) Lubricate the blade O-ring (150) with lubricant CM12 and slide it over the blade arm flange of the hub to a location inboard of the thrust bearing. Leave it there for use later in the reassembly.

(10) Repeat Steps 3.A.(4) through 3.A.(9) for the remaining hub arms.

(11) Remove the hub unit from the rotatable fixture on the assembly table and use special tool TE309 (Figure 702) to hold the hub unit as shown in Figure 703.

NOTE: The arm of the hub being fitted with bearing races must be facing down so that the hub flange and guide ring form a "cavity" that will hold the bearings.

WARNING: THE BREAK LINE OF THE BEARING-HALVES MUST BE AT A RIGHT ANGLE TO THE BREAK LINE OF THE BLADE CLAMP-HALVES.

CAUTION: ANY GAP BETWEEN THE HALVES OF THE OUTBOARD BEARING RACE SHOULD BE NO GREATER THAN 0.001 INCH (0.025 MM).

(12) Install the ball bearing spacer (130) and the required number of bearing balls onto the outboard bearing races, taking care not to scratch the races.

(13) Apply a slight amount of sealant CM93 to the broken edges of the inboard bearing race (matched set). Wipe clean any excess sealant that may extrude into the bearing area when the bearing halves are joined.

(14) Place the inboard halves of the bearing race around one blade arm of the hub unit and install the wire bearing retention ring (140) to hold the halves in place.

CAUTION: THE OPENING OF THE RETENTION RING MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE INBOARD BEARING RACE.

(15) Apply a small bead of sealant CM93 to the inboard bearing race at the chamfer (break point) in order to evenly fill the void in the chamfered area of the race.

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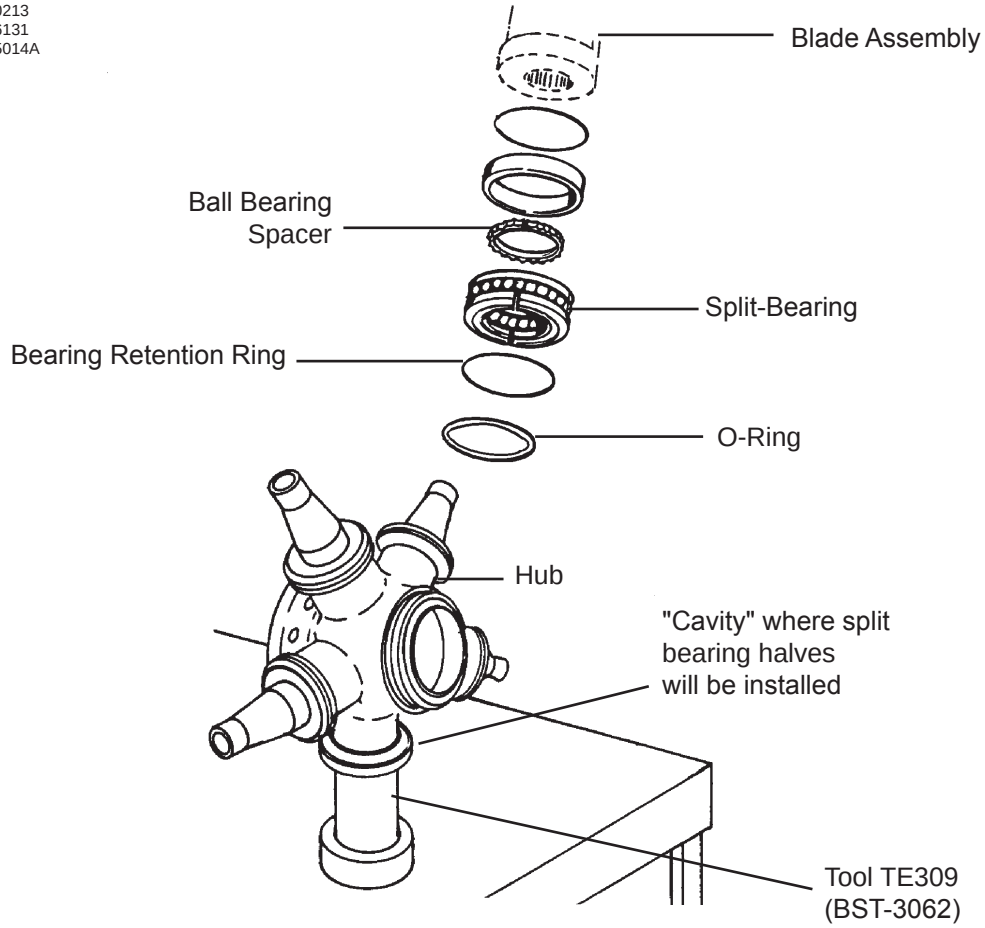
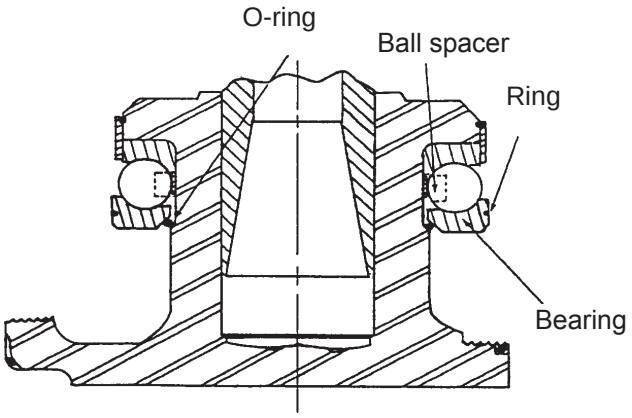
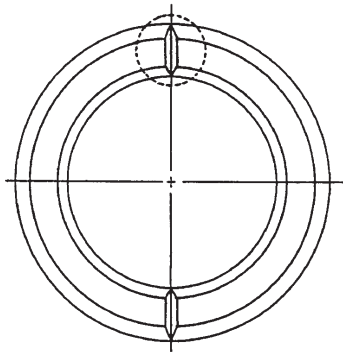
APS6131
APS5014A





Bearing installation



Bearing race chamfer

Blade and Mounting Parts
Figure 703

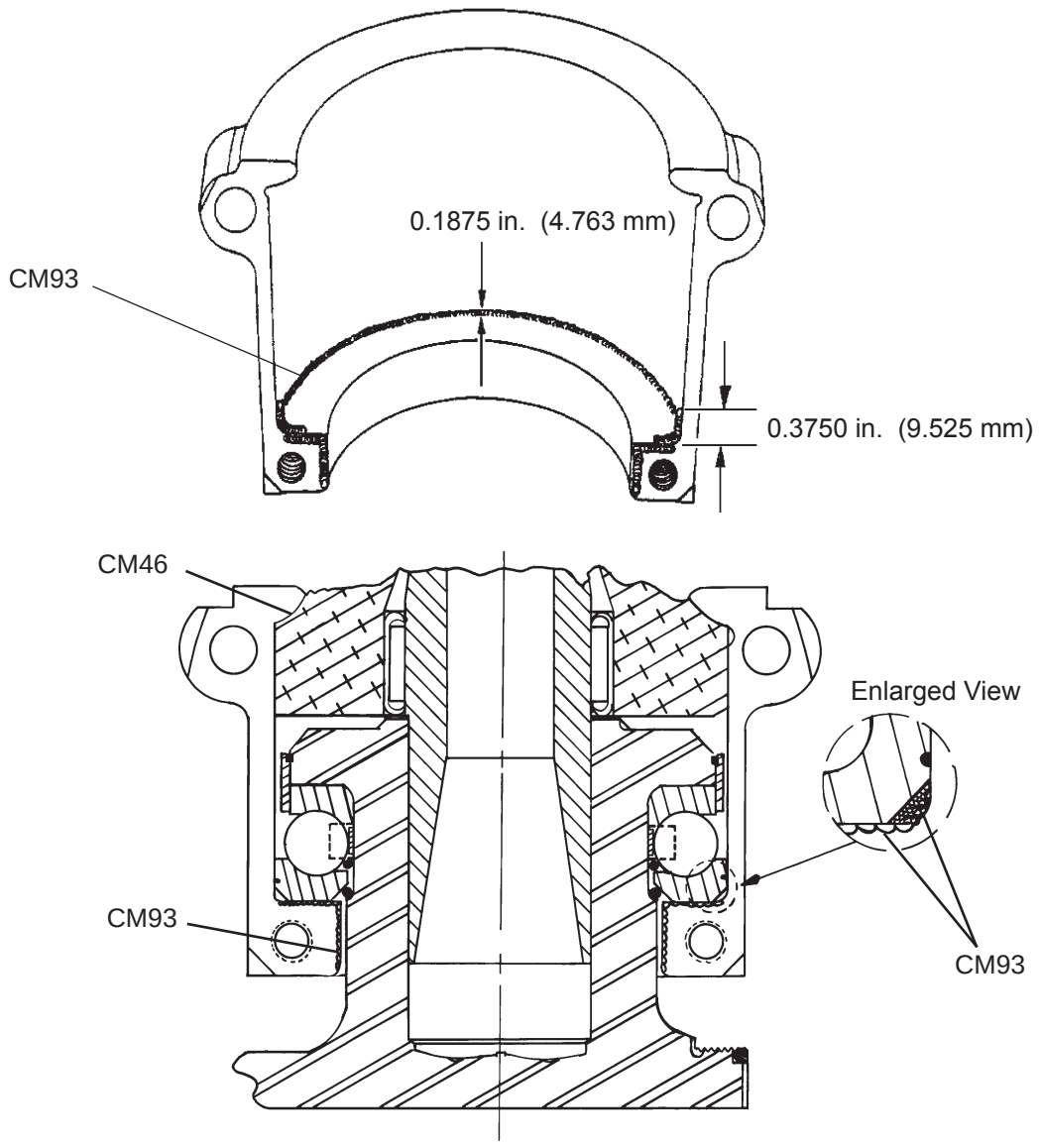
CAUTION: EXCESSIVE USE OF SEALANT COULD CAUSE UNEVEN SEATING BETWEEN BLADE CLAMP AND BEARING RACE.

(16) Slide the blade O-ring (150) outboard into place against the bearing race.

(17) Wrap wide masking tape around the outside diameter of the bearing assembly to hold the parts in place.

(18) Repeat these assembly procedures for each of the other blade arms on the hub unit.

APS0417
APS0426a



CM93 Sealant Application
Figure 704

4. Installation of Blades and Clamps

A. Installation for all models

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

(1) As specified in the Disassembly Procedure, each blade should have an identifying number to ensure correct assembly.

(2) Turn the propeller on the rotatable fixture and using a gage and adjustable pointer as shown in Figure 705, check the height at the tip of each blade

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

(3) Stand Blade One in vertical position (base up, tip down) and fill the pilot tube cavity with grease CM12 to the top of the bottom (inboard) bearing race level. Refer to Hartzell Standard Practices Manual 202A, Propeller Lubrication chapter, for lubrication guidelines.

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

(4) After making sure no air is trapped in the grease, press the blade onto the matching hub pilot tube.

NOTE: A slight amount of grease will ooze out around the pilot tube if the blade has been lubricated correctly.

(5) In consecutive order, repeat the lubrication and reinstallation procedure for the remaining blades.

CAUTION: BE SURE TO USE APPROVED HARDENING GASKET COMPOUND ON THE SHOULDER RADIUS OF THE BLADE BASE.

(6) Spread approved gasket compound CM46 on the shoulder radius of the blade base in the area where it will be in contact with the blade clamp. Refer to Figure 704.

NOTE: A bead of gasket compound CM46 approximately 0.25 inch (6.4 mm) wide and 0.06 inch (1.5 mm) thick is sufficient.

CAUTION: THE PARTING LINE OF THE CLAMP HALVES MUST BE AT A RIGHT ANGLE TO THE PARTING LINE OF THE INBOARD BEARING RACE.

(7) Place a gasket (430) between each of the clamp half parting surfaces.

(8) Permit a maximum of 0.06 inch (1.59 mm) of gasket material to be evenly exposed through the edges on each blade clamp-half parting surface.

CAUTION: METAL-TO-METAL CONTACT IS NECESSARY WHERE THE INBOARD CLAMP LUGS MEET.

(9) Trim the gasket material as necessary to permit metal-to-metal contact where the clamp lugs meet.

CAUTION: DO NOT TORQUE THE OUTBOARD CLAMP BOLTS AT THIS STAGE OF ASSEMBLY.

(10) Insert the outboard clamp bolts (450) and clamp washers (460) and fasten them with clamp nuts (470). Hand tighten.

NOTE 1: This step helps align the clamp gasket.

NOTE 2: If the standard clamp bolt installation causes interference with the spinner dome, reverse the position of the outboard clamp bolt (450). Install the leading edge bolt in the clamp with the head of the bolt located on the counterweight side of the clamp. Only one clamping bolt per clamp (adjacent to blade leading edge) is reversed. Refer to Figure 704.1.

CAUTION: TORQUE THE INBOARD CLAMP SOCKET SCREWS IN THE SEQUENCE SPECIFIED.

(11) Insert the inboard clamp socket screws (420).

CAUTION: DO NOT EXCEED 40 FT-LB (54 N•M) TORQUE ON INBOARD CLAMP SOCKET SCREWS.

(12) Torque each inboard clamp socket screw in increments of 10 ft-lb (14 N•m) to the required torque. Refer to the Torque Table in the Fits and Clearances chapter of this manual.

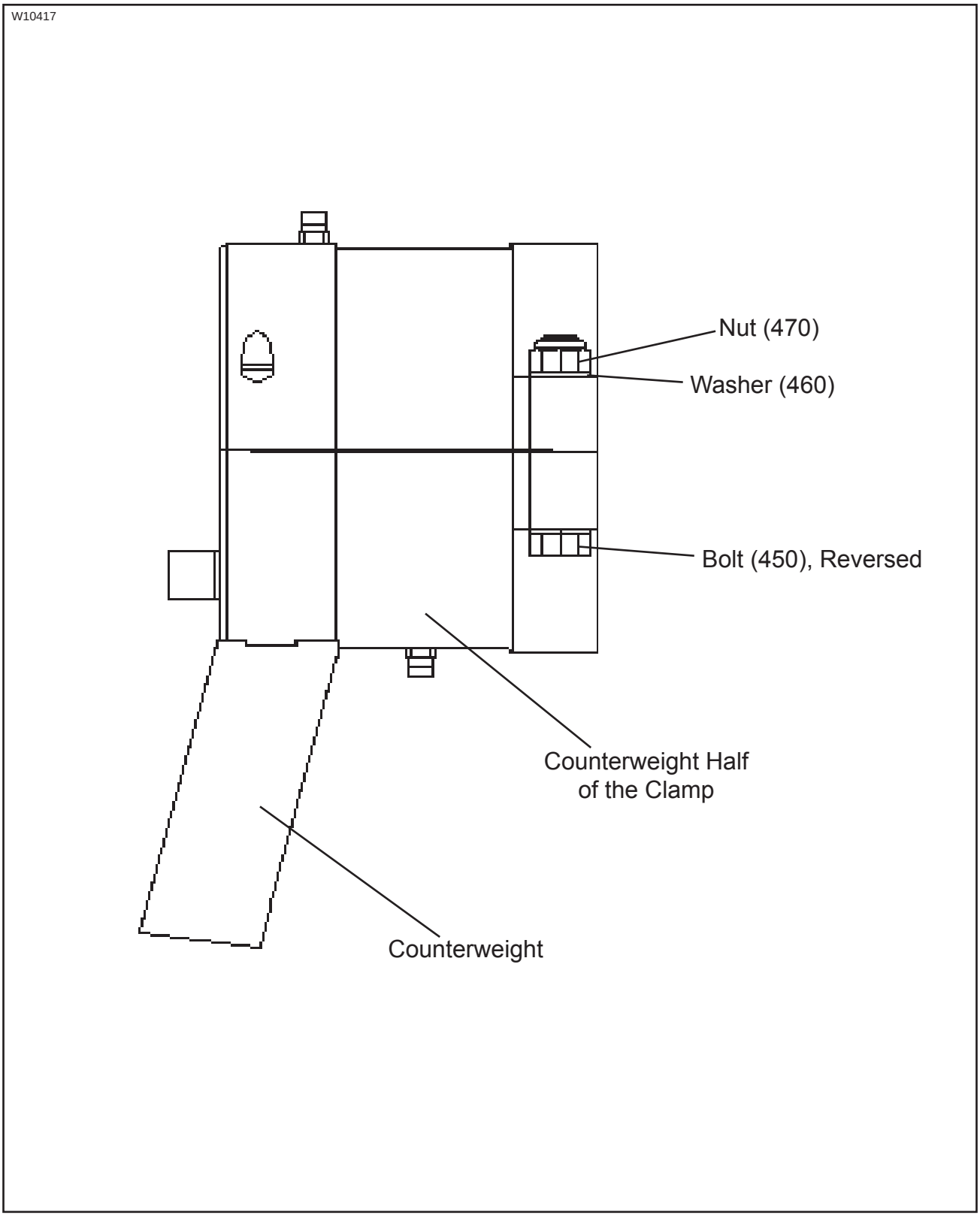
CAUTION: DO NOT TOUCH THE CLAMP WITH THE DRILL WHILE DRILLING TO SAFETY THE INBOARD CLAMP SOCKET SCREWS.

(13) With a #42 (0.0935 inch [2.375 mm]) drill bit, drill the head of each inboard clamp socket screw.

(14) Safety each socket screw with three loops of 0.032 inch (0.81 mm) safety wire or cotter pin.

(15) Repeat the blade clamp installation procedures for the remaining propeller blades.

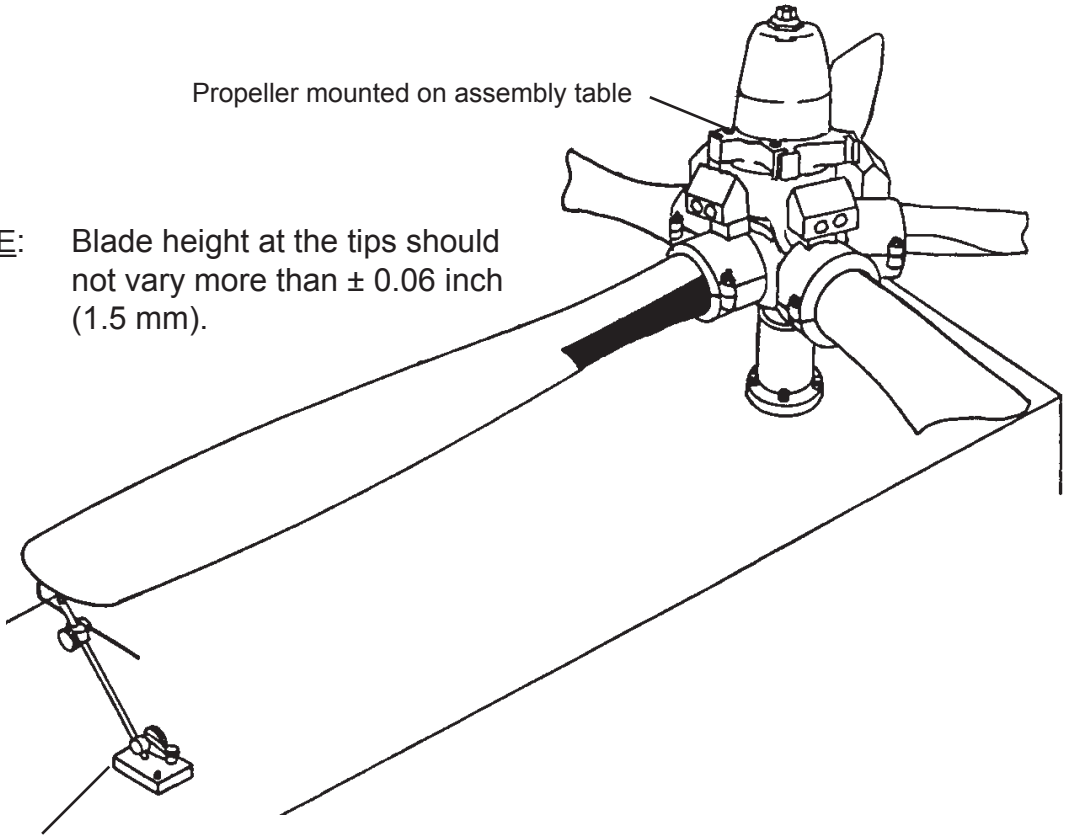
(16) Check the rotational freedom of each blade on the pilot tube of the hub.



Clamp with the Outboard Leading Edge Clamp Bolt in the Reversed Position
Figure 704.1

APS0094

NOTE: Figure for purpose of illustrating the procedure for checking blade height.



Checking Blade Height
Figure 705

5. Setting Blade Pitch

A. HC-D2V20-3

(1) Make an aluminum or steel setup spacer with an inside diameter larger than the hub and an outside diameter small enough that the spacer does not interfere with the clamps (Figure 706). The thickness of the spacer must be 1.093 ± 0.010 inch (27.76 ± 0.25 mm).

NOTE: The setup spacer is used only for set up. The setup spacer is not used when installing the propeller on the aircraft.

(2) Put the jack plate unit (770) over and around the rotatable fixture on the build table. Repeat with the setup spacer. Rest the unit and the spacer on the table.

(3) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701.

CAUTION: MAKE SURE THE POSITION OF THE PULLER RING (160) IS CORRECT. REFER TO FIGURE 708.1.

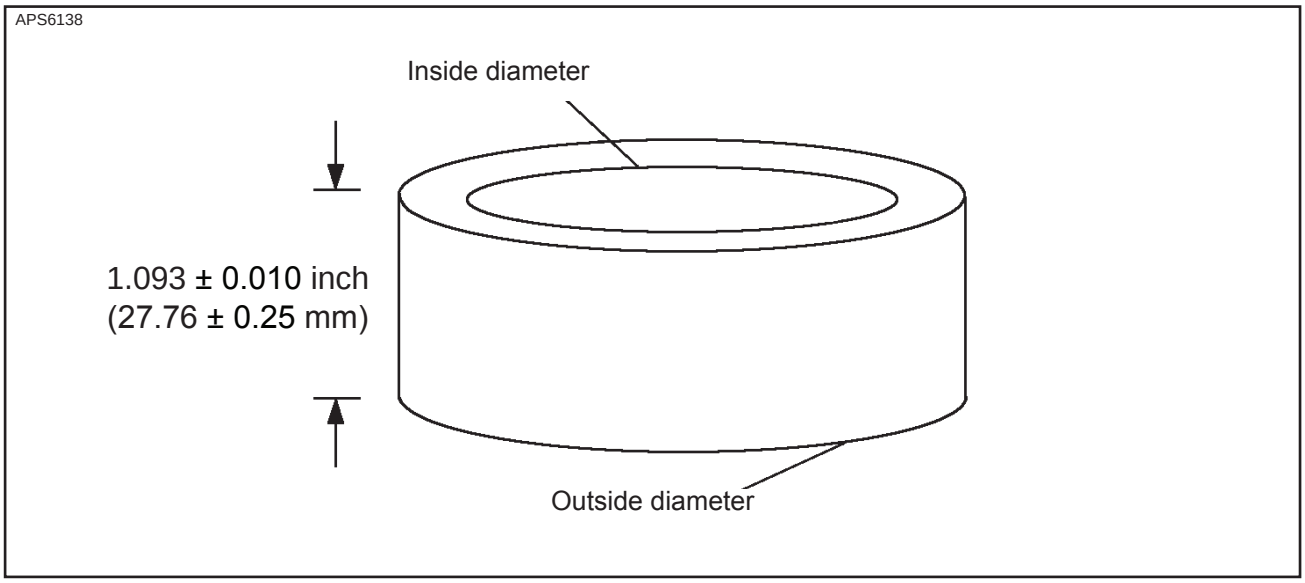
(4) Install the hub nut (180) and the puller ring (160).

(5) Tighten the hub nut (180).

(6) Install the snap ring (170) inside the groove in the hub (10) and encircling the hub nut (180).

(7) Lift the jack plate unit (770) into position.

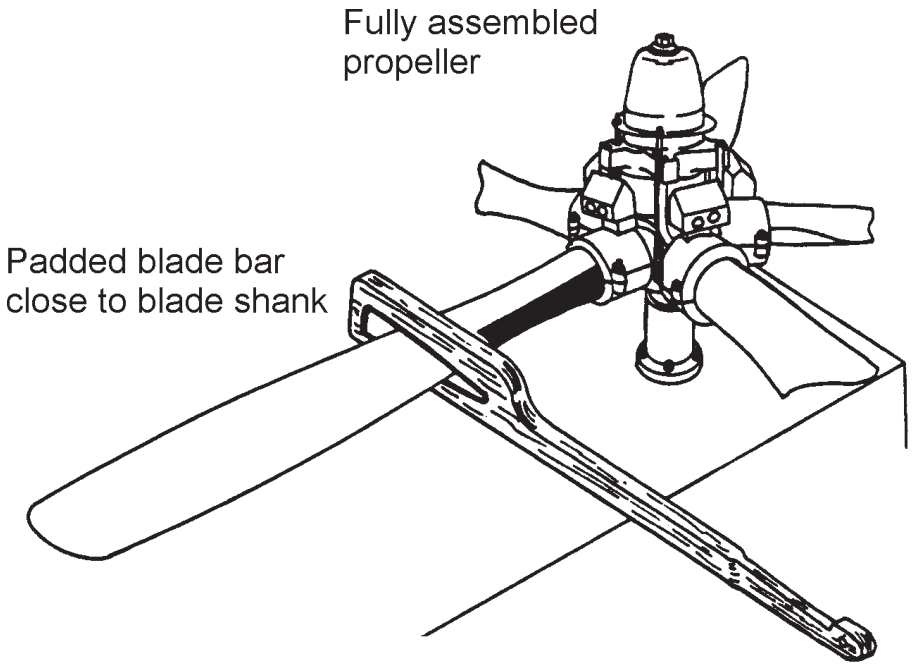
(8) Line up the push rods (800) with the holes in the guide lugs (60) that are welded to the hub.



Setup Spacer for HC-D2V20-3
Figure 706

APS0210a

NOTE: Figure illustrates the process for checking blade slippage in propeller models with blade clamps.



Using Padded Blade Bar to Check for Blade Slippage
Figure 707

CAUTION: MAKE SURE THE BLOCK (220) HAS A SLIDE FIT IN THE FORK. BEVEL THE BLOCK TO ALLOW HUB CLEARANCE.

(9) Rotate the blades until the forks (810) slide onto the blocks (220) and the push rods (800) enter the guide lugs (60).

(10) Move the jack plate unit (770) away from the table until the 1.093 inch (27.76 mm) thick setup spacer is pinched between the jack plate (770) and the spacer ring (320) that is already pressed onto the hub shoulder. This defines the high blade pitch position for the blade clamps.

(11) Rotate the blades in the clamps to low pitch position.

NOTE: Refer to the applicable aircraft Specifications Manual or Hartzell Application Guide for the specific angle required.

CAUTION: LOW PITCH BLADE ANGLE MUST BE WITHIN ± 0.5 DEGREE OF THE CORRECT SETTING.

(12) Set low pitch with the jack plate unit (770) in full forward position against the setup spacer and the hub.

(13) Torque the outboard clamp nuts. Refer to the torque table in the Fits and Clearances chapter of this manual.

CAUTION: LOW PITCH BLADE ANGLE OF ALL BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(14) Check low pitch blade angle of all blades within a tolerance of ± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet tolerance, reset the blades in the clamps.

(15) Using a padded blade bar, check blade tightness in the clamp by applying a torque of 167 ft-lb (226 N•m) to the blade near the blade root (Figure 707).

NOTE: Checking blade tightness ensures that a blade will not slip in flight.

(16) Recheck blade angles to assure no slippage has occurred.

(17) Turn the propeller on the rotatable fixture. Using a gage and adjustable pointer as shown in Figure 705, check the height at the tip of each blade

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

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

(18) Using a crayon or a soft, non-graphite pencil, mark the position of the jack plate unit (770) in relation to the hub

NOTE: Marking the jack plate-to-hub position will make sure that the correct orientation is maintained when assembling on the aircraft and engine.

(19) Pull the jack plate unit (770) toward the table.

(20) Rotate the jack plate unit (770) and disengage the forks (810) from the blocks (220).

(21) Identify the block (220) location and orientation for installation of the propeller on engine.

(22) Remove the jack plate unit (770) and the setup spacer from the propeller.

NOTE: The setup spacer is used only during set up. The setup spacer is not used when installing the propeller on the aircraft.

(23) Remove the propeller from the build bench.

(24) Static balance the propeller in accordance with the Static Balance chapter of Hartzell Standard Practices Manual 202A (61-01-02).

(a) Static balance will require a jack plate only to hold blades relative to each other.

(b) Insert plastic or aluminum wedges between the blade clamps and the hub.

(c) Use fixturing with a rear cone and a front nut to support the propeller for balancing.

(25) For installation of labels, refer to the Parts Identification and Marking chapter and the Paint and Finish chapter of Hartzell Standard Practices Manual 202A (61-01-02).

CAUTION: ON A REPUBLIC SEABEE INSTALLATION A CLAMP LUBRICATION FITTING MAY INTERFERE WITH THE PISTON MOUNTED VALVE. TO AVOID DAMAGING THE VALVE, INSTALL A LUBRICATION PLUG (400) IN THE CLAMP HOLE FACING THE ENGINE, AT OVERHAUL AFTER LUBRICATION.

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

B. HC-D2MV20-3

(1) Make an aluminum or steel setup spacer with an inside diameter of 3.25 inches (82.55 mm) and an outside diameter of 3.50 inches (88.9 mm). The thickness of the spacer must be 1.060 ± 0.010 inch (26.92 ± 0.25 mm) (Refer to Figure 708).

NOTE 1: To make it easier to position the setup spacer on the hub, cut the setup spacer into two equal pieces.

NOTE 2: The setup spacer is used only for set up. The setup spacer is not used when installing the propeller on the aircraft.

(2) Put the jack plate unit (770) over and around the rotatable fixture on the build table. Repeat with the setup spacer. Rest the unit and the spacer on the table.

(3) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701.

CAUTION: MAKE SURE THE POSITION OF THE PULLER RING (160) IS CORRECT. REFER TO FIGURE 708.1.

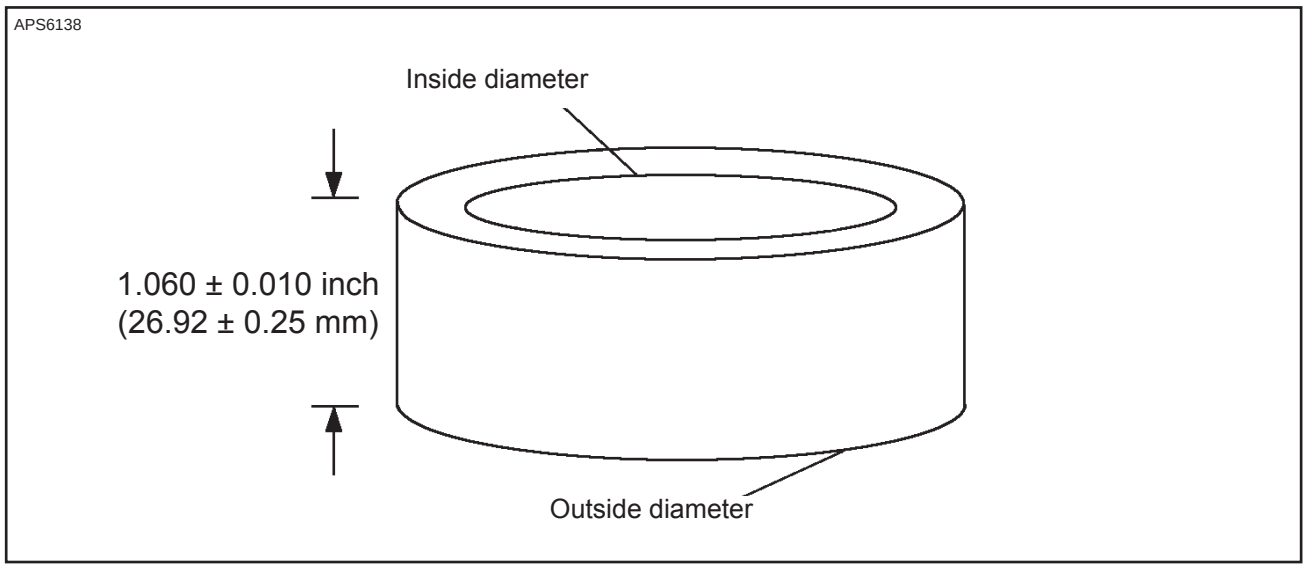
(4) Install the hub nut (180) and the puller ring (160).

(5) Tighten the hub nut (180).

(6) Install the snap ring (170) inside the groove in the hub (10) and encircling the hub nut (180).

(7) Lift the jack plate unit (770) into position.

(8) Line up the push rods (800) with the holes in the guide lugs (60) that are welded to the hub.



Setup Spacer for HC-D2MV20-3
Figure 708

CAUTION: MAKE SURE THE BLOCK (220) HAS A SLIDE FIT IN THE FORK. BEVEL THE BLOCK TO ALLOW HUB CLEARANCE.

(9) Rotate the blades until the forks (810) slide onto the blocks (220) and the push rods (800) enter the guide lugs (60).

(10) Move the jack plate unit (770) away from the table until the jack plate (770) contacts the spacer ring (320) that is already pressed onto the hub shoulder. This is the reverse blade pitch position for the blade clamps.

(11) Rotate the blades in the clamps to -11.5 ± 0.5 degrees. This is the reverse blade angle for the propeller.

NOTE 1: Use of a rubber mallet to rotate the blade in the clamp is acceptable.

NOTE 2: Propellers assembled in accordance with this procedure will not meet the Aircraft Type Certificate Data Sheet (TCDS) specification for reverse blade angle. An FAA form 337 is required to return the propeller/aircraft to service. (Installation of "MV" shank blade clamps requires the non-standard reverse blade angle for clearance purposes.)

(12) Torque the outboard clamp nuts. Refer to the torque table in the Fits and Clearances chapter of this manual.

CAUTION: LOW PITCH BLADE ANGLE OF ALL BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(13) Check that the reverse pitch blade angle of all the blades is within a tolerance of
± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet the tolerance, reset the blades in the clamps and recheck the reverse pitch.

(14) Using a padded blade bar, check blade tightness in the clamp by applying a torque of 167 ft-lb (226 N•m) to the blade near the blade root (Figure 707).

NOTE: Checking blade tightness ensures that a blade will not slip in flight.

(15) Recheck blade angles to assure no slippage has occurred.

(16) Move the jack plate (770) toward the table to allow clearance to place the two-piece set-up spacer between the jack plate and the spacer ring (320).

(17) Move the jack plate unit (770) away from the table until the jack plate pinches the set-up spacer against the spacer ring (320) that was previously pressed onto the hub shoulder. This is the high pitch position for the blade clamps.

(18) Measure the high pitch blade angle to confirm that it is a minimum of 19.5 degrees.

CAUTION: HIGH PITCH BLADE ANGLE OF BOTH BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(19) Check the high pitch blade angle of both blades to confirm they are within a tolerance of ± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet tolerance, reset the blades in the clamps and recheck the high pitch blade angle.

NOTE: It is acceptable to have greater than 0.2 degree variance at reverse if required to maintain a maximum of 0.2 degree variance at high pitch.

(20) Turn the propeller on the rotatable fixture. Using a gage and adjustable pointer as shown in Figure 705, check the height at the tip of each blade

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

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

(21) Using a crayon or a soft, non-graphite pencil, mark the position of the jack plate unit (770) in relation to the hub.

NOTE: Marking the jack plate-to-hub position will make sure that the correct orientation is maintained when assembling on the aircraft and engine.

(22) Pull the jack plate unit (770) toward the table.

(23) Rotate the jack plate unit (770) and disengage the forks (810) from the blocks (220).

(24) Identify block (220) location and orientation for installation of the propeller on the engine.

(25) Remove the jack plate unit (770) and the setup spacer from the propeller.

NOTE: The setup spacer is used only during set up. The setup spacer is not used when installing the propeller on the aircraft.

(26) Remove the propeller from the build bench.

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

(a) Static balance will require a jack plate only to hold blades relative to each other.

(b) Insert plastic or aluminum wedges between the blade clamps and the hub.

(c) Use fixturing with a rear cone and a front nut to support the propeller for balancing.

CAUTION: ON A REPUBLIC SEABEE INSTALLATION A CLAMP LUBRICATION FITTING MAY INTERFERE WITH THE PISTON MOUNTED VALVE. TO AVOID DAMAGING THE VALVE, INSTALL A LUBRICATION PLUG (400) IN THE CLAMP HOLE FACING THE ENGINE, AT OVERHAUL AFTER LUBRICATION.

(28) For installation of labels, refer to the Parts Identification and Marking chapter and the Paint and Finish chapter of Hartzell Standard Practices Manual 202A (61-01-02).

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

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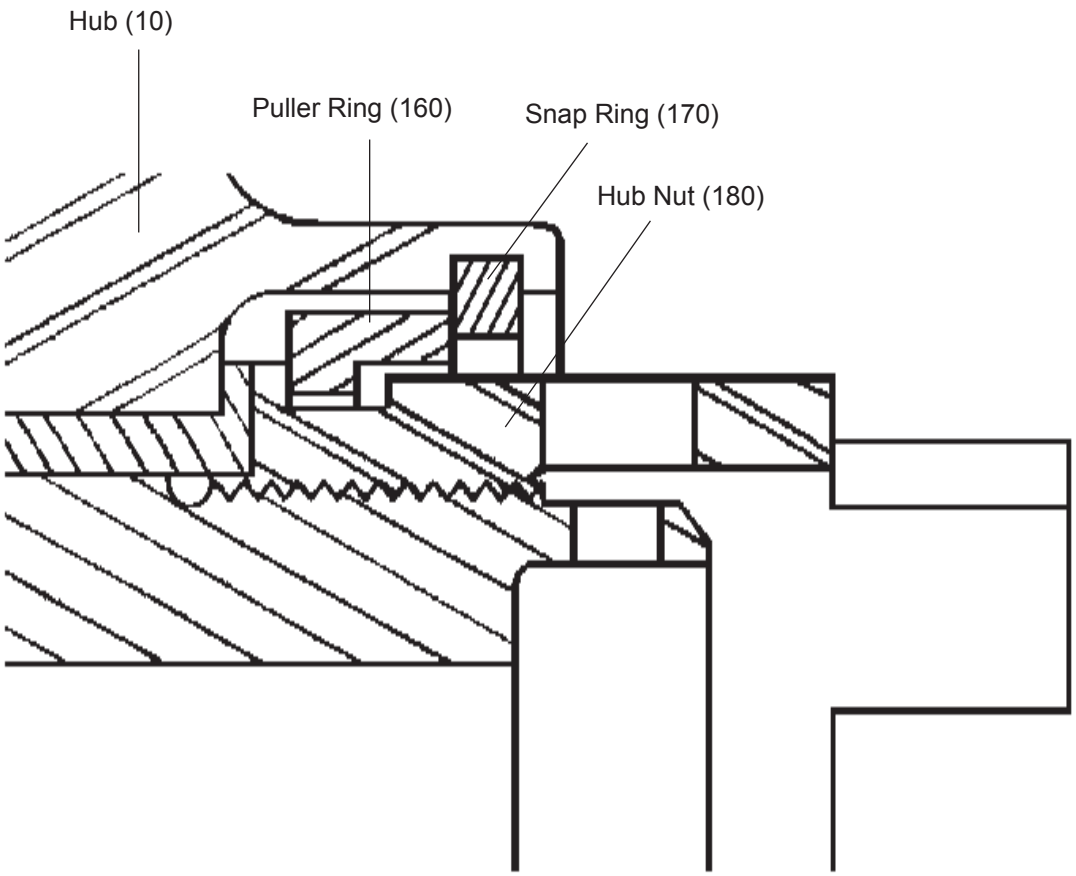
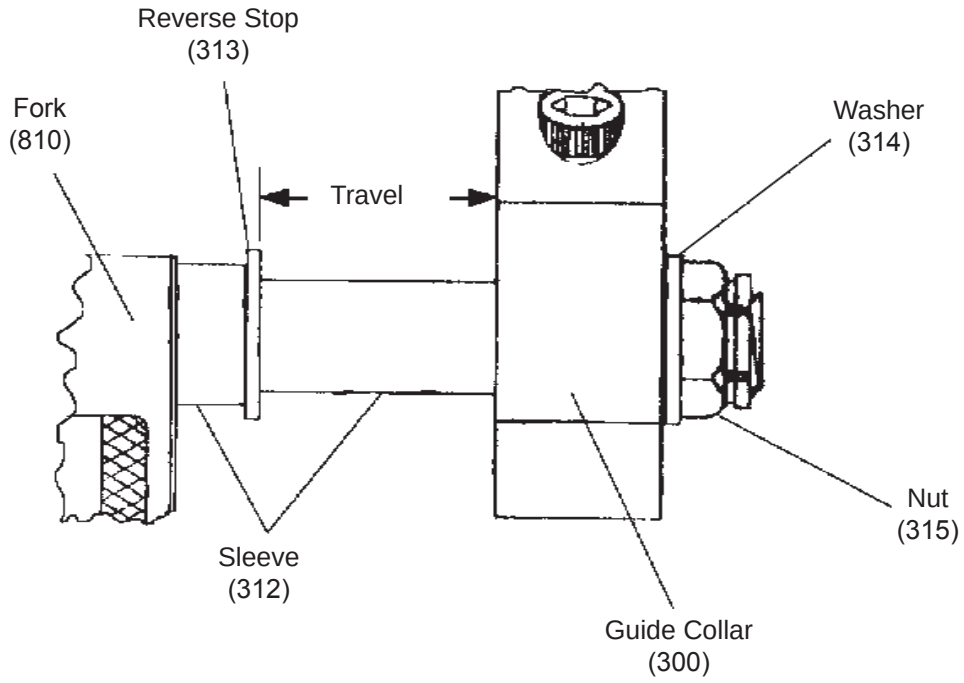


Puller Ring Position
Figure 708.1

APS6132



Reverse Stop Travel Length
Figure 709

C. HC-D3V20-6L

NOTE: High pitch is set when on the assembly table, but reverse pitch is only checked (not set) for reverse stop.

(1) Put the hydraulic unit (500) over the fixture on the build table and rest the unit on the table.

(2) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701. Tighten the shaft nut.

CAUTION: THE THICK ARM OF THE PITCH CHANGE BLOCK MUST BE TOWARD THE ENGINE.

(3) Install a fork (810) on each push rod (800). Do not tighten the set screw (830).

(4) Put a sleeve (312) on each of the push rods (800) with the flange-end of the sleeve toward the jack plate and the fork.

CAUTION: THE REVERSE STOP (313) ON THE PUSH ROD (800) WILL PREVENT THE SLEEVE (312) FROM PUSHING THE GUIDE COLLAR BUSHING OUT OF THE GUIDE COLLAR.

(5) Locate a reverse stop (313) that meets the required length for your propeller. Reverse stop width is selected to obtain reverse pitch and is determined by the amount of travel required from reverse pitch to high pitch. Each degree equals 1/32 inch (0.031 inch [0.79 mm]) in length.

NOTE: Example:

Reverse pitch 11 degrees
\+ High pitch 20 degrees

= Total travel 31 degrees = 31/32 inch (0.969 inch [2.46 mm]) of travel

Reverse stop (313) thickness must allow the calculated travel length between the reverse stop setting on the shoulder of the sleeve (312) and the guide collar (300). See Figure 709.

(6) Slide a reverse stop (313) on each sleeve (312) and push rod (800).

CAUTION: MAKE SURE THE BLOCK (220) HAS A SLIDE FIT IN THE FORK. BEVEL THE BLOCK TO ALLOW HUB CLEARANCE.

(7) Install the pitch change block (220) onto each clamp linkscrew (380).

(8) Lift the jack plate unit (770) into position on the hub to engage the pitch change blocks.

(9) Rotate the blades until the forks (810) can slide onto the blocks (220).

(10) Align the forks (810) with the pitch change blocks (220) and snug the set screws (830) in the forks.

NOTE: Do not peen the fork to set the screw because the fork will be removed after assembly is complete. Safety procedure is accomplished after installation on the engine.

(11) Install the guide collar (300) by positioning it over the push rods (800) so the push rods pass through the guide collar bushings. Maintain the alignment of the fork (810) and pitch change block (220).

(12) Install and torque the guide collar nut (310). Refer to torque table in chapter 800.

(13) Tighten the guide collar (300) against the shoulder on the guide collar nut (310).

(14) Install a washer (314) and a nut (315) on the end of each push rod protruding through the guide collar bushings.

(15) Loosen the set screws (830) in the fork (810).

(16) Tighten the nuts (315) until snug.

NOTE: Do not peen the fork to set the screw because the fork will be removed after assembly is complete. Safety procedure is accomplished after installation on the engine.

(17) Position each fork (810) to fully engage the pitch change blocks (220).

(18) Pull the jack plate unit (770) back toward the table rotating the clamps to a high pitch position.

NOTE: When the propeller is at high pitch, the nuts (315) and washers (314) on the end of the push rods will be firmly against the guide collar (300).

(19) Rotate the blades in the clamps to high pitch position.

NOTE: Refer to the applicable aircraft Specifications Manual of Hartzell Application Guide for the specific angle required.

CAUTION: HIGH PITCH BLADE ANGLE MUST BE WITHIN ± 0.5 DEGREE OF THE CORRECT SETTING.

(20) Torque the outboard clamp nuts. Refer to the torque table in the Fits and Clearances chapter of this manual.

CAUTION: HIGH PITCH BLADE ANGLE OF ALL BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(21) Check high pitch blade angle of all blades within a tolerance of ± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet tolerance, reset the blades in the clamps and re-check the high pitch blade angle.

(22) Using a padded blade bar, check blade tightness in the clamp by applying a torque of 167 ft-lb (226 N•m) to the blade near the blade root (Figure 707).

NOTE: Checking blade tightness ensures that a blade will not slip in flight.

(23) Recheck the blade angles to assure no slippage has occurred.

(24) Turn the propeller on the rotatable fixture. Using a gage and adjustable pointer as shown in Figure 705, check the height at the tip of each blade.

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

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

(25) Mark the position of the jack plate unit (770) using a crayon or a soft, non-graphite pencil.

(26) Remove the nuts (315) and washers (314) from the push rods (800).

(27) Mark the forks (810), sleeves (312), reverse stops (313), and jack plate push rods (800) to insure correct matching of parts when installed on engine.

(28) Pull the jack plate unit (770) toward the table allowing the sleeve (312), reverse stop (313), and fork (810) to slide off each push rod (800).

(29) Remove forks (810), sleeves (312) and reverse stops (313) and slide on appropriate push rod (800).

(30) Install a washer (314) and nut (315) on the end of each push rod (800).

NOTE: Tighten the nut enough that it does not come off the end of the push rod. This will keep the parts together.

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

(31) Identify the block (220) location and orientation for installation of the propeller on the engine.

(32) Remove the block (220) and keep it with the propeller.

(33) Static balance the propeller in accordance with the Static Balance Chapter of Hartzell Standard Practices Manual 202A (61-01-02).

(a) Static balance will require a jack plate only to hold blades relative to each other.

(b) Insert plastic or aluminum wedges between the blade clamps and the hub.

(c) Use fixturing with a rear cone and a front nut to support the propeller for balancing.

CAUTION: ON A REPUBLIC SEABEE INSTALLATION A CLAMP LUBRICATION FITTING MAY INTERFERE WITH THE PISTON MOUNTED VALVE. TO AVOID DAMAGING THE VALVE, INSTALL A LUBRICATION PLUG (400) IN THE CLAMP HOLE FACING THE ENGINE, AT OVERHAUL AFTER LUBRICATION.

(34) For installation of labels, refer to the Parts Identification and Marking chapter and the Paint and Finish chapter of Hartzell Standard Practices Manual 202A (61-01-02).

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

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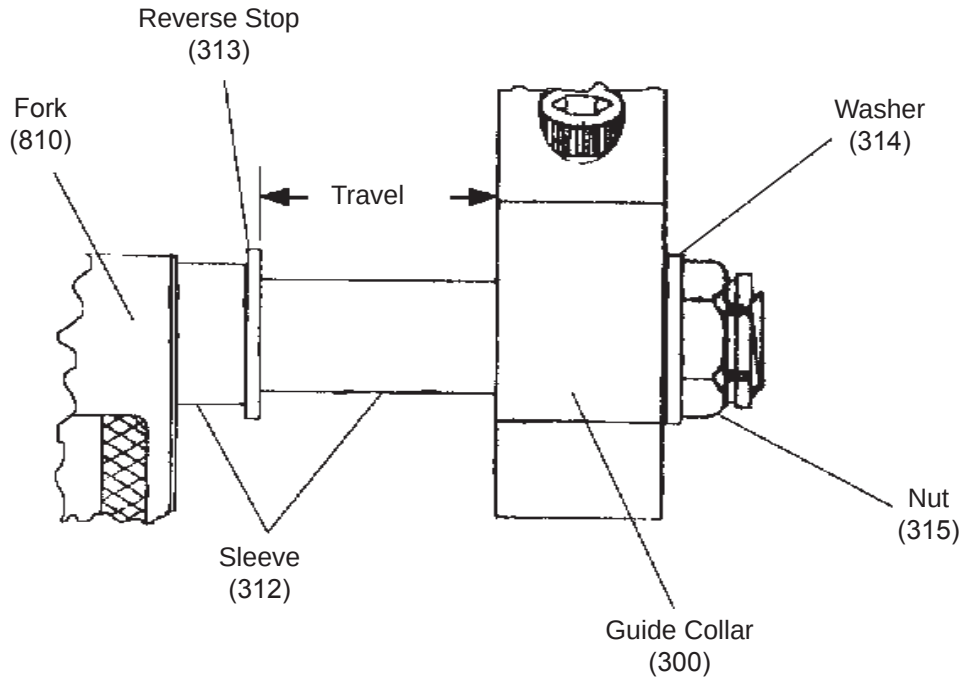

PART NO.	"A" DIMENSION
A-970-10	0.300 inch (7.62 mm)
A-970-9	0.270 inch (6.85 mm)
A-970-8	0.240 inch (6.09 mm)
A-970-7	0.210 inch (5.33 mm)
A-970-6	0.180 inch (4.57 mm)
A-970-5	0.150 inch (3.81 mm)
A-970-4	0.120 inch (3.04 mm)
A-970-3	0.090 inch (2.28 mm)
A-970-2	0.060 inch (1.52 mm)
A-970-1	0.030 inch (0.76 mm)

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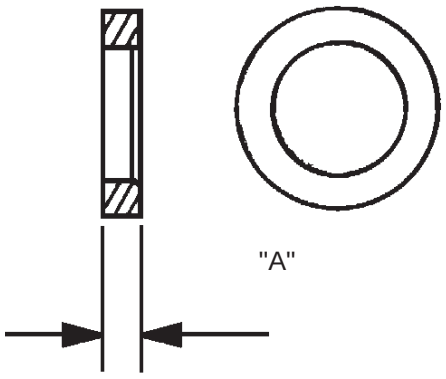

Reverse Stop Travel Length and Reverse Stop Thickness
Figure 710

D. HC-D3MV20-6L

NOTE: High pitch is set when on the assembly table, but reverse pitch is only checked (not set) for reverse stop.

CAUTION: USE THE HYDRAULIC UNIT THAT WILL BE USED DURING FLIGHT. THE HYDRAULIC UNIT MUST CONSIST OF THE JACK ASSEMBLY (770) AND PISTON (510) WITH THE ATTACHED VALVE ASSEMBLY (1000).

NOTE: A fit check between the blade clamp assemblies and the valve assembly is performed later in the assembly process.

(1) Put the hydraulic unit (500) over the fixture on the build table and rest the unit on the table.

(2) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701. Tighten the shaft nut.

CAUTION: THE THICK ARM OF THE PITCH CHANGE BLOCK MUST BE TOWARD THE ENGINE.

(3) Install a fork (810) on each push rod (800). Do not tighten the set screw (830).

(4) Put a sleeve (312) on each of the push rods (800) with the flange-end of the sleeve toward the jack plate and the fork.

CAUTION: THE REVERSE STOP (313) ON THE PUSH ROD (800) WILL PREVENT THE SLEEVE (312) FROM PUSHING THE GUIDE COLLAR BUSHING OUT OF THE GUIDE COLLAR.

(5) Locate a reverse stop (313) that meets the required length for your propeller. Reverse stop width is selected to obtain reverse pitch and is determined by the amount of travel required from reverse pitch to high pitch. Each degree equals 1/32 inch (0.031 inch [0.79 mm]) in length.

NOTE: Example:

Reverse pitch 11 degrees
\+ High pitch 20 degrees
= Total travel 31 degrees = 31/32 inch (0.969 inch [2.46 mm]) of travel

Reverse stop (313) thickness must allow the calculated travel length between the reverse stop setting on the shoulder of the sleeve (312) and the guide collar (300). See Figure 710.

(6) Slide a reverse stop (313) on each sleeve (312) and push rod (800).

CAUTION: MAKE SURE THE BLOCK (220) HAS A SLIDE FIT IN THE FORK. BEVEL THE BLOCK TO ALLOW HUB CLEARANCE.

(7) Install the pitch change block (220) onto each clamp linkscrew (380).

(8) Lift the jack plate unit (770) into position on the hub to engage the pitch change blocks.

(9) Rotate the blades until the forks (810) can slide onto the blocks (220).

(10) Align the forks (810) with the pitch change blocks (220) and snug the set screws (830) in the forks.

NOTE: Do not peen the fork to set the screw because the fork will be removed after assembly is complete. Safety procedure is accomplished after installation on the engine.

(11) Install the guide collar (300) by positioning it over the push rods (800) so the push rods pass through the guide collar bushings. Maintain the alignment of the fork (810) and pitch change block (220).

(12) Install and torque the guide collar nut (310). Refer to the torque table in the Fits and Clearances chapter of this manual.

(13) Tighten the guide collar (300) against the shoulder on the guide collar nut (310).

(14) Install a washer (314) and a nut (315) on the end of each push rod protruding through the guide collar bushings.

(15) Loosen the set screws (830) in the fork (810).

(16) Tighten the nuts (315) until snug.

NOTE: Do not peen the fork to set the screw because the fork will be removed after assembly is complete. Safety procedure is accomplished after installation on the engine.

(17) Position each fork (810) to fully engage the pitch change blocks (220).

(18) Pull the jack plate unit (770) back toward the table rotating the clamps to a high pitch position.

NOTE: When the propeller is at high pitch, the nuts (315) and washers (314) on the end of the push rods will be firmly against the guide collar (300).

(19) Rotate the blades in the clamps to high pitch position.

CAUTION: HIGH PITCH BLADE ANGLE MUST BE WITHIN ± 0.5 DEGREE OF THE CORRECT SETTING.

(20) Torque the outboard clamp nuts. Refer to the torque table in the Fits and Clearances chapter of this manual.

CAUTION: HIGH PITCH BLADE ANGLE OF ALL BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(21) Check high pitch blade angle of all blades within a tolerance of ± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet tolerance, reset the blades in the clamps and re-check the high pitch blade angle.

(22) Using a padded blade bar, check blade tightness in the clamp by applying a torque of 167 ft-lb (226 N•m) to the blade near the blade root (Figure 707).

NOTE: Checking blade tightness ensures that a blade will not slip in flight.

(23) Recheck the blade angles to assure no slippage has occurred.

(24) Rotate the blades by hand to reverse pitch position.

NOTE: When the propeller is in reverse pitch position, the reverse stop washer (313) is pinched between the guide collar (300) and the shoulder on the sleeve (312).

(25) Slowly turn the propeller on the rotatable fixture to identify if there is clearance between the blade clamp assemblies (330) and the valve assembly (1000).

(26) If there is no interference, continue with step 5.D.(27). If there is interference continue with the following steps:

(a) Identify a dimension required to space the clamp assembly (330) and valve assembly (1000) apart and re-establish positive clearance.

(b) Increase the thickness of the reverse stop (313) with the dimension required to re-establish positive clearance between the clamp assembly (330) and the valve assembly (1000).

1 Refer to Figure 7-10 for a listing of reverse stop thicknesses.

2 Select a single stop with the required thickness, or several stops that add up to the required thickness.

(c) Remove the nuts (315) and washers (314) from the ends of the three push rods protruding from the jack assembly (770).

NOTE: Keep the nuts (315) and washers (314) with the propeller and jack assembly.

(d) Twist the counterweights (340) toward high pitch so the push rods back out of the guide collar bushings in the guide collar (300).

NOTE: Push rods will move toward the build bench.

(e) Allow the jack assembly push rods (800) to completely slide out of the guide collar (300).

(f) Turn the jack plate unit (770) until the pitch change forks (810) disengage from the pitch change blocks (220).

(g) Install the reverse stop (313) with the new dimension thickness onto the sleeve (312) and push rod (800).

(h) Lift the jack plate unit (770) into position on the hub to engage the pitch change blocks (220).

(i) Rotate the blades until the forks (810) can slide onto the pitch change blocks (220).

(j) Align the push rods (800) and sleeves (312) with the guide collar bushings.

(k) Slide the push rods (800) and sleeves (312) through the guide collar bushings.

(l) Install a washer (314) and nut (315) on the end of each push rod protruding through the guide collar bushings

(m) Tighten the nuts (315) until snug.

(n) Rotate the blades by hand to reverse pitch position.

NOTE: When the propeller is in reverse pitch position, the reverse stop washer (313) will be pinched between the guide collar (300) and the shoulder on the sleeve (312)

(o) Slowly turn the propeller on the rotatable fixture to verify if there is clearance between the blade clamp assemblies (330) and the valve assembly (1000).

(27) Repeat steps 8.d.(24) through 8.D.(26)(o) until clearance between the blade clamp assemblies (330) and the valve assembly (1000) is achieved.

(28) Turn the propeller on the rotatable fixture. Using a gage and adjustable pointer as shown in Figure 705, check the height at the tip of each blade.

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

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

(29) Mark the position of the jack plate unit (770) using a crayon or a soft, non-graphite pencil.

(30) Remove the nuts (315) and washers (314) from the push rods (800).

(31) Mark the forks (810), sleeves (312), reverse stops (313), and jack plate push rods (800) to insure correct matching of parts when installed on engine.

(32) Pull the jack plate unit (770) toward the table allowing the sleeve (312), reverse stop (313), and fork (810) to slide off each push rod (800).

(33) Remove forks (810), sleeves (312) and reverse stops (313) and install the appropriate push rod (800).

(34) Install a washer (314) and nut (315) on the end of each push rod (800).

NOTE: Tighten the nut enough that it does not come off the end of the push rod. This will keep the parts together.

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

(35) Identify the block (220) location and orientation for installation of the propeller on the engine.

(36) Remove the block (220) and keep it with the propeller.

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

(a) Static balance will require a jack plate only to hold blades relative to each other.

(b) Use plastic or aluminum wedges to insert between the blade clamps and the hub.

(c) Use fixturing with a rear cone and a front nut to support the propeller for balancing.

CAUTION: ON A REPUBLIC SEABEE INSTALLATION A CLAMP LUBRICATION FITTING MAY INTERFERE WITH THE PISTON MOUNTED VALVE. TO AVOID DAMAGING THE VALVE, INSTALL A LUBRICATION PLUG (400) IN THE CLAMP HOLE FACING THE ENGINE, AT OVERHAUL AFTER LUBRICATION.

(38) For installation of labels, refer to the Parts Identification and Marking chapter and the Paint and Finish chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

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

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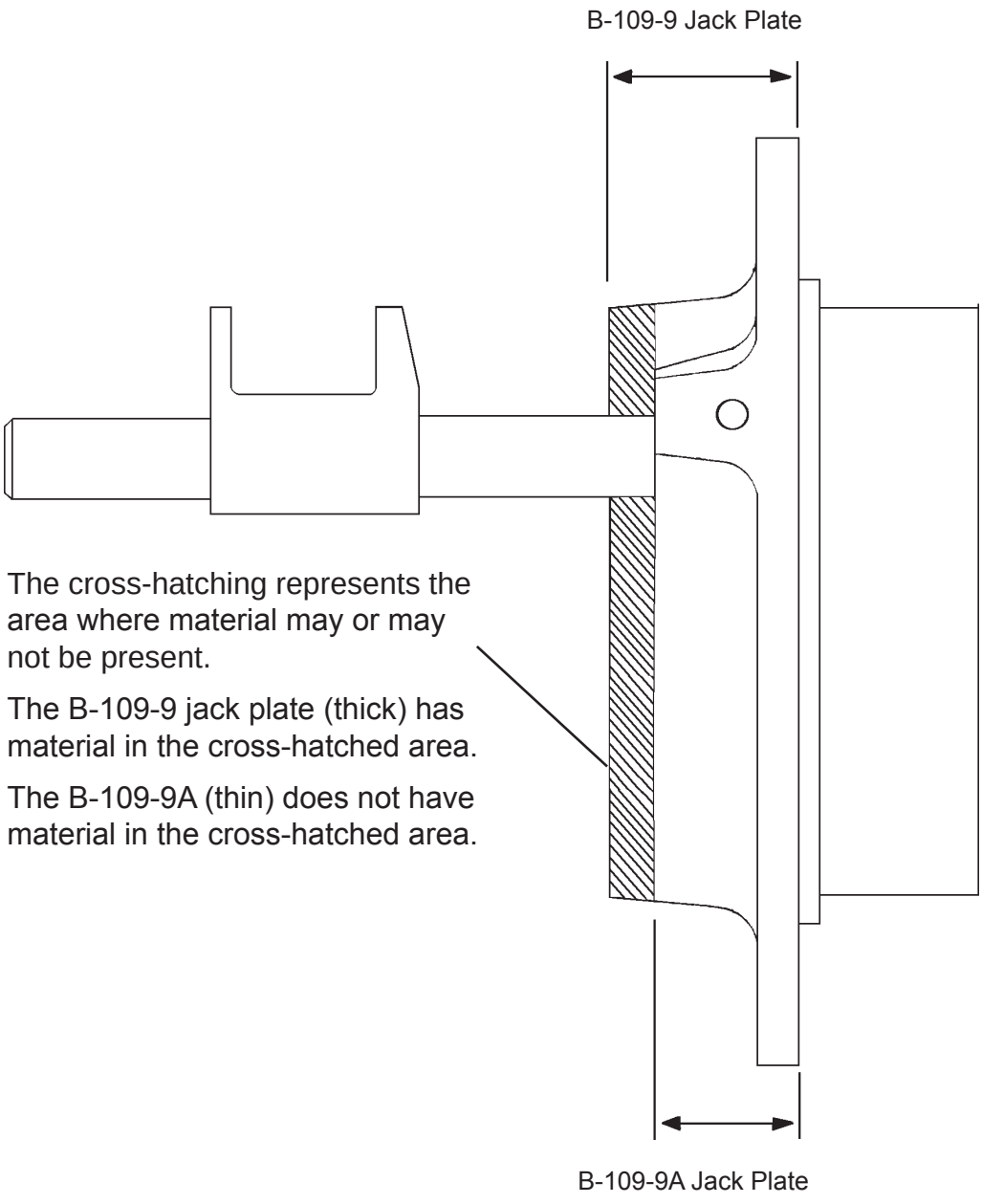


Identification of B-109-9( ) Jack Plate
Figure 711

E. HC-D2(V, MV)20-7 and -8( )

(1) Make a setup spacer with an inside diameter larger than the hub and an outside diameter small enough that the spacer does not interfere with the clamps (Figure 712). A setup spacer TE420 may be purchased for this purpose. Refer to Hartzell Tool and Equipment Manual 165A (61-00-65).

NOTE 1: The setup spacer is used only during set up and is not used when installing the propeller on the aircraft.

NOTE 2: The hydraulic unit may have either a B-109-A or a B-109-9 jack plate unit installed (Figure 711).

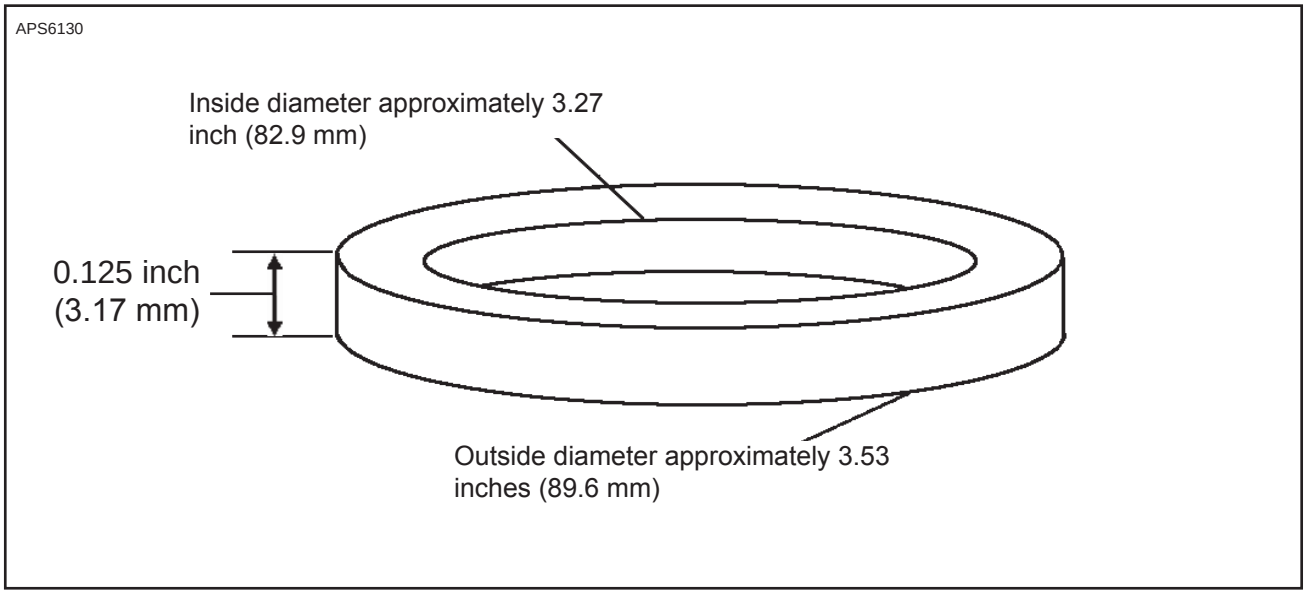
The B-109-9A (thinner jack plate) is used in the hydraulic unit (500) if either a C-175 or C-175-2 spinner adapter ring is installed on the hub.

The B-109-9A is also used if an A-165-( ) ring is installed instead of a spinner adapter ring. The C-175, the C-175-2, or the A-165-2 is press fit onto the neck of the hub on the side facing the engine and against a shoulder next to the blade arms.

If no spinner adapter or C-165-2 ring is installed on the hub, the B-109-9 (thicker jack plate) must be used in the hydraulic unit (500).

(2) Put the jack plate unit (770) and the setup spacer(s) over and around the rotatable fixture on the build table. Rest the unit and the spacer on the table.

(3) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701.



Setup Spacer for HC-D2(V, MV)20-7 and -8
Figure 712

CAUTION: MAKE SURE THE POSITION OF THE PULLER RING (160) IS CORRECT. REFER TO FIGURE 708.1.

(4) Install the hub nut (180) and puller ring (160).

(5) Tighten the hub nut (180).

(6) Install the snap ring (170) in the groove in the hub (10) and encircling the hub nut (180).

(7) Lift the jack plate unit (770) into position.

(8) Line up the push rods (800) with the holes in the guide lugs (60) that are welded to the hub.

CAUTION: MAKE SURE THE BLOCK (220) HAS A SLIDE FIT IN THE FORK. BEVEL THE BLOCK TO ALLOW HUB CLEARANCE.

(9) Rotate the blades until the forks (810) slide onto the blocks (220) and the push rods (800) enter the guide lugs (60).

(10) Move the jack plate unit (770) away from the table, rotating the clamps to a low pitch position.

(11) Move the jack plate unit (770) until the 0.125 inch (3.17 mm) thick setup spacer is pinched between the jack plate (770) and the spacer ring that is pressed onto the hub shoulder. This is the low pitch position for the blade clamps.

(12) Rotate the blades in the clamps to low pitch position.

NOTE: Refer to the applicable aircraft Specifications Manual or Hartzell Application Guide for the specific angle required.

CAUTION: LOW PITCH BLADE ANGLE MUST BE WITHIN ± 0.5 DEGREE OF THE CORRECT SETTING.

(13) Set low pitch with the jack plate unit (770) in full forward position against the set up spacer and the hub.

(14) Torque the outboard clamp nuts. Refer to the torque table in the Fits and Clearances chapter in this manual.

CAUTION: LOW PITCH BLADE ANGLE OF ALL BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(15) Check low pitch blade angle of all blades within a tolerance of ± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet tolerance, reset the blades in the clamps and recheck the low pitch blade angle.

(16) Using a padded blade bar, check blade tightness in the clamp by applying a torque of 167 ft-lb (226 N•m) to the blade near the blade root (Figure 707).

NOTE: Checking blade tightness ensures that a blade will not slip in flight.

(17) Recheck blade angles to assure no slippage has occurred.

(18) Using a gage and adjustable pointer as shown in Figure 705, turn the propeller on the rotatable fixture and check the height at the tip of each blade

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

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

(19) Using a crayon or a soft, non-graphite pencil, mark the position of the hydraulic unit (500).

NOTE: Marking the jack plate-to-hub position will make sure that the correct orientation is maintained when assembling on the aircraft and engine.

(20) Pull the jack plate unit (770) toward the table.

(21) Rotate the jack plate unit (770) and disengage the forks (810) from the blocks (220).

(22) Remove the jack plate unit (770) and the setup spacer from the propeller.

NOTE: The setup spacer is used only during set up and is not used when installing the propeller on the aircraft.

(23) Remove the propeller from the build bench.

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

(a) Static balance will require a jack plate only to hold blades relative to each other.

(b) Use plastic or aluminum wedges to insert between the blade clamps and the hub.

(c) Use fixturing with a rear cone and a front nut to support the propeller for balancing.

(25) For installation of labels, refer to the Parts Identification and Marking chapter and the Paint and Finish chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

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

F. HC-D3MV20-8D

(1) Make a setup spacer with an inside diameter larger than the hub and an outside diameter small enough that the spacer does not interfere with the clamps (Figure 713). A setup spacer TE420 may be purchased for this purpose. Refer to Hartzell Tool and Equipment Manual 165A (61-00-65).

NOTE: The setup spacer is used only during setup and is not used when installing the propeller on the aircraft.

(2) Put the jack plate unit (770) and the setup spacer(s) over and around the rotatable fixture on the build table. Rest the unit and the spacer on the table.

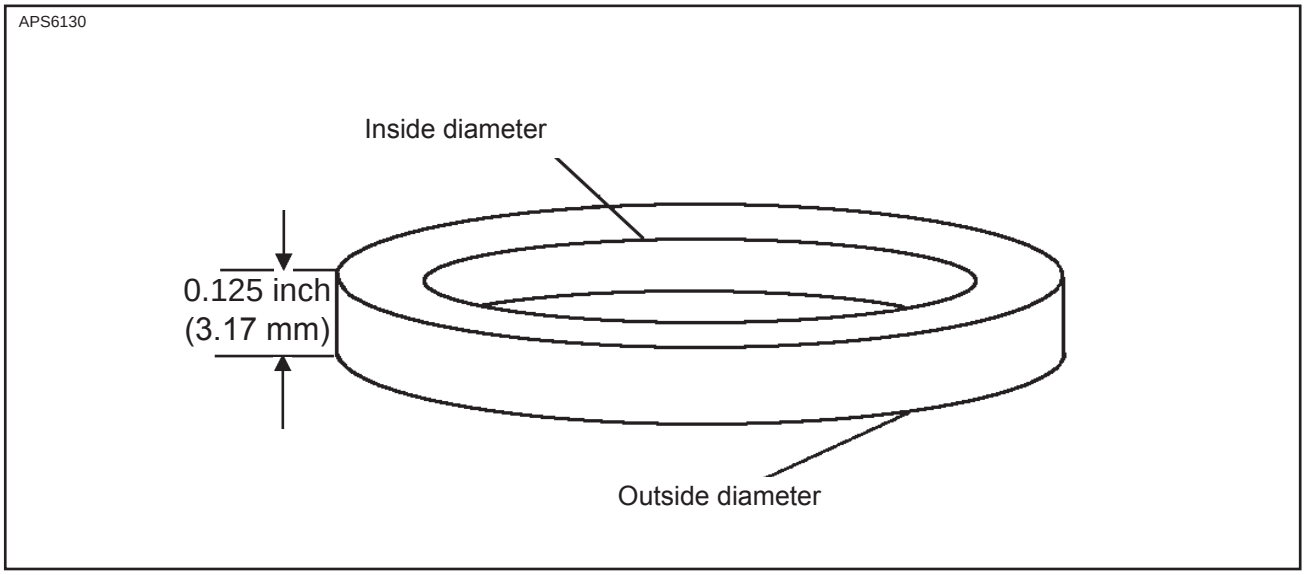
(3) Mount the hub unit on the rotatable fixture of the assembly table as shown in Figure 701.

CAUTION: MAKE SURE THE POSITION OF THE PULLER RING (160) IS CORRECT. REFER TO FIGURE 708.1.

(4) Install the hub nut (180) and puller ring (160).

(5) Tighten the hub nut (180).

(6) Install the snap ring (170) in the groove in the hub (10) and encircling the hub nut (180).



Setup Spacer for HC-D3MV20-8D
Figure 713

(7) Lift the jack plate unit (770) into position.

(8) Line up the push rods (800) with the holes in the guide collar (300).

CAUTION: MAKE SURE THE BLOCK (220) HAS A SLIDE FIT IN THE FORK. BEVEL THE BLOCK TO ALLOW HUB CLEARANCE.

(9) Rotate the blades until the forks (810) slide onto the blocks (220) and the push rods (800) enter the guide collar (300).

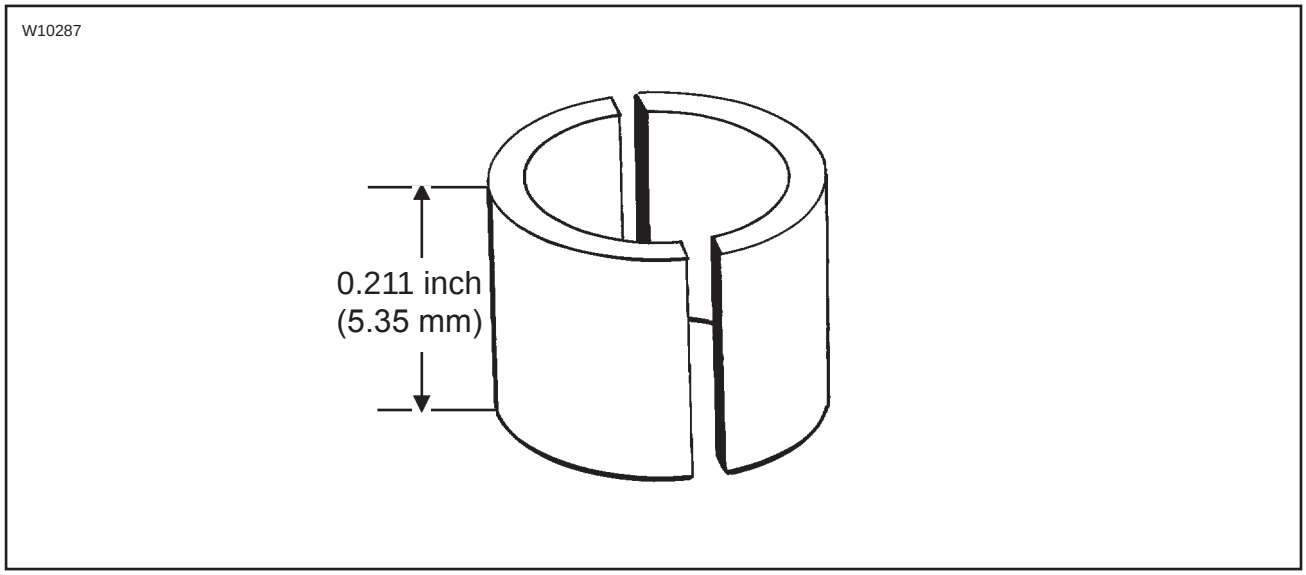
(10) Make a two-piece temporary blade spacer 0.211 inch (5.35 mm) thick, with an OD small enough not to interfere with the hub and an ID large enough to fit around the guide rod (550) (Figure 714).

NOTE: The two-piece blade spacer is to be temporarily installed between the fork and the guide collar and used to position the pitch change hardware when moving the blades in the clamps at low pitch. After the blades are in position, the blade spacer is removed.

(11) Place the locally fabricated two-piece blade spacer on a guide rod (550).

(12) Move the jack plate unit (770) away from the table, rotating the clamps to a low pitch position.

NOTE: The temporary two-piece blade spacer is positioned between the fork and the guide collar.



Temporary Two-Piece Blade Spacer for HC-D3MV20-8D
Figure 714

(13) Move the jack plate unit (770) until the 0.125 inch (3.17 mm) thick setup spacer is pinched between the jack plate (770) and the hub shoulder. This is the low pitch position for the blade clamps.

(14) Rotate the blades in the clamps to low pitch position.

NOTE: Refer to the applicable aircraft Specifications Manual or Hartzell Application Guide, Manual 159 (61-02-59) for the specific angle required.

CAUTION: LOW PITCH BLADE ANGLE MUST BE WITHIN ± 0.5 DEGREE OF THE CORRECT SETTING.

(15) Set low pitch with the jack plate unit (770) in full forward position against the set up spacer and the hub.

(16) Torque the outboard clamp nuts. Refer to the torque table in the Fits and Clearances chapter in this manual.

CAUTION: LOW PITCH BLADE ANGLE OF ALL BLADES MUST BE WITHIN A TOLERANCE OF ± 0.1 DEGREE OR A MAXIMUM OF 0.2 DEGREE VARIANCE FROM EACH OTHER.

(17) Check low pitch blade angle of all blades within a tolerance of ± 0.1 degree or a maximum of 0.2 degree variance from each other. If blades do not meet tolerance, reset the blades in the clamps.

(18) Using a padded blade bar, check blade tightness in the clamp by applying a torque of 167 ft-lb (226 N•m) to the blade near the blade root (Figure 707).

NOTE: Checking blade tightness ensures that a blade will not slip in flight.

(19) Recheck blade angles to assure no slippage has occurred.

(20) Remove the two-piece temporary spacer from the propeller.

(21) Turn the propeller on the rotatable fixture and check the height at the tip of each blade using a gage and adjustable pointer as shown in Figure 705.

NOTE: Blade heights at the tip should not vary more than ± 0.06 inch (1.5 mm).

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

(22) Mark the position of the hydraulic unit (500) using a crayon or a soft, non-graphite pencil.

NOTE: Marking the jack plate-to-hub position will make sure that the correct orientation is maintained when assembling on the aircraft and engine.

(23) Pull the jack plate unit (770) toward the table.

(24) Rotate the jack plate unit (770) and disengage the forks (810) from the blocks (220).

(25) Remove the jack plate unit (770), temporary low pitch spacer, and the setup spacer from the propeller.

NOTE: The setup spacer is used only during setup and is not used when installing the propeller on the aircraft.

(26) Remove the propeller from the build bench.

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

(a) Static balance will require a jack plate only to hold blades relative to each other.

(b) Use plastic or aluminum wedges to insert between the blade clamps and the hub.

(c) Use fixturing with a rear cone and a front nut to support the propeller for balancing.

(28) For installation of labels, refer to the Parts Identification and Marking chapter and the Paint and Finish chapter of Hartzell Propeller Inc. Standard Practices Manual 202A (61-01-02).

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

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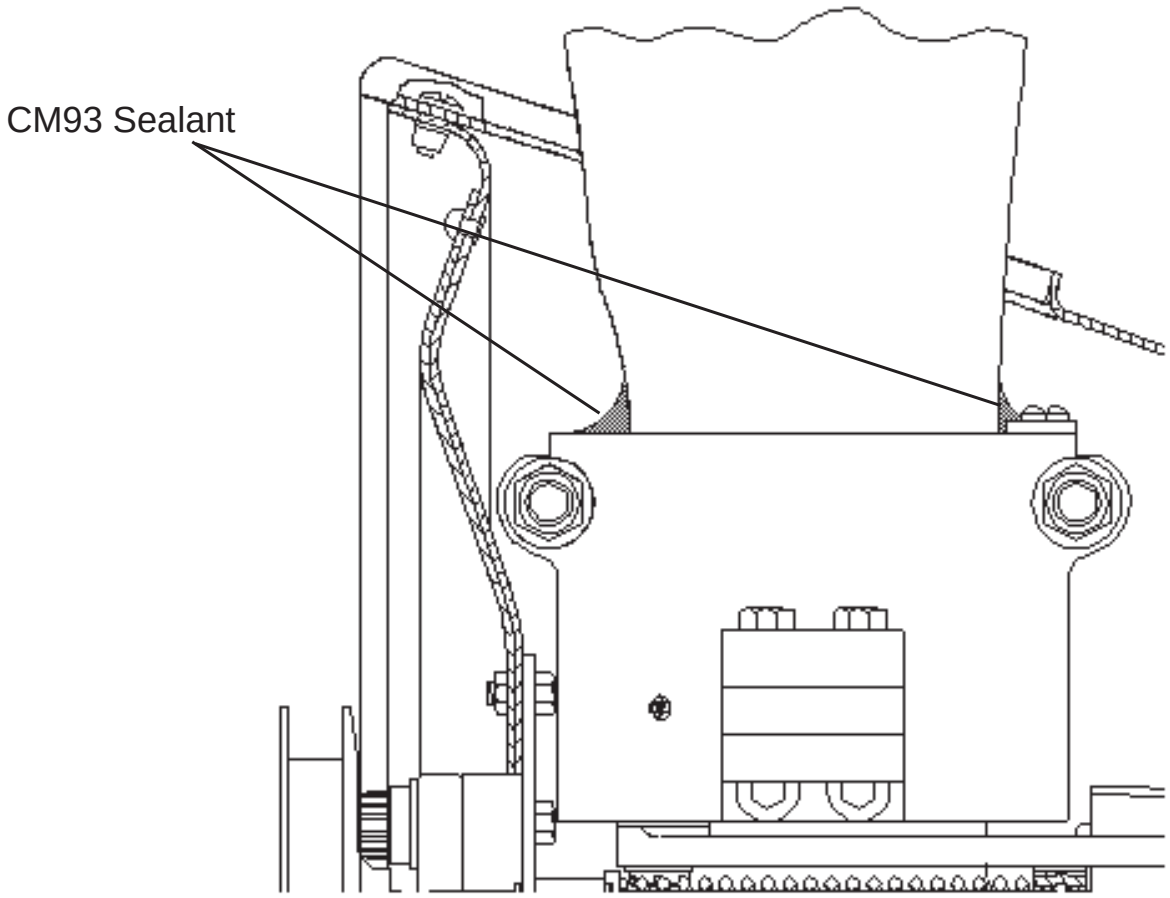

Sealant CM93 Application
Figure 714.1

G. Sealant CM93 Application - All Models

The application of sealant CM93 to the blade/blade clamp interface is an optional procedure that may provide additional protection against corrosion of the blade retention components.

CAUTION 1: TO AVOID PERMANENT DAMAGE TO THE BLADE RETENTION COMPONENTS CAUSED BY TRAPPED CHEMICALS, THIS PROCEDURE MUST BE PERFORMED FOLLOWING THE ASSEMBLY OF A PROPELLER AFTER OVERHAUL OR AFTER ANY OTHER PROCEDURE INVOLVING DISASSEMBLY AND CLEANING OF THE PROPELLER BLADE RETENTION COMPONENTS.

CAUTION 2: TO ASSURE PROPER ADHESION OF SEALANT CM93, BLADE AND BLADE CLAMP SURFACES MUST BE FREE OF GREASE AND DIRT.

(1) After performing the check for blade slippage in the clamp, fill the external void at the blade/blade clamp interface with a 0.25 inch (6.35 mm) maximum bead of sealant CM93, around the entire circumference of blade, as shown in Figure 714.1.

NOTE: Do not allow sealant CM93 to extend onto the surface of the clamp where balance weights and de-ice hardware are installed.

(2) Allow the sealant to cure for a minimum of two hours, before returning the propeller to service.

6. Jack Plate and Hydraulic Piston Assembly

CAUTION 1: DO NOT interchange cylinders and pistons. They are paired by stamped numbers on the outer edges of both units.

CAUTION 2: DO NOT interchange the valve body and valve plate on the "C" series valve assemblies.

A. HC-D2(V, MV)20-3 and HC-D3(V, MV)20-6L
(Hydraulic Unit Assemblies 91-E and 91-6L)

(1) Hand pack the bearing (670) with high speed bearing grease CM139.

CAUTION: BEARING SURFACE MARKED "THRUST HERE" MUST BE PRESSED INTO PISTON FIRST.

(2) Press the bearing (670) into the piston (510). A slight press fit is required. If necessary, use gasket compound CM93 between the bearing and the piston to insure tight fit.

NOTE: A bearing will take thrust in only one direction. The words "Thrust Here" are marked on the bearing and are not visible after the bearing is installed in the piston.

(3) Install the gasket (710) and cover plate (720).

(4) Install lock washers (750) and screws (760) in the cover plate (720) and into the piston (510). Torque the screws as required per Torque Values Table 801 in the Fits and Clearances chapter of this manual.

NOTE: Gasket may require trimming after the cover plate is installed.

(5) Press the jack plate (770) into the bearing (670)

NOTE: The groove just inside the inner race of the bearing must match the groove in the jack plate.

(6) Insert the wire ring (930) in the groove between the bearing inner race and the jack plate casting (780). Use pliers to work the wire ring around groove.

B. HC-D(2,3)(V,MV)20-7 and -8( )
(Hydraulic Unit Assemblies 91-7DS, 91-8DS, and 91-8DT)

(1) Hand pack the bearing (670) with high speed bearing grease CM139.

CAUTION: BEARING SURFACE MARKED "THRUST HERE" MUST BE PRESSED INTO PISTON FIRST.

(2) Press the bearing (670) into the piston (510). A slight press fit is required. If necessary, use gasket compound between the bearing and the piston to insure a tight fit.

NOTE: A bearing will take thrust in only one direction. The words "Thrust Here" are marked on the bearing and are not visible after the bearing is installed in the piston.

(3) Install the gasket (710) and cover plate (720).

(4) Insert lock washers (750) and screws (760) in the cover plate (720) and piston (510). Torque the screws as required, per Torque Values Table 801 in the Fits and Clearances chapter of this manual.

(5) Press the jack plate (770) into the bearing (670)

(a) The groove just inside the inner race of the bearing must match the groove in the jack plate.

7. Valve Reassembly

A. Reassembly of B-93-D Valve

(1) Install the O-ring (1230) in the valve body (1040).

(2) Install the guide pin (1200) connecting the valve link (1240) and valve spool (1050).

(3) Slide the valve spool (1050) and the guide pin (1200) into the valve body (1040) while sliding the guide pin (1200) onto the guide rod (1210).

(4) Install the cotter pin (1170) in the valve body (1040) to hold the other end of the spring.

(5) Attach the end of the spring into the cotter pin loop.

(6) Attach the other end of the spring (1180) on the groove in the guide pin (1200).

B. Reassembly of B-93-A, -B, -C Valve

(1) Install two O-rings (1230) in the valve body (1040).

(2) Slide the valve spool (1050) into the valve body (1040).

(3) Install the stop nut (1110) and stop screw (1120) on the link (1130).

(4) Assemble the links (1140) and (1130), and the spacer (1090). Install the clevis pin (1100) and the cotter pin (1075).

(5) Attach the link (1140) to the valve spool (1050) with the clevis pin (1080) and cotter pin (1070).

C. Reassembly of B-93-AG, -BG, -CG Valve

(1) Install two O-rings (1230) in the valve body (1040).

(2) Slide the valve spool (1050) into the valve body (1040).

(3) Connect the link (1130) to the valve spool (1050). Install the clevis pin (1080) and the cotter pin (1070).

D. Reassembly of B-93-E Valve

(1) Install two O-rings (1230) in the valve body (1040).

(2) Slide the valve spool (1050) into the valve body (1040).

(3) Install the stop nut (1110) and stop screw (1120) on the link (1130).

(4) Assemble the links (1140) and (1130), and the spacer (1090). Install the clevis pin (1100) and the cotter pin (1075).

(5) Attach the link (1140) to the valve spool (1050) with the clevis pin (1080) and cotter pin (1070).

8. Installing the Propeller Assembly on the Aircraft

A. The procedures for installing the propeller assembly on the aircraft that were previously part of this manual have been relocated to Hartzell Propeller Inc. Owner's Manual 140 (61-00-40).

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FITS AND CLEARANCES - CONTENTS

LIST OF FIGURES

LIST OF TABLES

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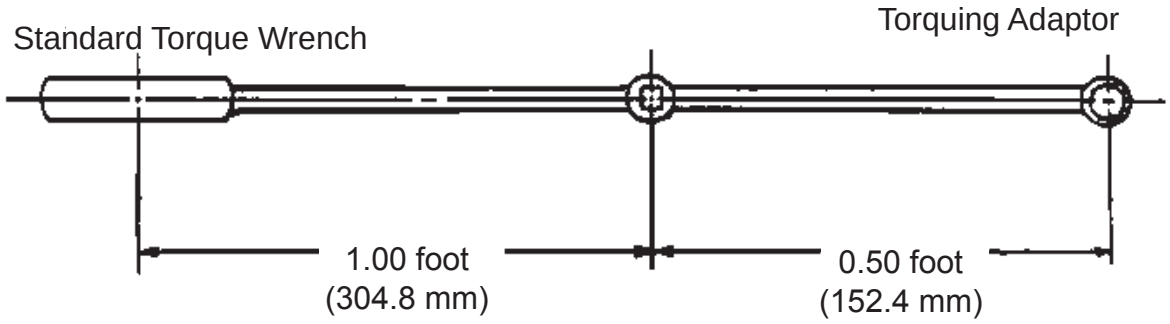

$$\frac{\text{(actual torque required) x (torque wrench length)}}{\text{(torque wrench length) + (length of adaptor)}} = \text{torque wrench reading to achieve required actual torque}$$

EXAMPLE:

$$\frac{\text{100 Ft-Lb (136 N•m) x 1 ft (304.8 mm)}}{\text{1 ft (304.8 mm) + 0.50 ft (152.4 mm)}} = \text{66.7 Ft-Lb (90.1 N•m)} < \text{reading on torque wrench with 6-inch (152.4 mm) adaptor for actual torque of 100 Ft-Lb (136 N•m)}$$

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

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Determining Torque Value of a Standard Torque Wrench with Adaptor
Figure 801

1. Torque Values

A. The structural integrity of joints in the propeller held together with threaded fasteners is dependent upon proper torque application.

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

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

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

B. Use accurate wrenches and professional procedures to make sure of correct tensioning.

C. For the torque values to use when assembling a Hartzell Propeller Inc. propeller, refer to Table 801, Torque Values in this chapter

D. When an adapter is used with a torque wrench, use the equation in Figure 801 to determine the correct torque value.

CAUTION 1: TORQUE VALUES ARE BASED ON NON-LUBRICATED THREADS, UNLESS OTHERWISE STATED IN TABLE 801.

CAUTION 2: REFER TO FIGURE 801 FOR TORQUE READING WHEN USING A TORQUE WRENCH ADAPTER.

NOTE: Torque tolerance is ± 10 percent unless otherwise noted. Refer to the Assembly chapter of this manual when wet torque is designated.

Part Number	Description	Torque		
		Ft-Lb	In-Lb	N•m
A-63B	Shaft Nut, 20-Spline	450	5400	610
A-279	Lubrication Fitting	-	50	5.6
A-304	Link Screw	35-45	420-540	47-61
A-321	Screw, Socket, Clamp	40	480	54
A-2017 or A-2043-1	Bolt, Clamp	35	420	47
A-2036-( )	Cap Screw, Socket Hd. (counterweight)	65	780	88
A-2038-( )	Cap Screw, Nylon Socket (Guide Collar)	-	48	5.4
B-352	Guide Collar Nut	125-150	1500-1800	170-203
B-3840-6	Screw, Filister Head	-	25	2.8
B-3840-12	Screw, Cover Plate	-	18	2.0
B-3359	Nut, Elastic	12	144	16
Aluminum Blade, mounted in blade clamp		167	2004	226

Torque Values
Table 801

2. Blade Tolerances

Tolerances Affecting the Blades	
Balance Tolerance:	1 slug A-48
Blade Track:	± 0.06 inch (1.5 mm)
Blade End Play:	0.100inch max. (2.54 mm)
Radial Play in Blade:	± 0.5 degree (1 degree total)
Fore and Aft Movement at Tip:	0.1 inch max. (2.54 mm)
Blade Pitch Setting Tolerance Between Blades:	0.2 degrees

NOTE 1: Blades are intended to be tight in the propeller; however, slight movement is acceptable if the blade returns to its original position when released. Blades with excessive movement, or that do not return to their original position when released may indicate internal wear or damage that should be referred to an authorized propeller repair station.

NOTE 2: For blade movement illustration, refer to Figure 101.

Blade Tolerances
Table 802

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SPECIAL TOOLS, FIXTURES, AND EQUIPMENT - CONTENTS

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1. Minimum Facility and Tooling Requirements

   A. Tooling

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

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

   B. Facilities

      (1) Grinding, plating, and painting of propeller components have the potential for health and safety hazards beyond that of other areas of a typical workshop.

         (a) It is expected that such areas be in compliance with industry standards and governmental regulations concerning occupational safety and health, as well as environmental protection.

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

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

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

2. Special Tools

   A. General

      (1) While Hartzell Propeller Inc. does not maintain an exact list of standard tools used in repair or servicing of our propellers, Hartzell Propeller Inc. frequently also requires the use of special tools during servicing, repair, or overhaul.

         (a) The applicable overhaul manual and Hartzell Propeller Inc. Tool and Equipment Manual 165A (61-00-65) provide this necessary tooling information.

         (b) It is the responsibility of the repair station or the technician performing the repair or servicing to use these special tools as required.

   B. Special Tools

      (1) Hartzell Propeller Inc. Tool and Equipment Manual 165A (61-00-65) contains a listing of special tools.

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ILLUSTRATED PARTS LIST - CONTENTS

PROPELLER ASSEMBLIES

LIST OF FIGURES

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: ILLUSTRATIONS 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 a repair station has questions about a propeller configuration as stated in the Illustrated Parts List, contact the Hartzell Propeller Inc. Product Support Department.

NOTE 1: Counterweight slugs and counterweight slug mounting hardware are application specific. For information concerning counterweight slugs and counterweight slug hardware, refer to Hartzell Application Guide Manual 159 (61-02-59).

NOTE 2: Spinner parts and mounting hardware are application specific. For information concerning spinner parts and mounting hardware, refer to the Hartzell Application Guide Manual 159 (61-02-59).

(2) Basic Propeller Parts: Refers to all of the propeller components that may be unique to a particular propeller model.

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 socket head cap screw (A-2037) that is item 640 was replaced by the socket head cap screw (A-2037-2C) that is item 640A.

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 (C-111-7) that is item 540, yet another configuration uses a counterweight (C-111-8) that is item 540A. 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) Nomenclature

This column identifies the item. The relationship of parts to assembly is 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) Effectivity Code (EFF CODE)

The effectivity column shows the prefix and/or suffix of the propeller model to which the parts apply. In some cases, the specific engine or aircraft manufacturer may be called out. Effectivity codes assigned apply only to the figure/listing in which they appear. Parts common to all end items show no code.

(6) Units Per Assembly (UPA)

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

(7) 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 numbers may be used interchangeably 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 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 be used for maintenance and/or repair of effected assemblies. Replaced parts may no longer be available, and the new part number must be used when ordering/ stocking new parts.

(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 Propeller Inc. manuals have previously been specified with AN, MS, NAS or vendor part number. To provide internal controls and procurement flexibility, Hartzell Propeller Inc. has made engineering changes to provide all O-rings, fasteners, and hardware with a Hartzell Propeller Inc. part number. Part shipments from Hartzell Propeller Inc. will specify only the Hartzell Propeller Inc. part numbers.

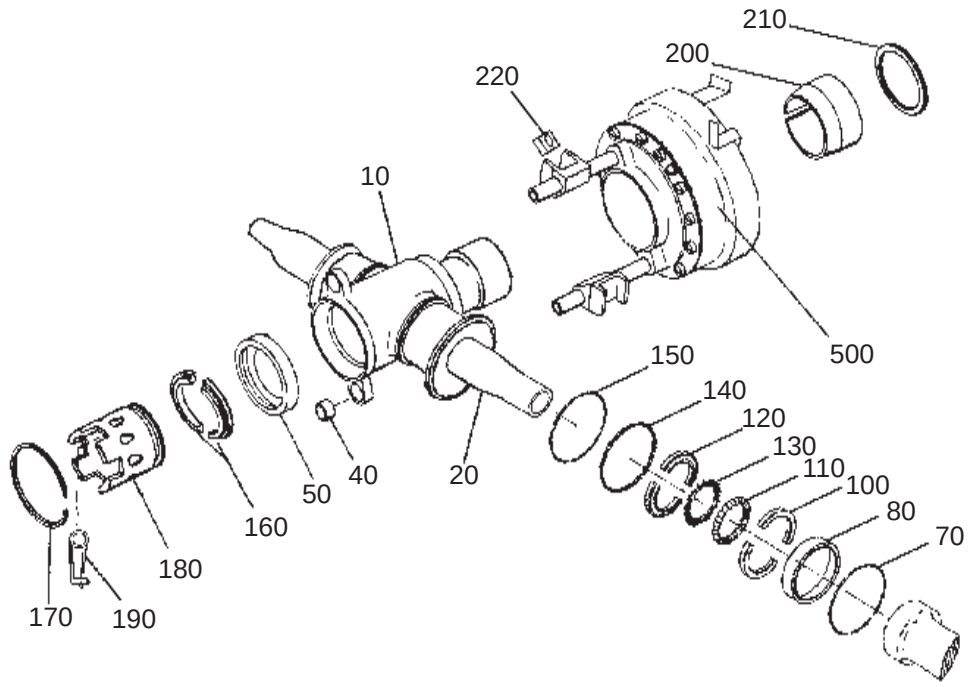
(2) Some O-rings, fasteners, and hardware manufactured in accordance with established industry specifications (certain AN, MS, NAS items) are acceptable for use in Hartzell Propeller Inc. products without additional standards imposed by Hartzell Propeller Inc.

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

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

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

APS5093



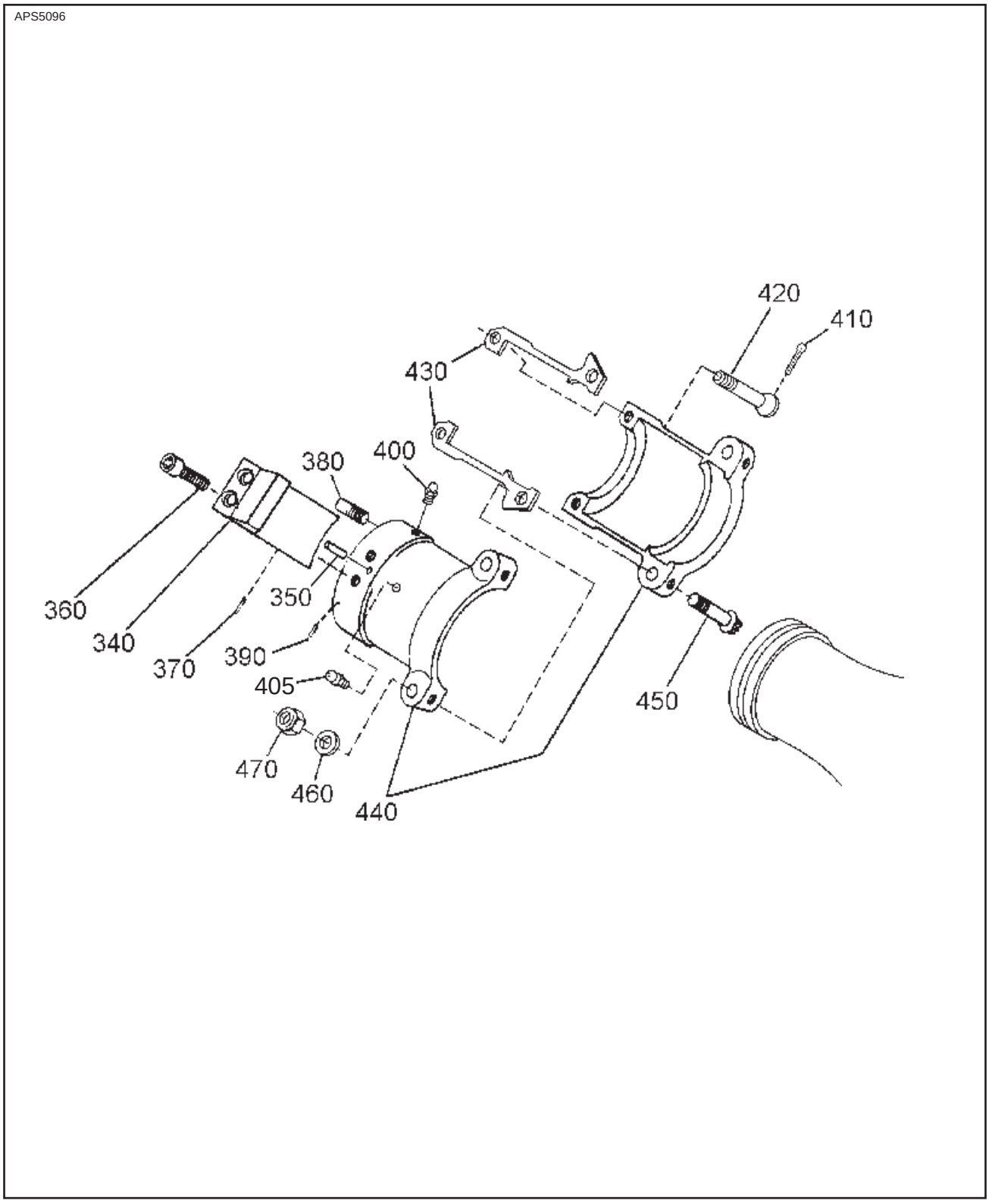
HC-D2V20-3 Propeller Assembly
Figure 10-1

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-1						
-1	HC-D2V20-3		PROPELLER ASSEMBLY		1	
10	840-124		• HUB UNIT		2	
20	A-1496-( )		• • PILOT TUBE SUPERSEDED BY ITEM 20A		2	
20A	D-7080-( )		• • PILOT TUBE SUPERSEDES ITEM 20		2	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		2	Y
40	A-116-A1		• • BUSHING		2	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		2	Y
80	A-972		• GUIDE RING		2	
-90	A-971		• SPLIT BEARING UNIT		2	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		2	Y
140	A-2027		• WIRE RETENTION RING		2	Y
150	C-3317-230		• O-RING		2	Y
160	A-156		• PULLER RING		1	
170	A-46		• SNAP RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB SAFETY PIN		1	Y
200	A-50-1		• REAR CONE		1	
210	A-186		• SPACER, REAR CONE		AR	
220	A-95-A		• BLOCK, PITCH CHANGE		2	Y
-320	A-165-3		• SPACER RING		2	
500	C-91-3E		• HYDRAULIC UNIT		1	
			NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGHT SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL159 (61-02-59).			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2V20-3



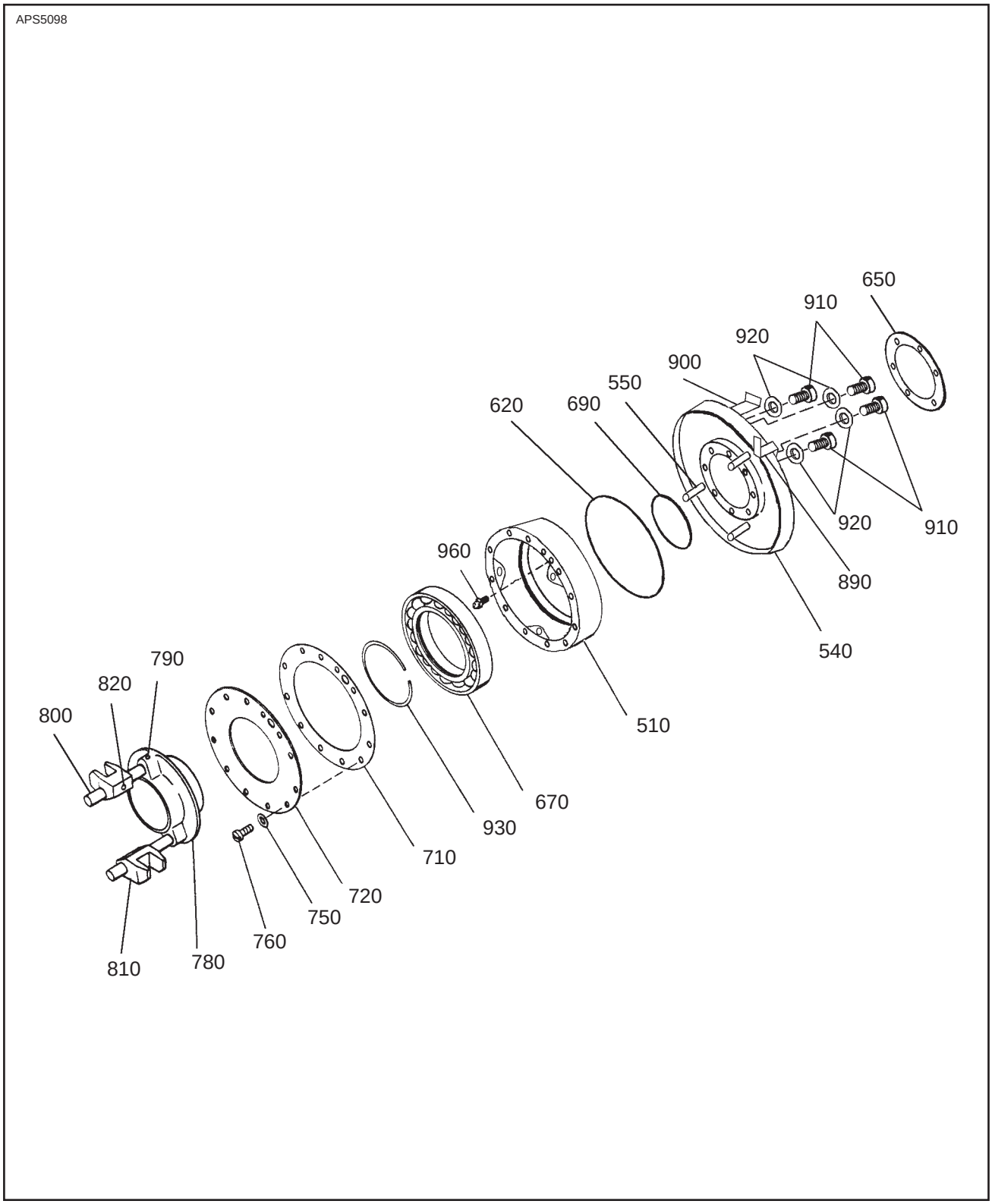
HC-D2V20-3 Clamp Assembly
Figure 10-2

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-2						
-330	838-29		• CLAMP ASSEMBLY		2	
340	A-833-4		• • COUNTERWEIGHT UNIT		1	
350	A-65		• • COUNTERWEIGHT DOWEL PIN		1	
360	A-2036-30		• • SOCKET HEAD CAP SCREW		2	Y
370	A-285		• • STAKING PIN		2	Y
380	A-295		• • LINK SCREW		1	Y
390	A-285		• • STAKING PIN		1	Y
400	B-6588-1		• • LUBRICATION FITTING		1	Y
-400A	B-6855		• • LUBRICATION PLUG		1	Y
405	B-6588-1		• • LUBRICATION FITTING		1	Y
410	B-3838-3-2		• • COTTER PIN		2	Y
420	A-321		• • SOCKET SCREW		2	Y
430	A-47-1		• • GASKET		2	Y
440	C-3-3A		• • CLAMP		1	
450	A-2017		• • CLAMP BOLT		2	Y
460	A-2031		• • WASHER		2	Y
470	A-2043-1		• • CLAMP NUT		2	Y
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y
-483	B-3840-( )		• • WEIGHT SCREW		AR	Y
-484	A-48		• BALANCE WEIGHT		AR	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2V20-3



HC-D2V20-3 91-3E Hydraulic Unit
Figure 10-3

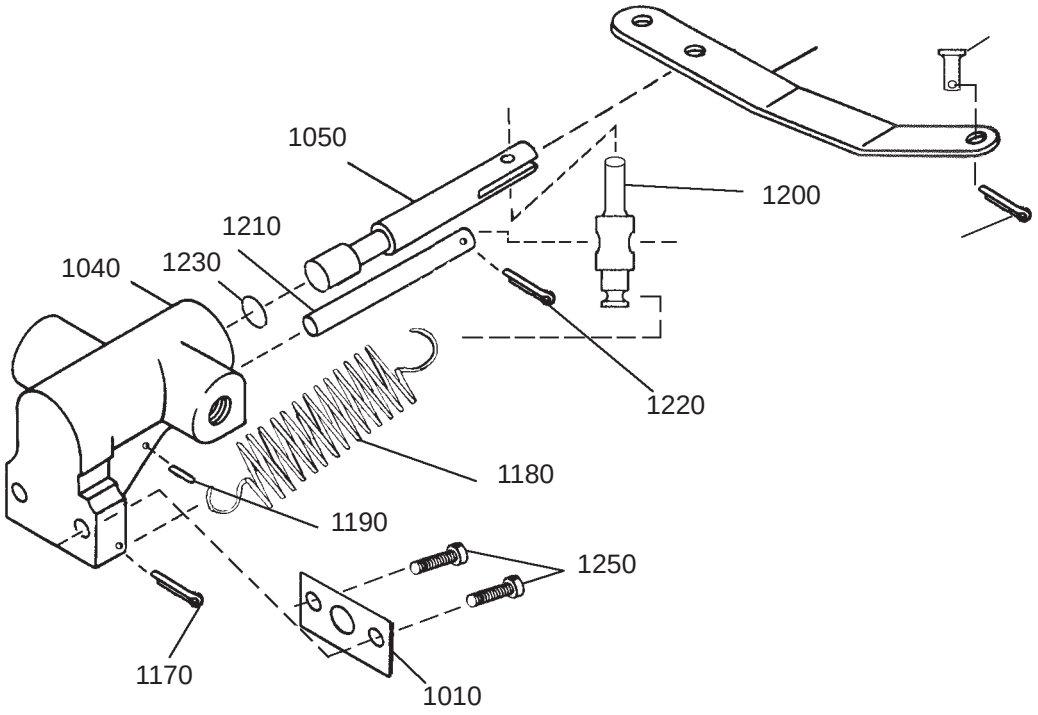
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-3						
-500	C-91-3E		HYDRAULIC UNIT		1	
510	D-78		• PISTON		1	
540	C-77		• CYLINDER		1	
550	A-11-A		• GUIDE PIN		3	
-570	A-312		• NUT		3	
620	C-3317-445		• O-RING		1	Y
650	A-181		• GASKET		1	Y
670	A-38-BG		• THRUST BEARING		1	
690	C-3317-341		• O-RING		1	Y
710	B-73		• GASKET, COVER PLATE		1	Y
720	B-12-3		• COVER PLATE		1	
-730	A-2043-1		• ELASTIC NUT		6	Y
-740	A-181		• GASKET		1	Y
750	B-3864-39		• INTERNAL LOCK WASHER		12	Y
760	B-3840-6		• FILISER HEAD SCREW		12	Y
-770	B-109-10		• JACK PLATE UNIT		1	
780	B-87F		• • JACK PLATE		1	
790	A-114-F		• • STAKING PIN		2	
800	A-97-3E		• • PUSH ROD		2	
810	A-821L		• • FORK		2	
820	A-114-8		• • STAKING PIN		2	
890	A-76		• STOP, LEVER		1	
900	A-41		• STOP, PITCH CONTROL VALVE		1	
910	B-3840-6		• FILISTER HEAD SCREW		4	Y
920	B-3864-39		• INTERNAL LOCK WASHER		4	Y
930	A-43		• WIRE RETAINER		1	
960	B-6588-1		• LUBRICATION FITTING (SEE NOTE 1)		1	Y
-963	B-6855		• PLUG (SEE NOTE 1)		1	
			NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 BEARING LUBRICATION FITTING WITH THE B-6855 PLUG.			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2V20-3 91-3E Hydraulic Unit

APS6002



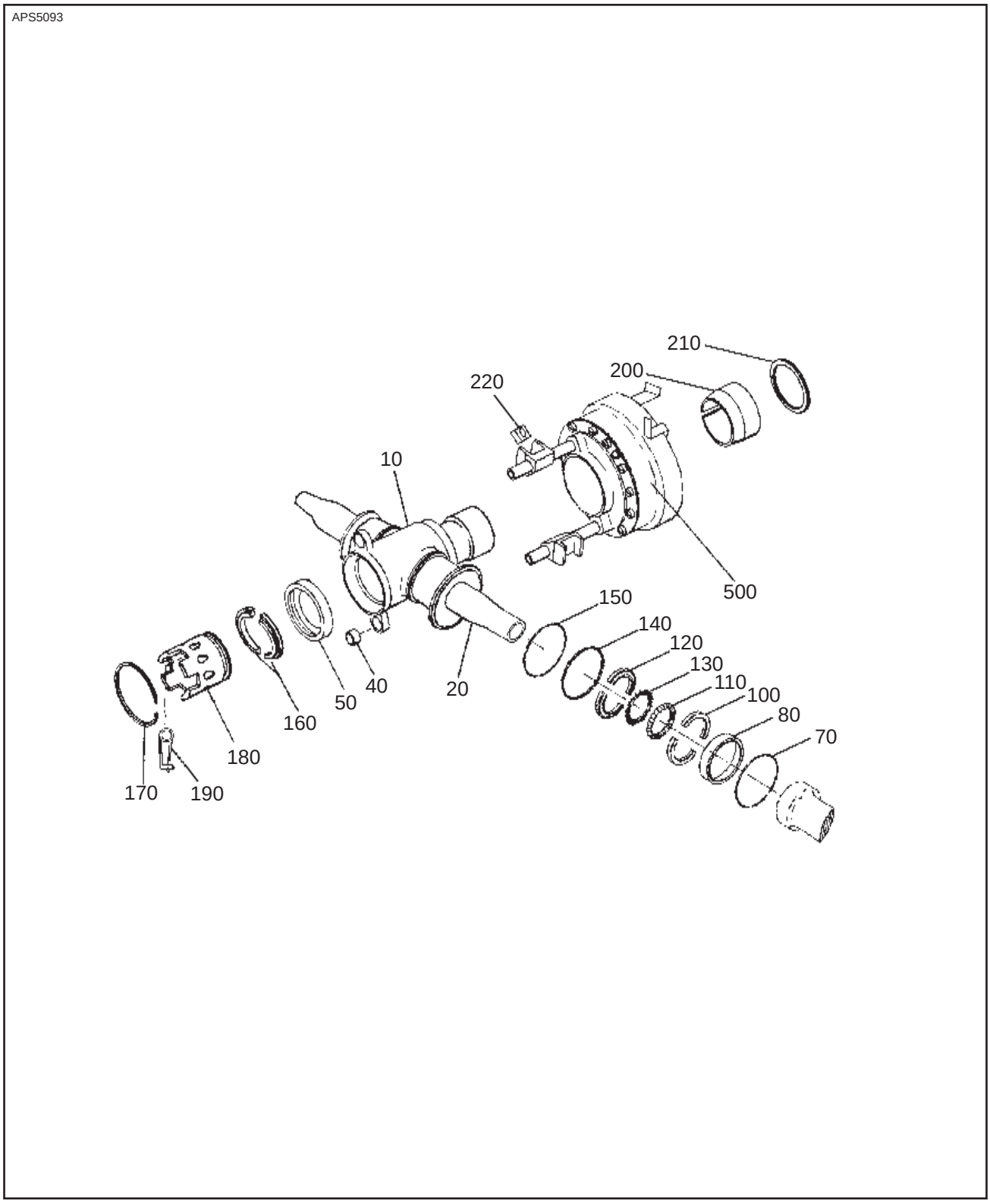
HC-D2V20-3 93-D Valve Assembly
Figure 10-4

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-4						
-1000A	B-93-D		• VALVE ASSEMBLY		1	
1010	A-71-2		• • GASKET		1	Y
-1030	B-299		• • VALVE UNIT		1	
1040	B-301		• • • VALVE BODY		1	
1050	A-307		• • • VALVE SPOOL		1	
1170	B-3838-3-2		• • • COTTER PIN		1	Y
1180	A-306-A		• • • SPRING		1	
1190	A-285		• • • STAKING PIN		1	
1200	A-303		• • • GUIDE PIN		1	
1210	A-302		• • • GUIDE ROD		1	
1220	B-3838-3-2		• • • COTTER PIN		1	Y
1230	C-3317-112		• • • O-RING		2	Y
1240	A-44		• • LINK, CONTROL VALVE		1	
1250	A-2038-6		• • SOCKET HEAD SCREW		2	Y
1260	B-3838-2-2		• • COTTER PIN		2	Y
1270	B-6644-21		• • CLEVIS PIN		1	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2V20-3 93-D Valve Assembly



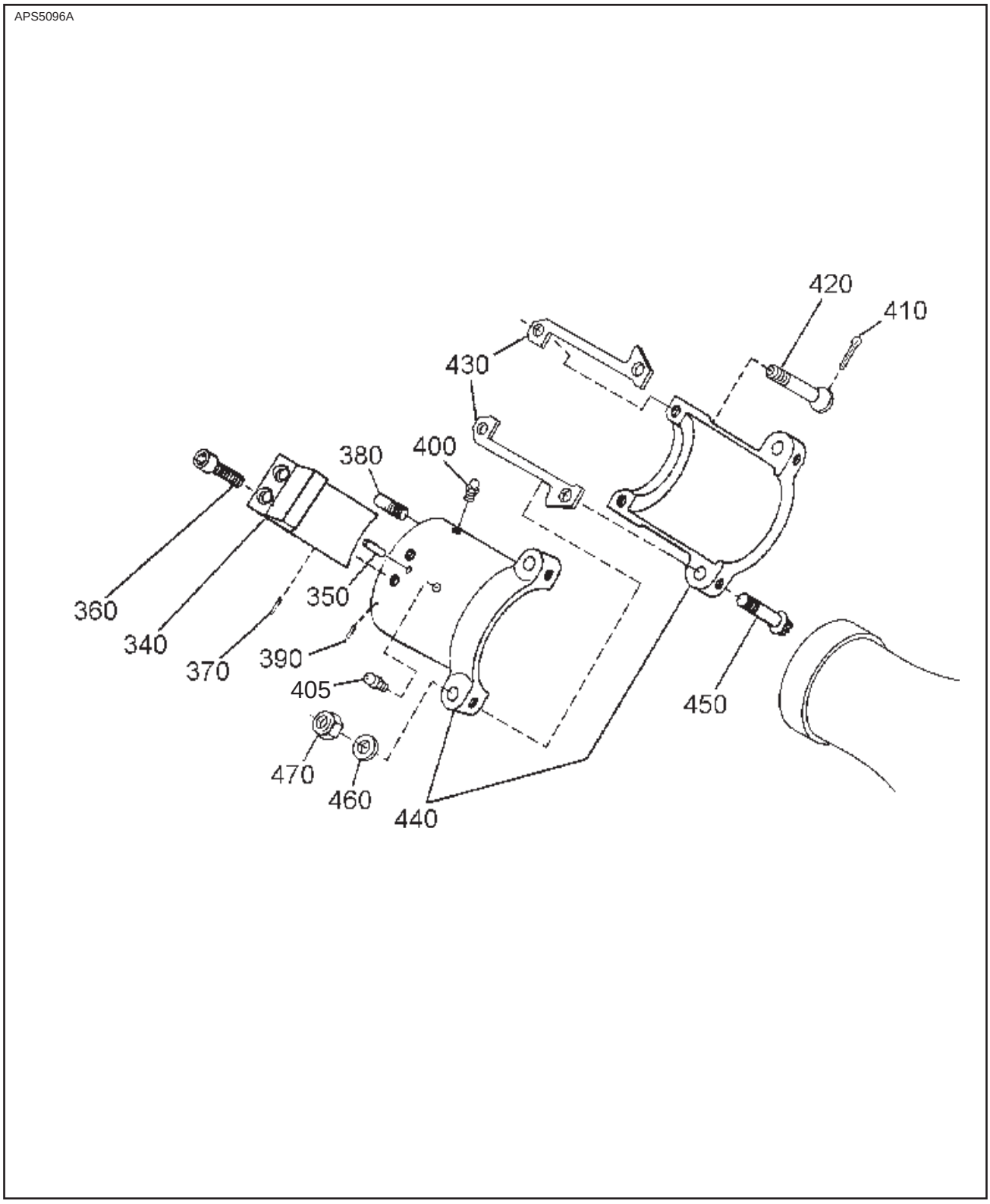
HC-D2MV20-3 Propeller Assembly
Figure 10-5

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-5						
-1	HC-D2MV20-3		PROPELLER ASSEMBLY		1	
10	840-124		• HUB UNIT		1	
20	A-1496-( )		• • PILOT TUBE SUPERSEDED BY ITEM 20A		2	
20A	D-7080-( )		• • PILOT TUBE SUPERSEDES ITEM 20		2	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		2	Y
40	A-116-A1		• • BUSHING		2	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		2	Y
80	A-972		• GUIDE RING		2	
-90	A-971		• SPLIT BEARING UNIT		2	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		2	Y
140	A-2027		• WIRE RETENTION RING		2	Y
150	C-3317-230		• O-RING, BLADE		2	Y
160	A-156		• PULLER RING		1	
170	A-46		• SNAP RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB SAFETY PIN		1	Y
200	A-50-1		• REAR CONE		1	
210	A-186		• SPACER, REAR CONE		AR	
220	A-95-A		• BLOCK, PITCH CHANGE		2	Y
-320	A-165-6		• SPACER RING (USED FOR NEW PROPELLER ASSEMBLY)		1	
-320A	A-165-(4,5)		• SPACER RING, SB HC-SB-61-241		AR	
-500	C-91-3E		• HYDRAULIC UNIT		1	
			NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGHT SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2MV20-3



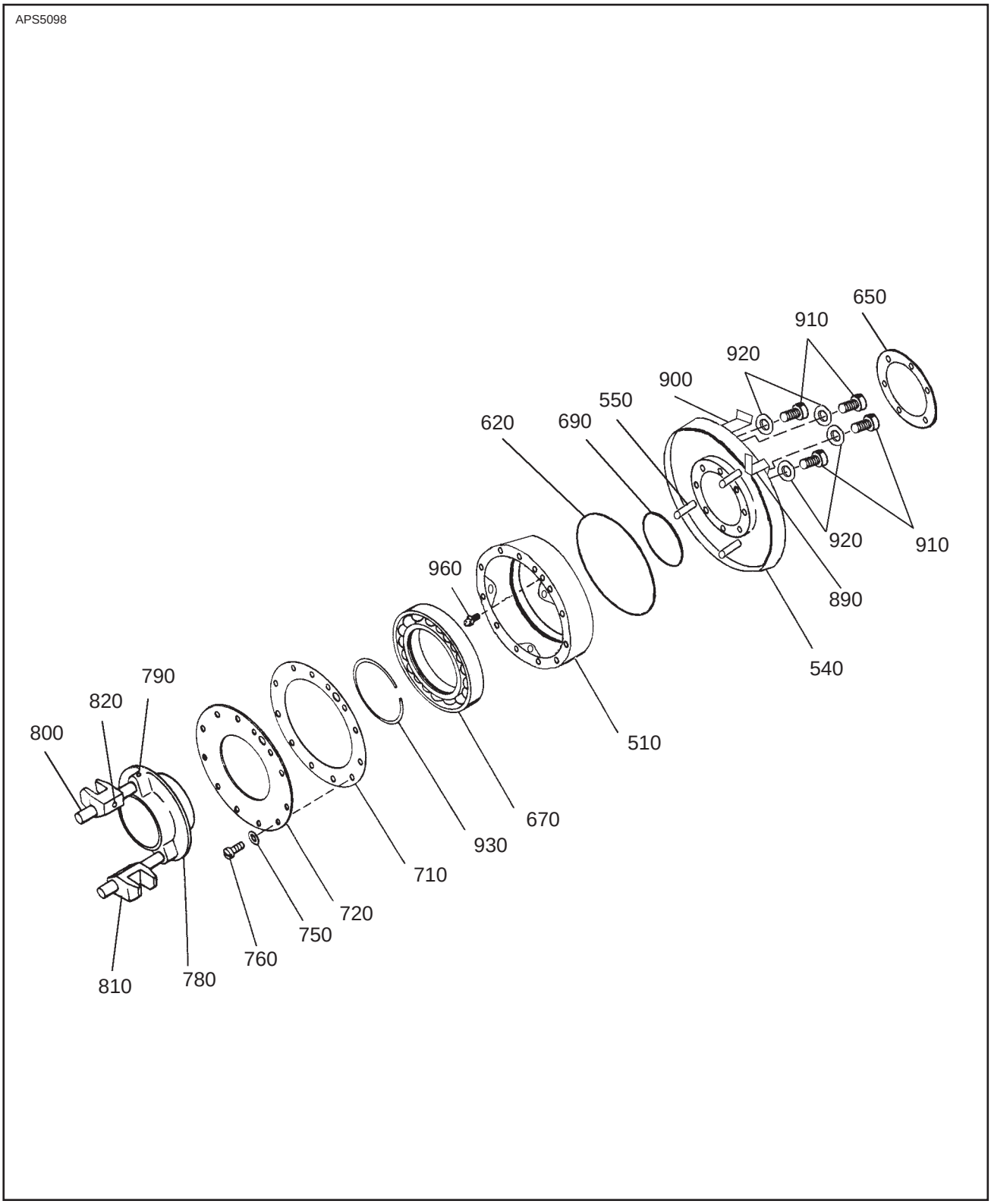
HC-D2MV20-3 Clamp Assembly
Figure 10-6

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-6						
-330	838-1029		• CLAMP ASSEMBLY		2	
340	A-833-4		• • COUNTERWEIGHT UNIT		1	
350	A-65		• • COUNTERWEIGHT DOWEL PIN		1	
360	A-2036-30		• • SOCKET HEAD CAP SCREW		2	Y
370	A-285		• • STAKING PIN		2	Y
380	A-295		• • LINK SCREW		1	Y
390	A-285		• • STAKING PIN		1	Y
400	B-6588-1		• • LUBRICATION FITTING		1	Y
-400A	B-6855		• • LUBRICATION PLUG		1	Y
405	B-6588-1		• • LUBRICATION FITTING		1	Y
410	B-3838-3-2		• • COTTER PIN		2	Y
420	A-321		• • SOCKET SCREW		2	Y
430	A-6871-1		• • GASKET		2	Y
440	D-6831-3A		• • CLAMP		1	
450	A-2017		• • CLAMP BOLT		2	Y
460	A-2031		• • WASHER		2	Y
470	A-2043-1		• • CLAMP NUT		2	Y
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y
-483	B-3840-( )		• • WEIGHT SCREW		AR	Y
-484	A-48		• BALANCE WEIGHT		AR	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2MV20-3 Clamp Assembly



HC-D2MV20-3 91-3E Hydraulic Unit
Figure 10-7

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-7						
-500	C-91-3E		• HYDRAULIC UNIT		1	
510	D-78		• • PISTON		1	
540	C-77		• • CYLINDER		1	
550	A-11-A		• • GUIDE PIN		3	
-570	A-312		• • NUT		3	
620	C-3317-445		• • O-RING		1	Y
650	A-181		• • GASKET		1	Y
670	A-38-BG		• • THRUST BEARING		1	
690	C-3317-341		• • O-RING		1	Y
710	B-73		• • GASKET, COVER PLATE		1	Y
720	B-12-3		• • COVER PLATE		1	
-730	A-2043-1		• • ELASTIC NUT		6	Y
-740	A-181		• • GASKET		1	Y
750	B-3864-39		• • INTERNAL LOCK WASHER		12	Y
760	B-3840-6		• • FILISER HEAD SCREW		12	Y
-770	B-109-10		• • JACK PLATE UNIT		1	
780	B-87F		• • • JACK PLATE		1	
790	A-114-F		• • • STAKING PIN		2	
800	A-97-3E		• • • PUSH ROD		2	
810	A-821L		• • • FORK		2	
820	A-114-8		• • • STAKING PIN		2	
890	A-76		• • STOP, LEVER		1	
900	A-41		• • STOP, PITCH CONTROL VALVE		1	
910	B-3840-6		• • FILISTER HEAD SCREW		4	Y
920	B-3864-39		• • INTERNAL LOCK WASHER		4	Y
930	A-43		• • WIRE RETAINER		1	
960	B-6588-1		• • LUBRICATION FITTING (SEE NOTE 1)		1	Y
-963	B-6855		• • PLUG (SEE NOTE 1)		1	

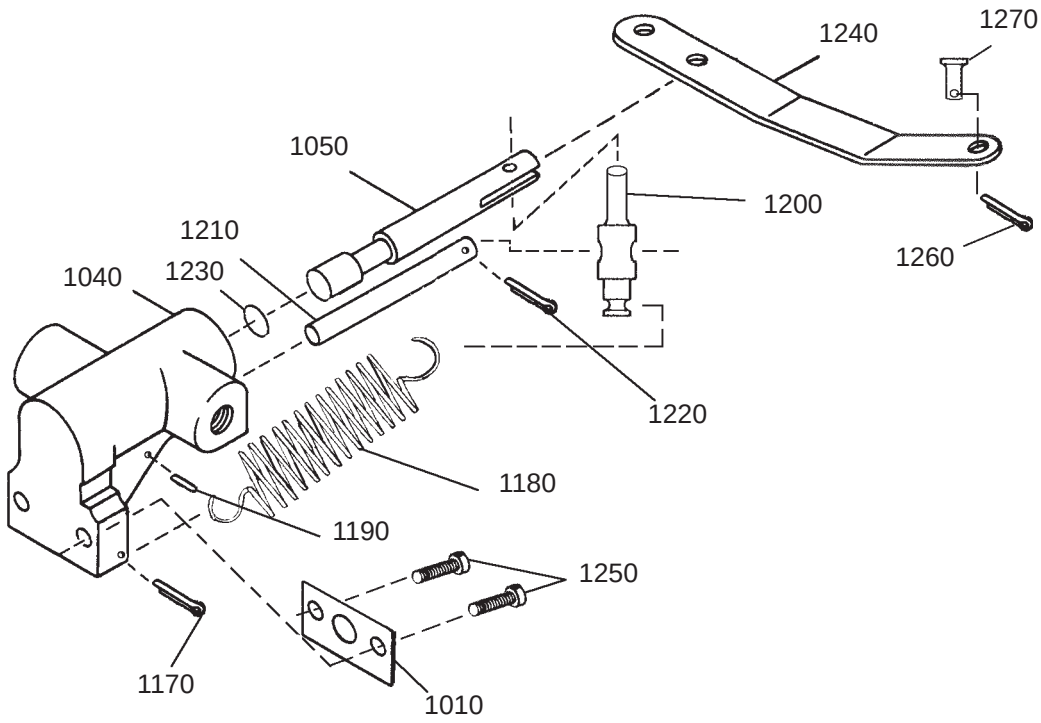
NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 LUBRICATION FITTING WITH THE B-6855 PLUG.

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2MV20-3 91-3E Hydraulic Unit

APS6002



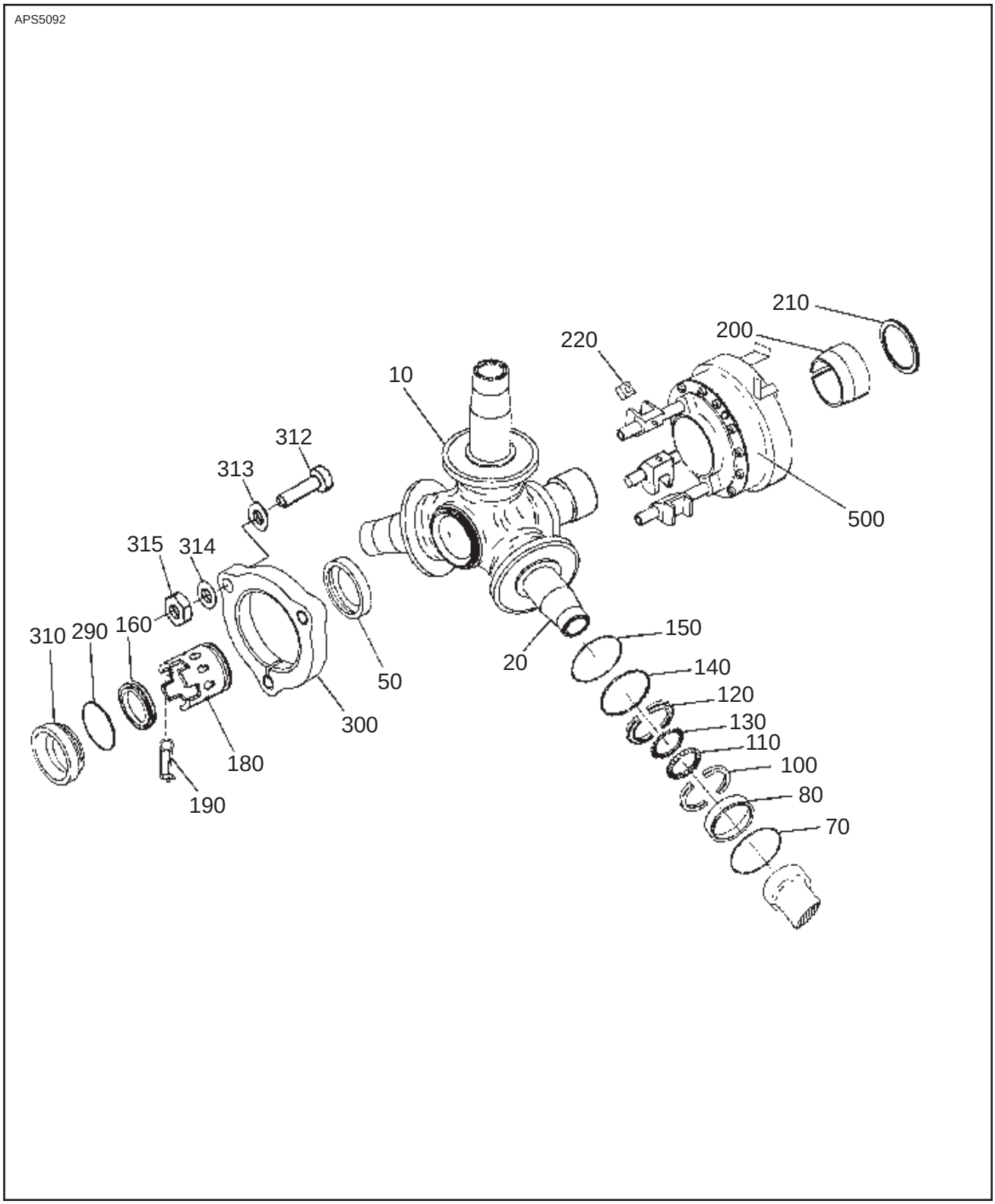
HC-D2MV20-3 93-D Valve Assembly
Figure 10-8

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-8						
-1000	B-93-D		• VALVE ASSEMBLY		1	
1010	A-71-2		• • GASKET		1	Y
-1030	B-299		• • VALVE UNIT		1	
1040	B-301		• • • VALVE BODY		1	
1050	A-307		• • • VALVE SPOOL		1	
1170	B-3838-3-2		• • • COTTER PIN		1	Y
1180	A-306-A		• • • SPRING		1	
1190	A-285		• • • STAKING PIN		1	
1200	A-303		• • • GUIDE PIN		1	
1210	A-302		• • • GUIDE ROD		1	
1220	B-3838-3-2		• • • COTTER PIN		1	Y
1230	C-3317-112		• • • O-RING		2	Y
1240	A-44		• • LINK, CONTROL VALVE		1	
1250	A-2038-6		• • SOCKET HEAD SCREW		2	Y
1260	B-3838-2-2		• • COTTER PIN		2	Y
1270	B-6644-21		• • CLEVIS PIN		1	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2MV20-3 93-D Valve Assembly



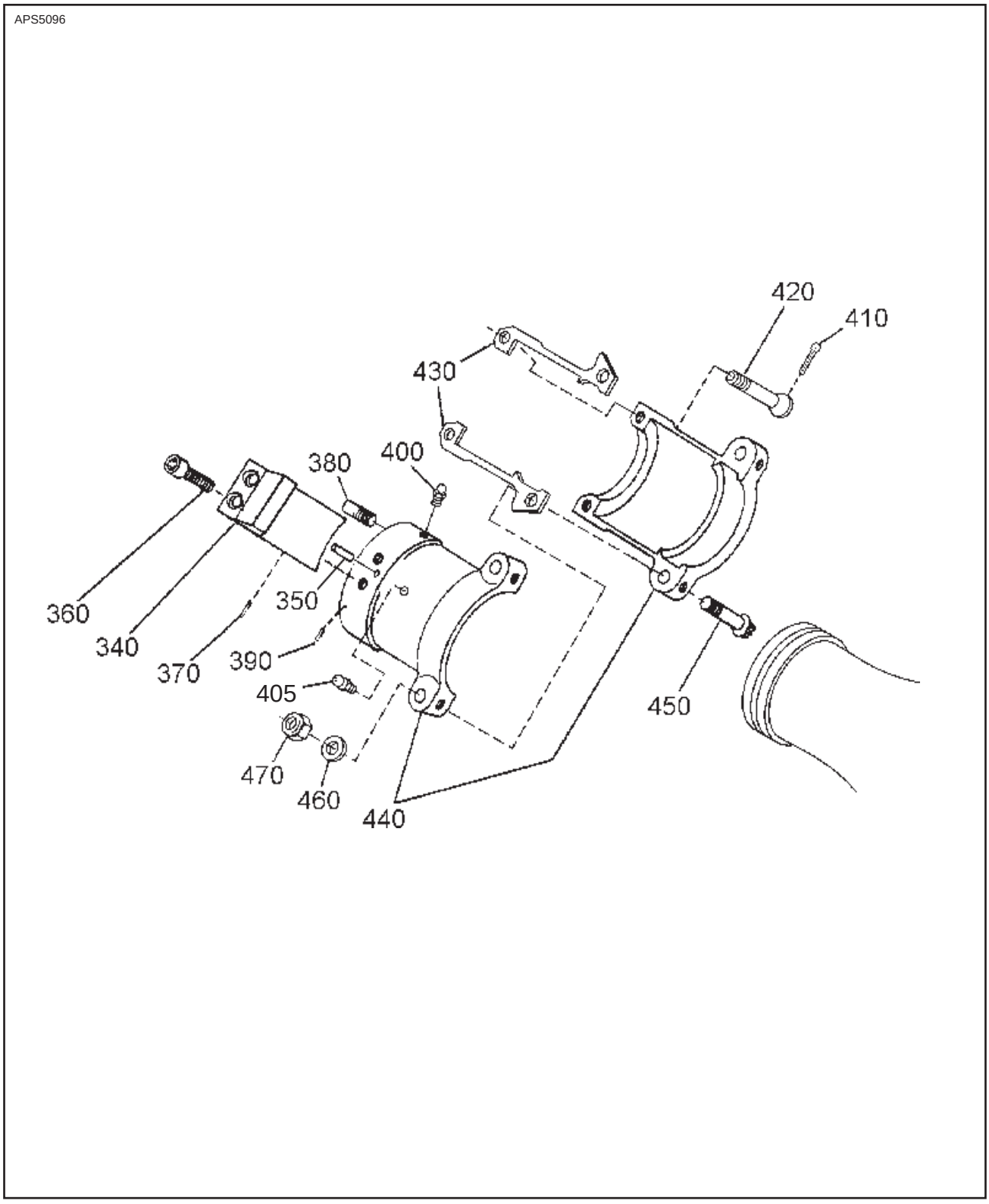
HC-D3V20-6L Propeller Assembly
Figure 10-9

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-9						
-1	HC-D3V20-6L		PROPELLER ASSEMBLY		RF	
10	840-85		• HUB UNIT		1	
20	A-1496-( )		• • PILOT TUBE (SUPERSEDED BY ITEM 20A)		3	
20A	D-7080-( )		• • PILOT TUBE (SUPERSEDES ITEM 20)		3	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		3	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		3	Y
80	A-972		• GUIDE RING		3	
-90	A-971		• SPLIT BEARING UNIT		3	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		3	Y
140	A-2027		• WIRE RETENTION RING		3	Y
150	C-3317-230		• O-RING		3	Y
160	A-870		• PULLER RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB SAFETY PIN		1	Y
200	A-50-1		• REAR CONE		1	
210	A-186		• SPACER, REAR CONE		AR	
220	A-95-A		• BLOCK, PITCH CHANGE		3	Y
290	C-3317-235		• O-RING		1	Y
300	834-1L		• GUIDE COLLAR UNIT		1	
-303	A-116-D1		• • PLASTIC BUSHING		3	
-305	A-2038-12		• • SOCKET HEAD CAP SCREW		1	
-307	A-114C		• • STAKING PIN		3	
-310	B-352		• • NUT, GUIDE COLLAR		1	
312	A-827-7		• SLEEVE		3	
313	A-970-2		• REVERSE STOP		3	
314	A-965		• WASHER		3	Y
315	A-848-2		• NUT		3	Y
500	91-6L		• HYDRAULIC UNIT		1	
			NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGHT SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3V20-6L

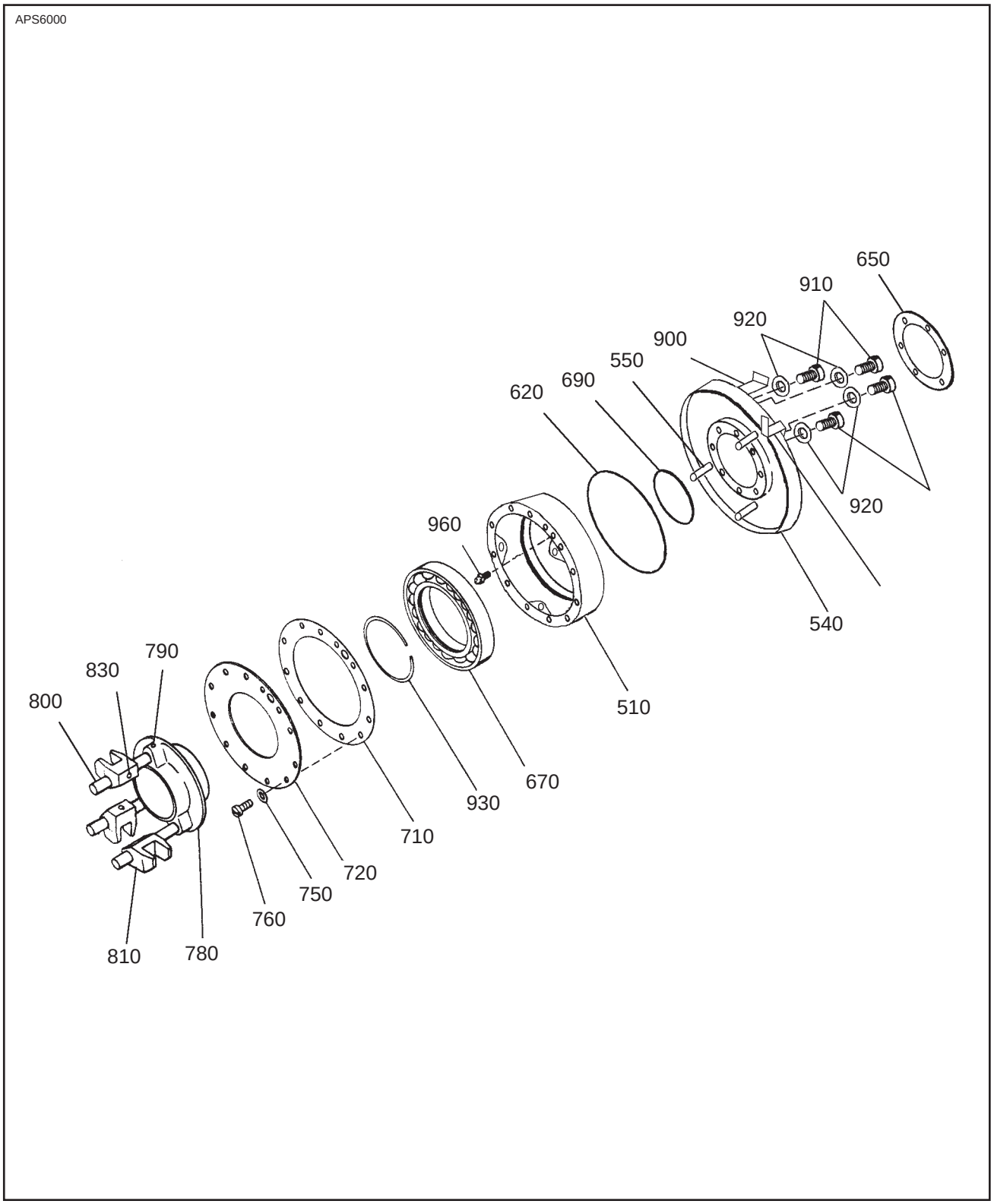


HC-D3V20-6L Clamp Assembly
Figure 10-10

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-10						
-330	838-29		• CLAMP ASSEMBLY		3	
340	833-4		• • COUNTERWEIGHT UNIT		1	
350	A-65		• • COUNTERWEIGHT DOWEL PIN		1	
360	A-2036-30		• • SOCKET HEAD CAP SCREW		2	Y
370	A-285		• • STAKING PIN		2	Y
380	A-295		• • LINK SCREW		1	Y
390	A-285		• • STAKING PIN		1	Y
400	B-6588-1		• • LUBRICATION FITTING		1	Y
400A	B-6855		• • LUBRICATION PLUG		1	Y
405	B-6588-1		• • LUBRICATION FITTING		1	Y
410	B-3838-3-2		• • COTTER PIN		2	Y
420	A-321		• • SOCKET SCREW		2	Y
430	A-47-1		• • GASKET		2	Y
440	C-3-3A		• • CLAMP		1	
450	A-2017		• • CLAMP BOLT		2	Y
460	A-2031		• • WASHER		2	Y
470	A-2043-1		• • CLAMP NUT		2	Y
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y
-483	B-3840-( )		• • WEIGHT SCREW		AR	Y
-484	A-48		• BALANCE WEIGHT		AR	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED



HC-D3V20-6L 91-6L Hydraulic Unit
Figure 10-11

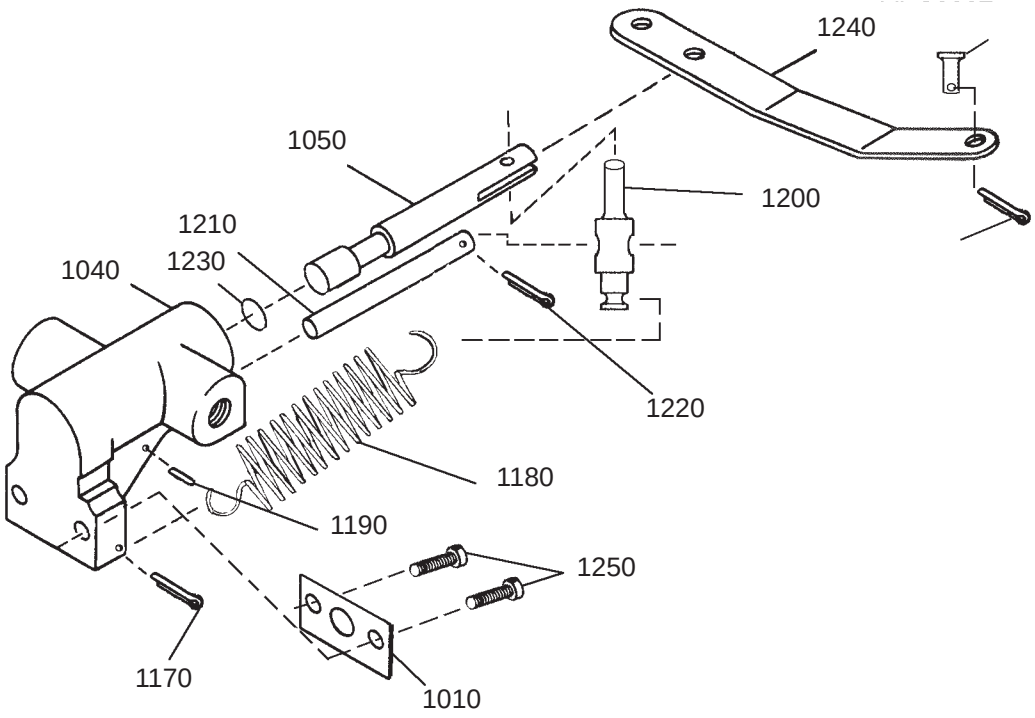
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-11						
-500	91-6L		• HYDRAULIC UNIT		1	
510	D-78		• • PISTON		1	
540	C-77		• • CYLINDER		1	
550	A-11-A		• • GUIDE PIN		3	
-570	A-312		• • NUT		3	
620	C-3317-445		• • O-RING		1	Y
650	A-181		• • GASKET		1	Y
670	A-38-BG		• • THRUST BEARING		1	
690	C-3317-341		• • O-RING		1	Y
710	B-73		• • GASKET, COVER PLATE		1	Y
720	B-12-3		• • COVER PLATE		1	
-730	A-2043		• • ELASTIC NUT SUPERSEDED BY BY ITEM 730A		6	Y
-730A	A-2043-1		• • ELASTIC NUT SUPERSEDES ITEM 730		6	Y
750	B-3864-39		• • INTERNAL LOCK WASHER		12	Y
760	B-3840-6		• • FILISTER HEAD SCREW		12	Y
-770	B-351-3		• • JACK ASSEMBLY		1	
780	B-356		• • • JACK PLATE		1	
790	A-114-E		• • • STAKING PIN		3	
800	A-826-10		• • • PUSH ROD		3	
810	A-921-1L		• • • FORK		3	
830	A-2039		• • • SET SCREW		3	Y
890	A-76		• • STOP, LEVER		1	
900	A-41		• • STOP, PITCH CONTROL VALVE		1	
910	B-3840-6		• • FILISTER HEAD SCREW		4	Y
920	B-3864-39		• • INTERNAL LOCK WASHER		4	Y
930	A-43		• • WIRE RETAINER		1	
960	B-6588-1		• • LUBRICATION FITTING (SEE NOTE 1)		1	Y
963	B-6855		• • PLUG (SEE NOTE 1)		1	
			NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 LUBRICATION FITTING WITH THE B-6855 PLUG.			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3V20-6L 91-6L Hydraulic Unit

APS6002



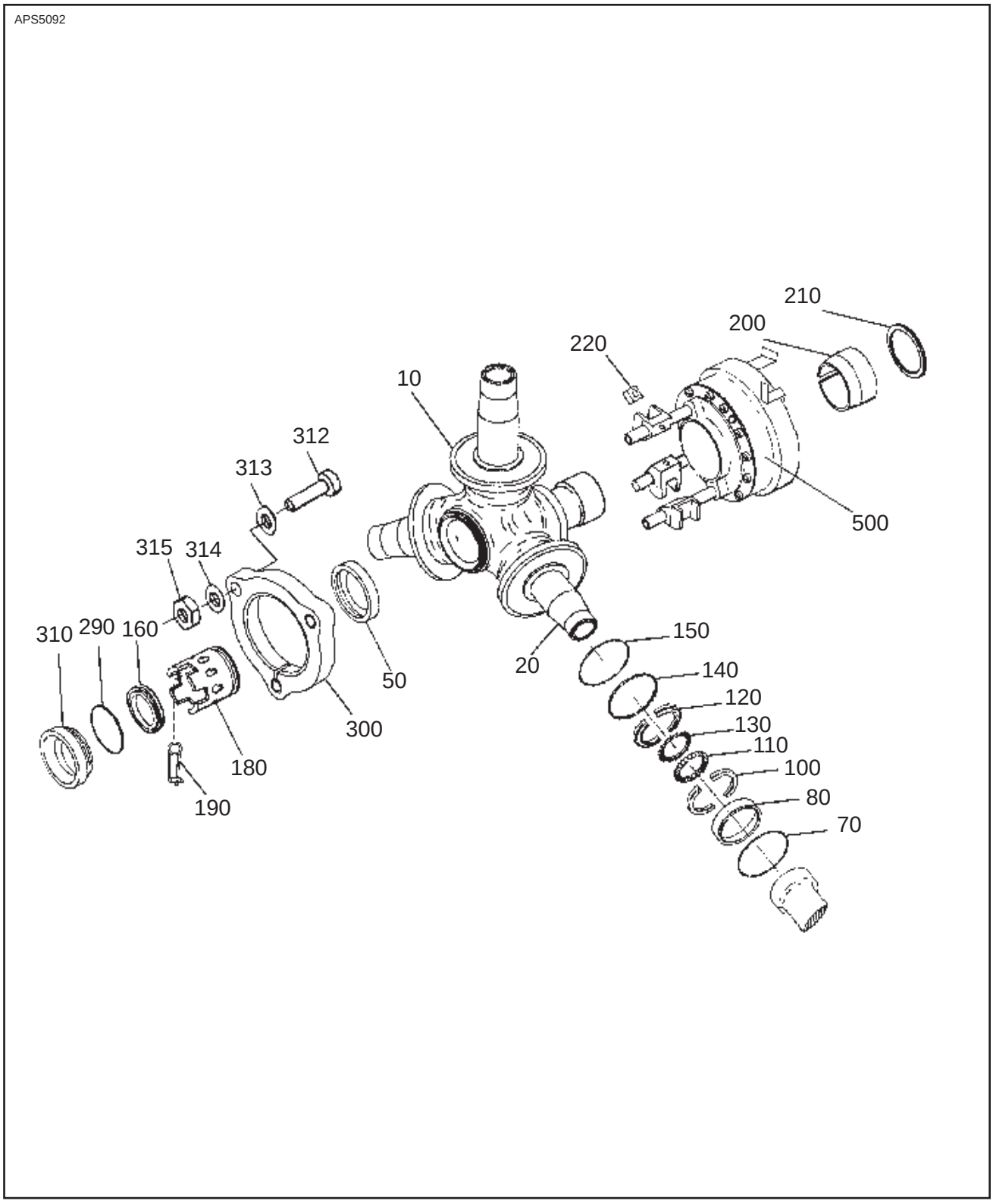
HC-D3V20-6L 93-D Valve Assembly
Figure 10-12

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-12						
-1000	93-D		• VALVE ASSEMBLY		1	
1010	A-71-2		• • GASKET		1	Y
-1030	B-299		• • VALVE UNIT		1	
1040	B-301		• • • VALVE BODY		1	
1050	A-307		• • • VALVE SPOOL		1	
1170	B-3838-3-2		• • • COTTER PIN		1	Y
1180	A-306-A		• • • SPRING		1	
1190	A-285		• • • STAKING PIN		1	
1200	A-303		• • • GUIDE PIN		1	
1210	A-302		• • • GUIDE ROD		1	
1220	B-3838-3-2		• • • COTTER PIN		1	Y
1230	C-3317-112		• • • O-RING		2	Y
1240	A-44		• • VALVE LINK		1	
1250	A-2038-6		• • SOCKET HEAD SCREW		2	Y
1260	B-3838-2-2		• • COTTER PIN		2	Y
1270	B-6644-21		• • CLEVIS PIN		1	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3V20-6L 93-D Valve Assembly



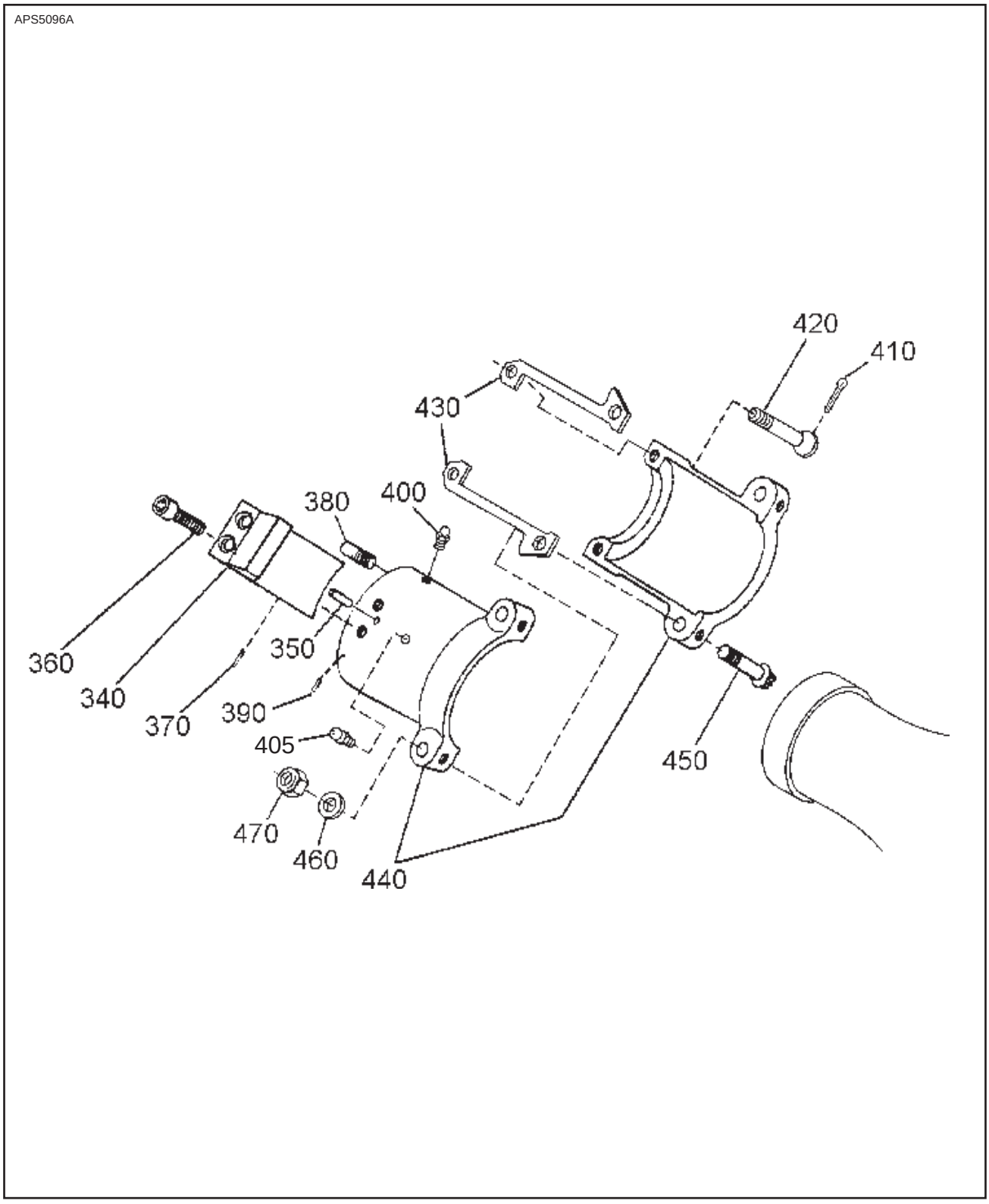
HC-D3MV20-6L Propeller Assembly
Figure 10-13

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-13						
-1	HC-D3MV20-6L		PROPELLER ASSEMBLY		RF	
10	840-85		• HUB UNIT		1	
20	A-1496-( )		• • PILOT TUBE (SUPERSEDED BY ITEM 20A)		3	
20A	D-7080-( )		• • PILOT TUBE (SUPERSEDES ITEM 20)		3	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		3	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		3	Y
80	A-972		• GUIDE RING		3	
-90	A-971		• SPLIT BEARING UNIT		3	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		3	Y
140	A-2027		• WIRE RETENTION RING		3	Y
150	C-3317-230		• O-RING		3	Y
160	A-870		• PULLER RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB SAFETY PIN		1	Y
200	A-50-1		• REAR CONE		1	
210	A-186		• SPACER, REAR CONE		AR	
220	A-95-A		• BLOCK, PITCH CHANGE		3	Y
290	C-3317-235		• O-RING		1	Y
300	834-1L		• GUIDE COLLAR UNIT		1	
310	B-352		• • NUT, GUIDE COLLAR		1	
312	A-827-7		• SLEEVE		3	
313	A-970-2		• REVERSE STOP		3	
314	A-965		• WASHER		3	Y
315	A-848		• NUT		3	Y
500	91-6L		• HYDRAULIC UNIT		1	
			NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGHT SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-6L



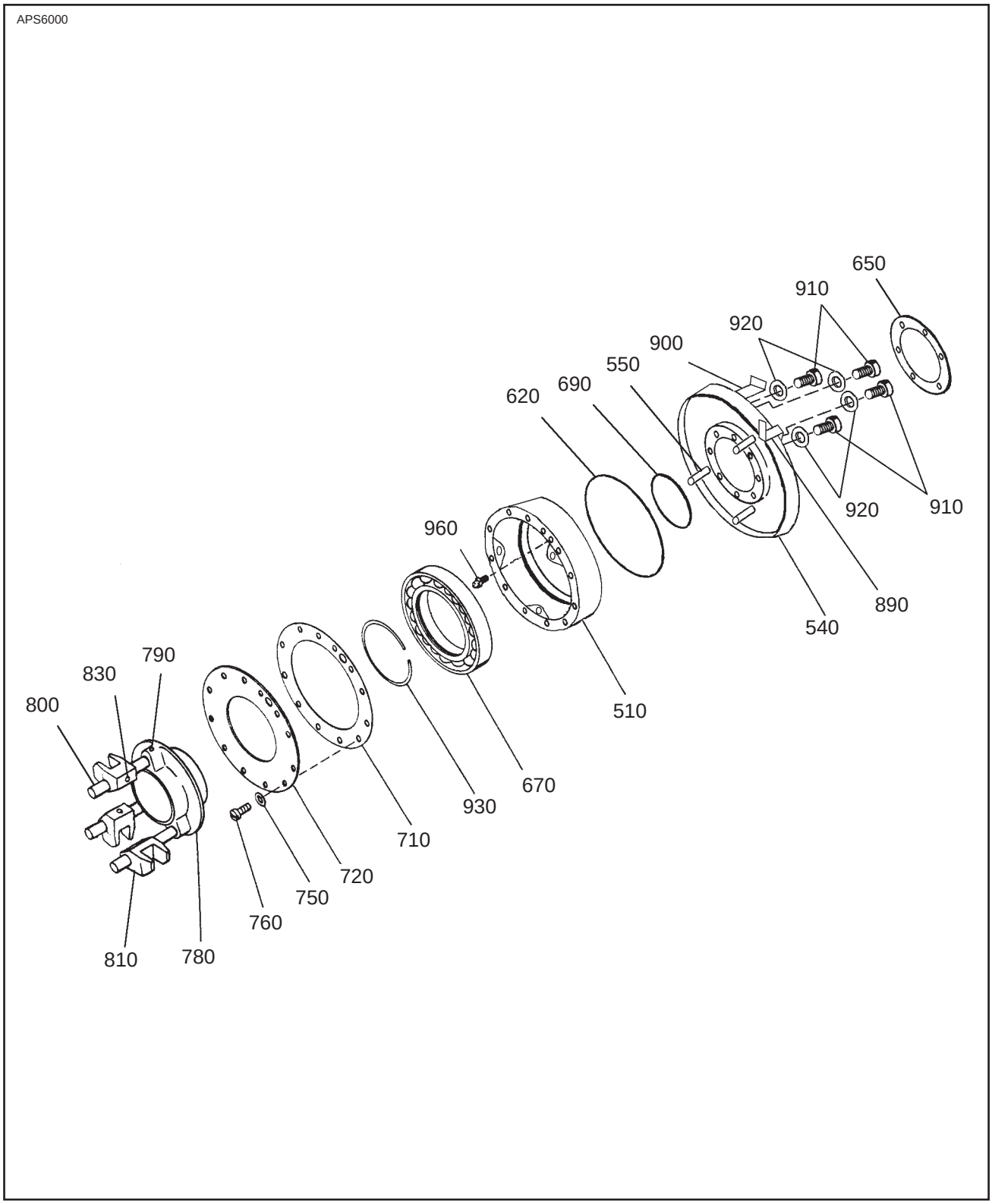
HC-D3MV20-6L Clamp Assembly
Figure 10-14

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-14						
-330	838-1029		• CLAMP ASSEMBLY		3	
340	833-4		• • COUNTERWEIGHT UNIT		1	
350	A-65		• • COUNTERWEIGHT DOWEL PIN		1	
360	A-2036-30		• • SOCKET HEAD CAP SCREW		2	Y
370	A-285		• • STAKING PIN		2	Y
380	A-295		• • LINK SCREW		1	Y
390	A-285		• • STAKING PIN		1	Y
400	B-6588-1		• • LUBRICATION FITTING		1	Y
400A	B-6855		• • LUBRICATION PLUG		1	Y
405	B-6588-1		• • LUBRICATION FITTING		1	Y
410	B-3838-3-2		• • COTTER PIN		2	Y
420	A-321		• • SOCKET SCREW		2	Y
430	A-6871-1		• • GASKET		2	Y
440	D-6831-3A		• • CLAMP		1	
450	A-2017		• • CLAMP BOLT		2	Y
460	A-2031		• • WASHER		2	Y
470	A-2043-1		• • CLAMP NUT		2	Y
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y
-483	B-3840-( )		• • WEIGHT SCREW		AR	Y
-484	A-48		• BALANCE WEIGHT		AR	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-6L Clamp Assembly



HC-D3MV20-6L 91-6L Hydraulic Unit
Figure 10-15

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-15						
-500	91-6L		• HYDRAULIC UNIT		1	
510	D-78		• • PISTON		1	
540	C-77		• • CYLINDER		1	
550	A-11-A		• • GUIDE PIN		3	
-570	A-312		• • NUT		3	
620	C-3317-445		• • O-RING		1	Y
650	A-181		• • GASKET		1	Y
670	A-38-BG		• • THRUST BEARING		1	
690	C-3317-341		• • O-RING		1	Y
710	B-73		• • GASKET, COVER PLATE		1	Y
720	B-12-3		• • COVER PLATE		1	
-730	A-2043-1		• • ELASTIC NUT		6	Y
750	B-3864-39		• • INTERNAL LOCK WASHER		12	Y
760	B-3840-6		• • FILLISTER HEAD SCREW		12	Y
-770	B-351-3		• • JACK ASSEMBLY		1	
780	B-356		• • • JACK PLATE		1	
790	A-114-E		• • • STAKING PIN		3	
800	A-826-10		• • • PUSH ROD		3	
810	A-921-1L		• • • FORK		3	
830	A-2039		• • • SET SCREW		3	Y
-840	A-827-7		• • SLEEVE		3	
-850	A-970-4		• • • SPACER		3	
-860	A-965		• • • WASHER		3	Y
-870	A-848		• • • NUT		3	Y
-880	A-970-2		• • • SPACER		3	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-6L 91-6L Hydraulic Unit

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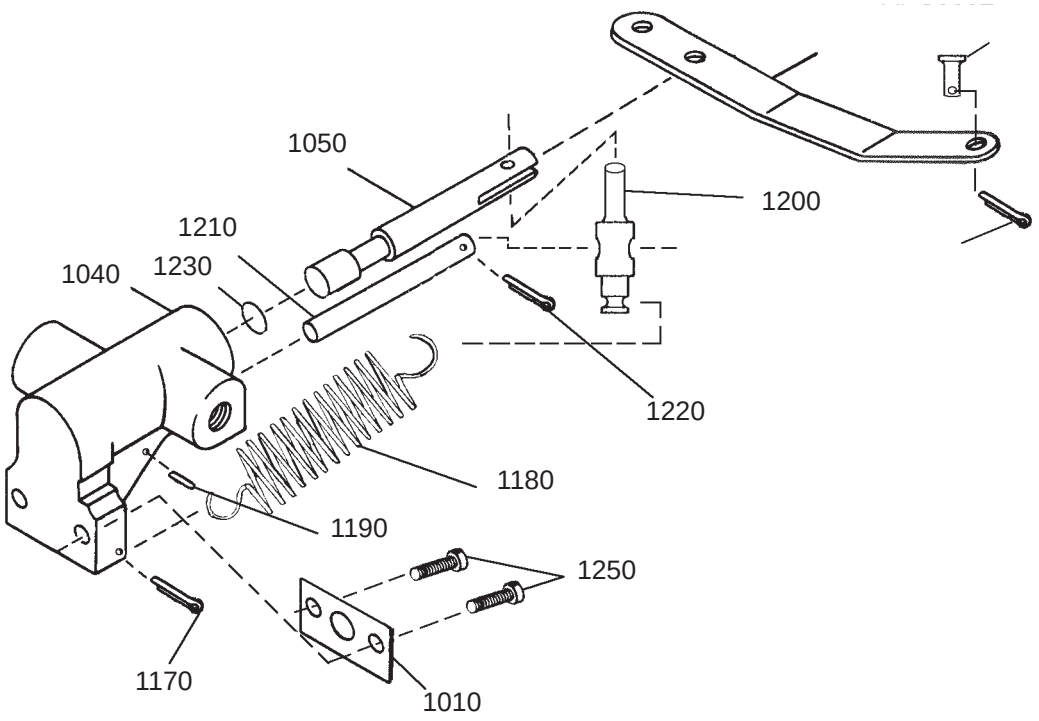
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-15						
890	A-76		• • • STOP, LEVER		1	
900	A-41		• • • STOP, PITCH CONTROL VALVE		1	
910	B-3840-6		• • • FILISTER HEAD SCREW, STOP		4	Y
920	B-3864-39		• • • INTERNAL LOCK WASHER, STOP		4	Y
930	A-43		• • • WIRE RETAINER		1	
960	B-6588-1		• • • LUBRICATION FITTING (SEE NOTE 1)		1	Y
-963	B-6855		• • • PLUG (SEE NOTE 1)		1	
			NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 LUBRICATION FITTING WITH THE B-6855 PLUG.			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-6L 91-6L Hydraulic Unit

APS6002



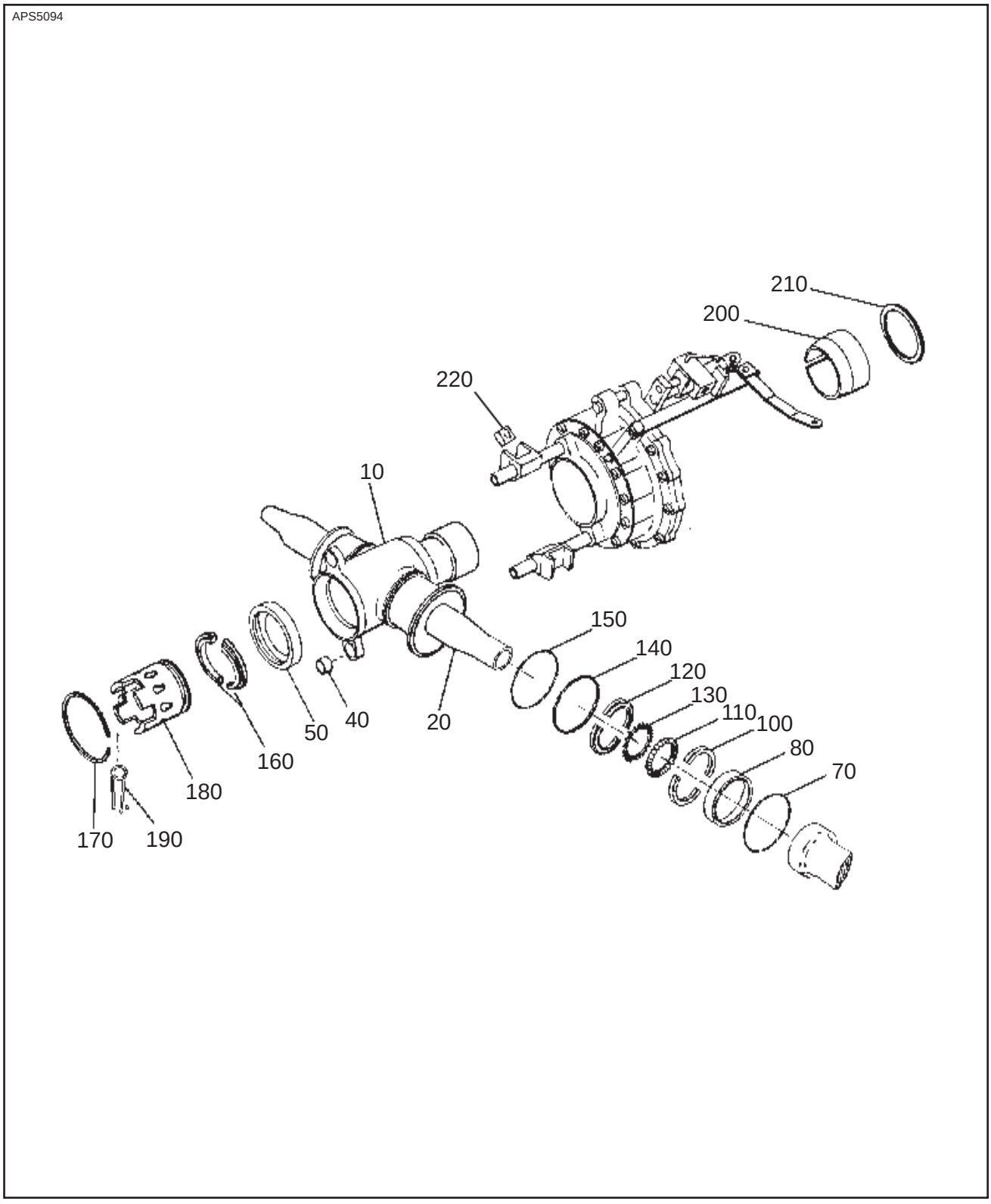
HC-D3MV20-6L 93-D Valve Assembly
Figure 10-16

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-16						
-1000	93-D		• VALVE ASSEMBLY		1	
1010	A-71-2		• • GASKET		1	Y
-1030	B-299		• • VALVE UNIT		1	
1040	B-301		• • • VALVE BODY		1	
1050	A-307		• • • VALVE SPOOL		1	
1170	B-3838-3-2		• • • COTTER PIN		1	Y
1180	A-306-A		• • • SPRING		1	
1190	A-285		• • • STAKING PIN		1	
1200	A-303		• • • GUIDE PIN		1	
1210	A-302		• • • GUIDE ROD		1	
1220	B-3838-3-2		• • • COTTER PIN		1	Y
1230	C-3317-112		• • • O-RING		2	Y
1240	A-44		• • LINK,CONTROL VALVE		1	
1250	A-2038-6		• • SOCKET HEAD SCREW		2	Y
1260	B-3838-2-2		• • COTTER PIN		2	Y
1270	B-6644-21		• • CLEVIS PIN		1	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-6L 93-D Valve Assembly



HC-D2V20-7, -8 Propeller Assembly
Figure 10-17

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-17						
-1	HC-D2V20-7,-8		PROPELLER ASSEMBLY		RF	
10	840-123		• HUB UNIT		1	
20	A-1496-( )		• • PILOT TUBE -SUPERSEDED BY ITEM 20A		2	
20A	D-7080-( )		• • PILOT TUBE -SUPERSEDES ITEM 20		2	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		2	Y
40	A-116-A1		• • BUSHING		2	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		2	Y
80	A-972		• GUIDE RING		2	
-90	A-971		• SPLIT BEARING UNIT		2	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		2	Y
140	A-2027		• WIRE RETENTION RING		2	Y
150	C-3317-230		• O-RING		2	Y
160	A-156		• PULLER RING		1	
170	A-46		• SNAP RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB LOCK SAFETY		1	Y
200	A-50-1		• REAR CONE		1	
210	A-186		• SPACER, REAR CONE		AR	
220	A-95-A		• BLOCK, PITCH CHANGE		2	Y
-250	C-175-2		• SPINNER ADAPTER RING	C, D	1	
-250A	C-175-1		• SPINNER ADAPTER RING (ALTERNATE)	C, D	1	
-250B	A-165-2		• SPINNER ADAPTER RING (ALTERNATE)	C, D, E	1	
-250C	A-165-3		• SPINNER ADAPTER RING (ALTERNATE)	C, D, E	1	
-260	B-3977-11		• HEX HEAD BOLT		4	Y
-270	B-6652-7		• NUT		4	Y

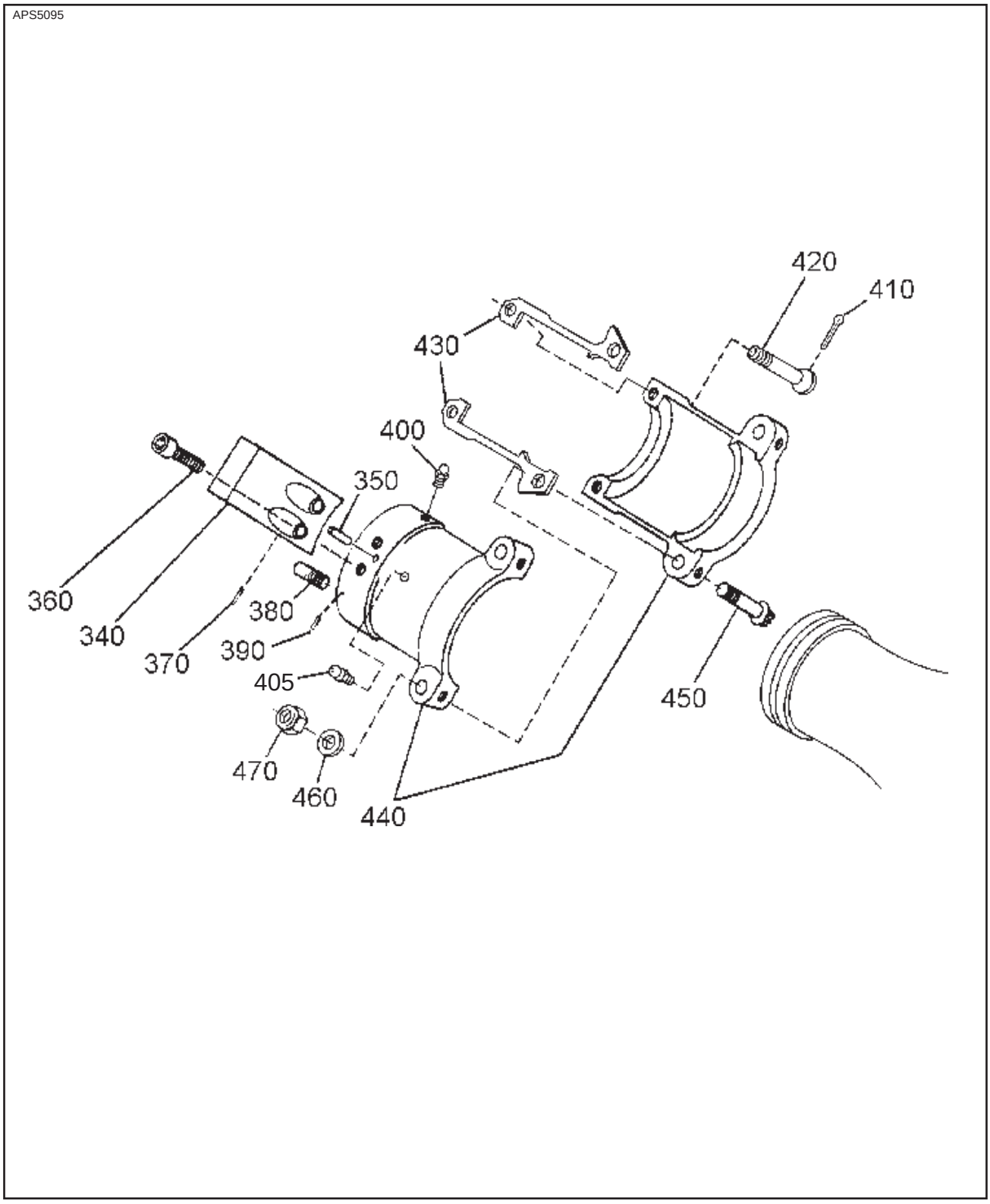
NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGH SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).

NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).

NOTE 3: PROPS NOT USING A C-175-(1, 2) OR A-165-(2, 3) RING ON THE BACK OF THE HUB MUST USE THE B-109-9 JACK ASSY.

EFFECTIVITY	MODEL
A	HC-D2V20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2V20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2V20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2V20-7 BONANZA, WITH GOVERNOR
E	HC-D2V20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2V20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2V20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2V20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED



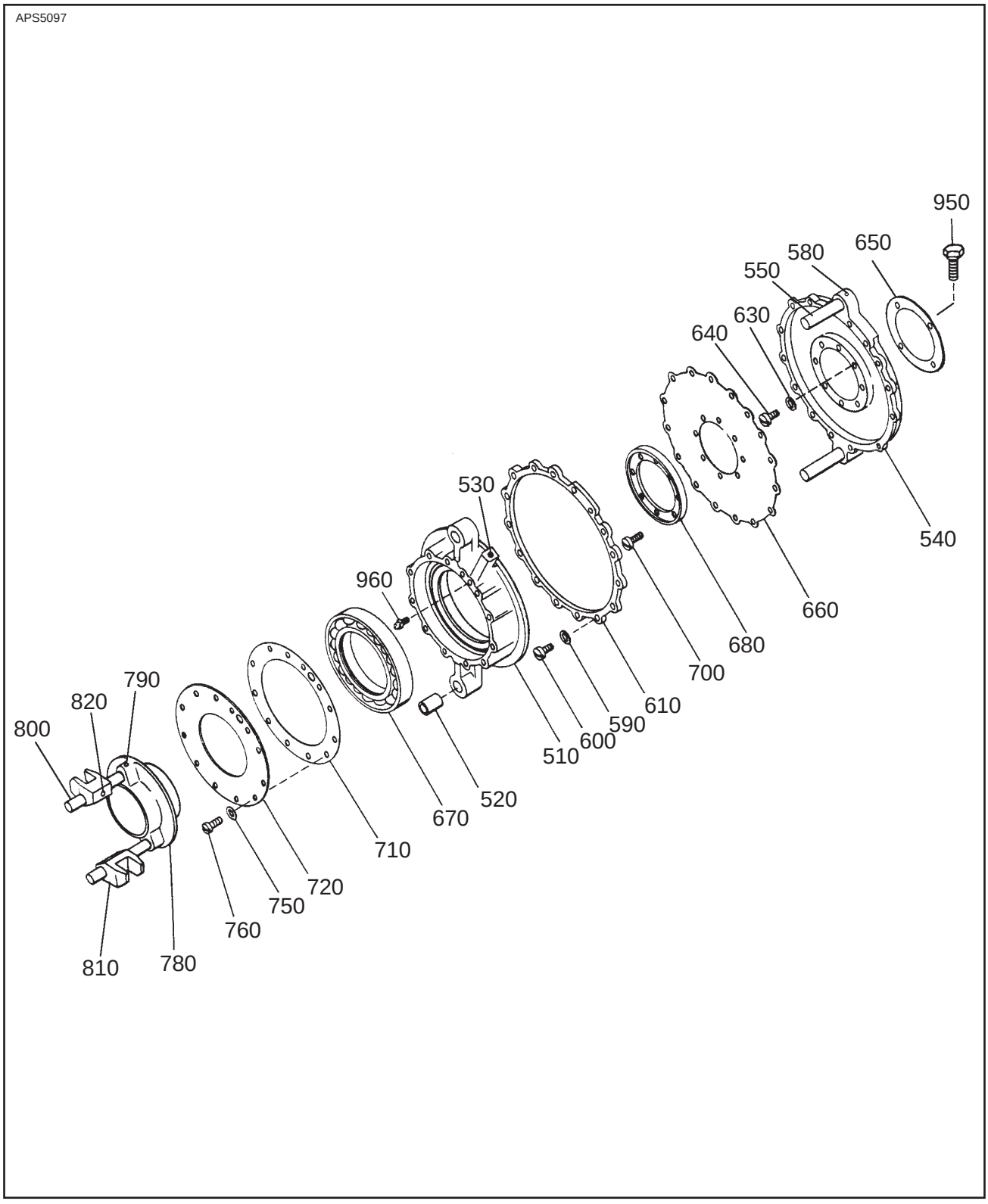
HC-D2V20-7, -8 Clamp Assembly
Figure 10-18

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-18						
-330	838-12		• CLAMP ASSEMBLY		2	
340	B-17-6A		• • COUNTERWEIGHT		1	
350	A-65		• • COUNTERWEIGHT DOWEL PIN		1	
360	A-2036-12		• • SOCKET HEAD CAP SCREW		2	Y
370	A-285		• • STAKING PIN		2	Y
380	A-295		• • LINK SCREW		1	Y
390	A-285		• • STAKING PIN		1	Y
400	B-6588-1		• • LUBRICATION FITTING		1	Y
405	B-6588-1		• • LUBRICATION FITTING		1	Y
410	B-3838-3-2		• • COTTER PIN		2	Y
420	A-321		• • SOCKET SCREW		2	Y
430	A-47-1		• • GASKET		2	Y
440	C-3-1A		• • CLAMP		1	
450	A-2017		• • CLAMP BOLT		2	Y
460	A-2031		• • WASHER		2	Y
470	A-2043-1		• • CLAMP NUT		2	Y
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y
-483	B-3840-( )		• WEIGHT SCREW		AR	Y
-484	A-48		• BALANCE WEIGHT		AR	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2V20-7, -8 Clamp Assembly



HC-D2V20-7, -8 91-7DS,-8DS Hydraulic Unit
Figure 10-19

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-19						
-500	C-91-7DS		• HYDRAULIC UNIT	A,B,C,D,H	1	
-500A	C-91-8DS		• HYDRAULIC UNIT	E,F,G	1	
510	C-112-2		• • PISTON		1	
520	A-116-B1		• • • BUSHING		2	
530	B-6711-0500		• • • HELICOIL		1	
540	C-111-7		• • CYLINDER	A,B,C,D,H	1	
540A	C-111-8		• • CYLINDER	E,F,G	1	
550	A-122		• • • GUIDE ROD		2	
580	A-114-B		• • • STAKING PIN		2	
590	B-3864-39		• • LOCKWASHER		18	Y
600	B-3840-12		• • SCREW		18	Y
610	B-120		• • OUTER RING		1	
630	A-128		• • WASHER	A,B,C,D,H	4	
640	A-2037		• • SOCKET HEAD CAP SCREW REPLACED BY ITEM 640A	A,B,C,D,H	4	Y
640A	A-2037-2C		• • SOCKET HEAD CAP SCREW REPLACES ITEM 640	A,B,C,D,H	4	Y
650	A-135		• • GASKET	A,B,C,D,H	1	Y
650A	A-181		• • GASKET	E,F,G	1	Y
660	B-119-2		• • DIAPHRAGM		1	Y
670	A-38B		• • THRUST BEARING		1	
680	A-113-2		• • INNER RING		1	
700	B-3840-10		• • SCREW		8	Y
710	B-73		• • GASKET		1	Y
720	B-12-7		• • COVER PLATE		1	
-730	A-2043-1		• • NUT	E,F,G	6	Y
750	B-3864-39		• • LOCK WASHER		12	Y
760	B-3840-6		• • SCREW		12	Y

EFFECTIVITY	MODEL
A	HC-D2V20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2V20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2V20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2V20-7 BONANZA, WITH GOVERNOR
E	HC-D2V20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2V20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2V20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2V20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2V20-7,-8 91-7DS,-8DS Hydraulic Unit

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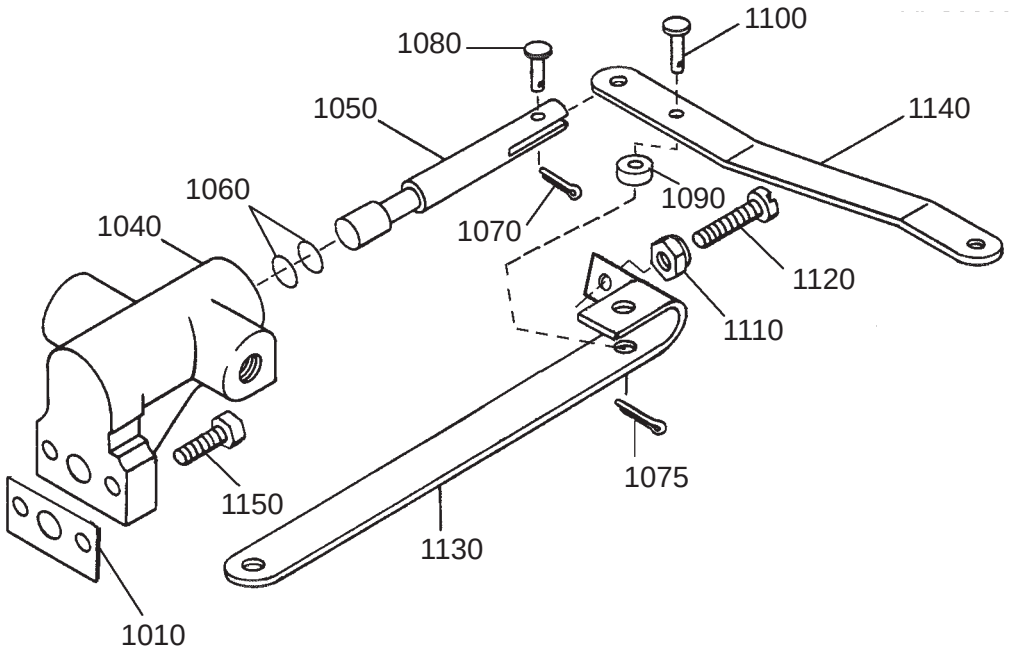
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-19						
-770	B-109-9		• • JACK PLATE ASSEMBLY		1	
-770A	B-109-9A		• • JACK PLATE ASSEMBLY (ALTERNATE)		1	
780	B-87C-1		• • • JACK		1	
790	A-114F		• • • STAKING PIN		2	
800	A-97-7		• • • PUSH ROD		2	
810	A-821		• • • FORK		2	
820	A-114-8		• • • STAKING PIN		2	
-940	C-3317-012		• • O-RING	E,F,G	6	Y
950	A-121		• • SCREW		1	Y
960	B-6588-1		• • LUBRICATION FITTING (SEE NOTE 1)		1	Y
-963	B-6855		• • PLUG (SEE NOTE 1)		1	
			NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 BEARING LUBRICATION FITTING WITH THE B-6855 PLUG.			
			NOTE 2: PROPS NOT USING A C-175-(1, 2) OR A-165-(2, 3) RING ON THE BACK OF THE HUB MUST USE THE B-109-9 JACK ASSY.			

EFFECTIVITY	MODEL
A	HC-D2V20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2V20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2V20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2V20-7 BONANZA, WITH GOVERNOR
E	HC-D2V20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2V20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2V20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2V20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2V20-7,-8 91-7DS,-8DS Hydraulic Unit

APS5099



HC-D2V20-7, -8 93-A,-B,-C Valve Assembly
Figure 10-20

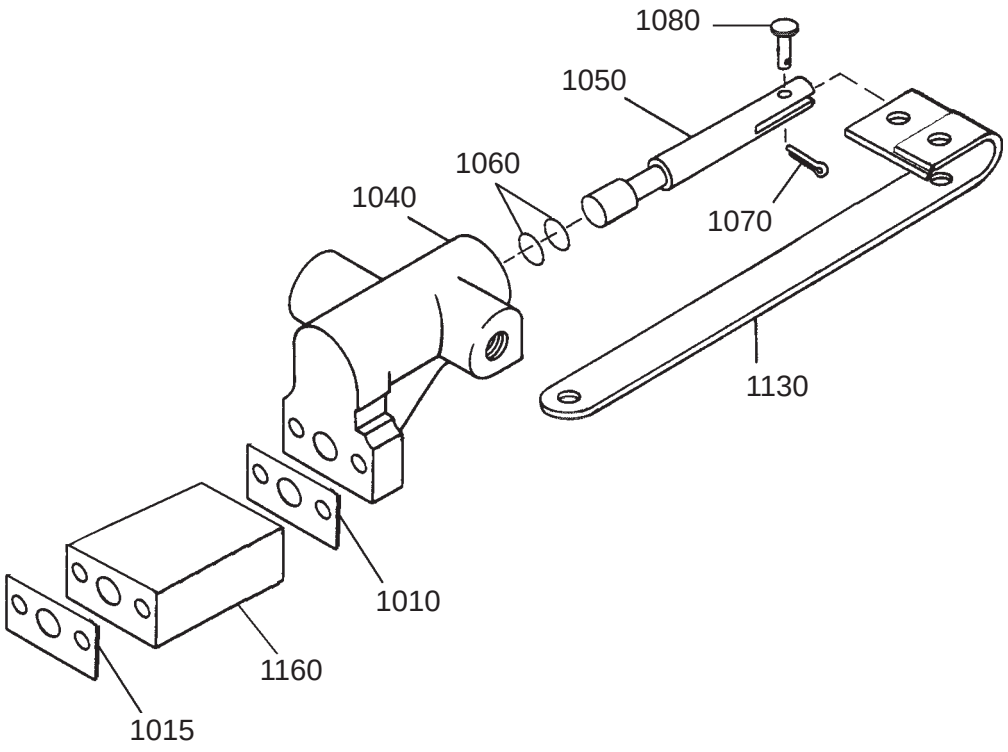
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-20						
-1000	B-93-A		• VALVE ASSEMBLY	A	1	
-1000A	B-93-B		• VALVE ASSEMBLY	C,E,H	1	
-1000B	B-93-C		• VALVE ASSEMBLY	F	1	
1010	A-71-2		• • GASKET		1	Y
-1020	B-3837-0463		• • WASHER		2	Y
-1030	B-166		• • VALVE UNIT		1	
1040	B-167		• • • BODY		1	
1050	A-168		• • • SPOOL		1	
1060	C-3317-112		• • • O-RING		2	Y
1070	B-3838-2-2		• • COTTER PIN		1	Y
1075	B-3838-2-2		• • COTTER PIN		1	Y
1080	B-6646-17		• • CLEVIS PIN		1	
1090	A-126		• • SPACER		1	
1100	B-6646-23		• • CLEVIS PIN		1	
1110	B-3870-1032		• • STOP NUT		1	Y
1120	B-3840-10		• • STOP SCREW		1	Y
1130	A-184-6		• • LINK,CONTROL VALVE		1	
1140	A-180		• • LINK,CONTROL VALVE	A	1	
1140A	A-187		• • LINK,CONTROL VALVE	C	1	
1150	A-2038-10		• • SOCKET HEAD CAP SCREW		2	Y

EFFECTIVITY	MODEL
A	HC-D2V20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2V20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2V20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2V20-7 BONANZA, WITH GOVERNOR
E	HC-D2V20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2V20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2V20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2V20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2V20-7,-8 93-A,-B,-C Valve Assembly

APS5099A



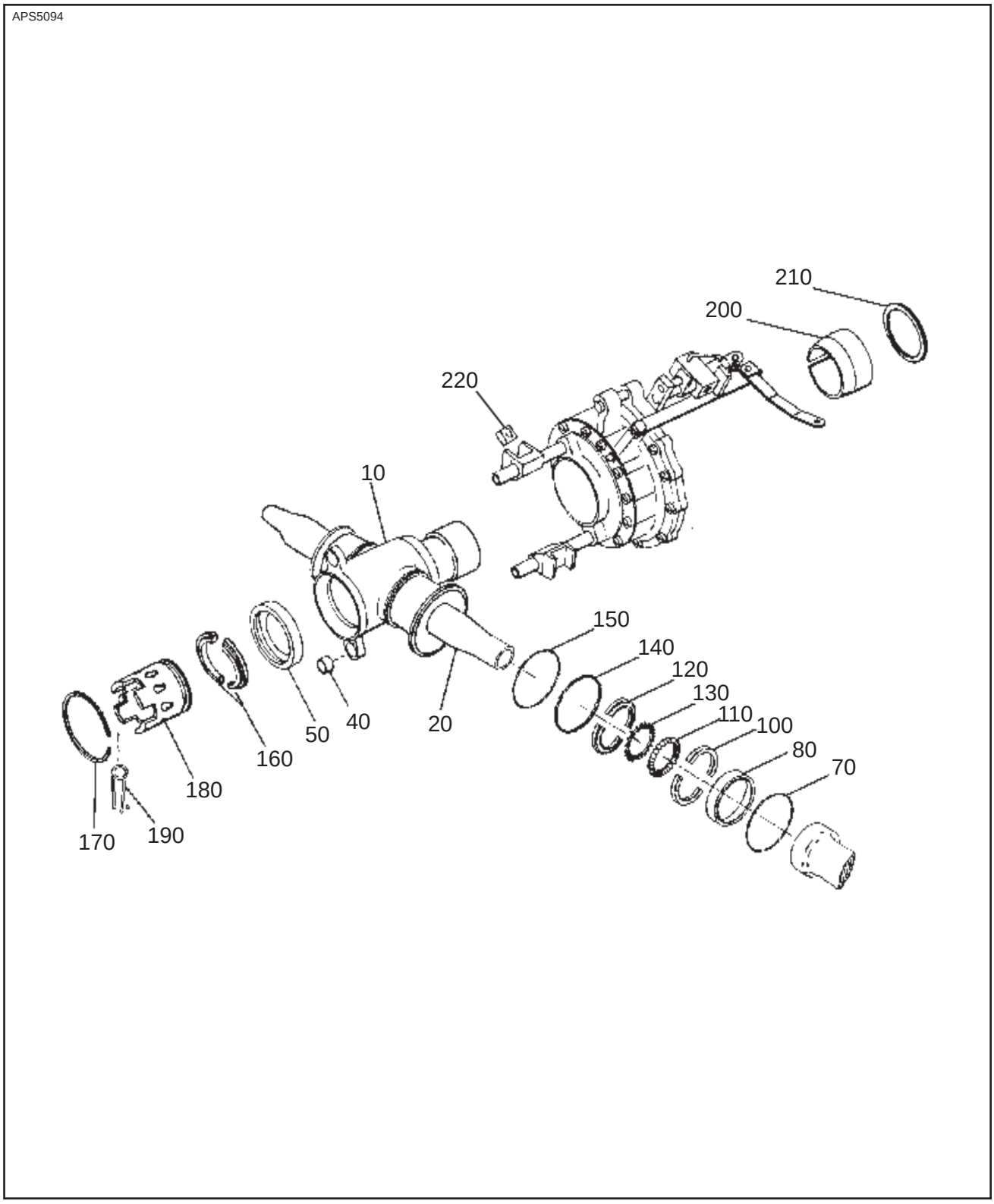
HC-D2V20-7, -8 93-AG,-BG,-CG Valve Assembly
Figure 10-21

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H
10-21						
-1000	B-93-AG		• VALVE ASSEMBLY	B	1	
-1000A	B-93-BG		• VALVE ASSEMBLY	D	1	
-1000B	B-93-CG		• VALVE ASSEMBLY	G	1	
1010	A-71-2		• • GASKET		1	Y
1015	A-71-2		• • GASKET	G	1	Y
-1020	B-3837-0463		• • WASHER		2	Y
-1030	B-166		• • VALVE UNIT		1	
1040	A-167		• • • BODY		1	
1050	A-168		• • • SPOOL		1	
1060	C-3317-112		• • • O-RING		2	Y
1070	B-3838-2-2		• • COTTER PIN		1	Y
1080	B-6646-23		• • CLEVIS PIN		1	
1130	A-173-2		• • LINK,CONTROL VALVE	B	1	
1130A	A-173-4		• • LINK,CONTROL VALVE	D	1	
1130B	A-173-5		• • LINK,CONTROL VALVE	G	1	
-1150	A-2038-10		• • SOCKET HEAD CAP SCREW		2	Y
1160	A-171		• • EXTENSION BLOCK	G	1	

EFFECTIVITY	MODEL
A	HC-D2V20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2V20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2V20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2V20-7 BONANZA, WITH GOVERNOR
E	HC-D2V20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2V20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2V20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2V20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2V20-7,-8 93-AG,-BG,-CG Valve Assembly

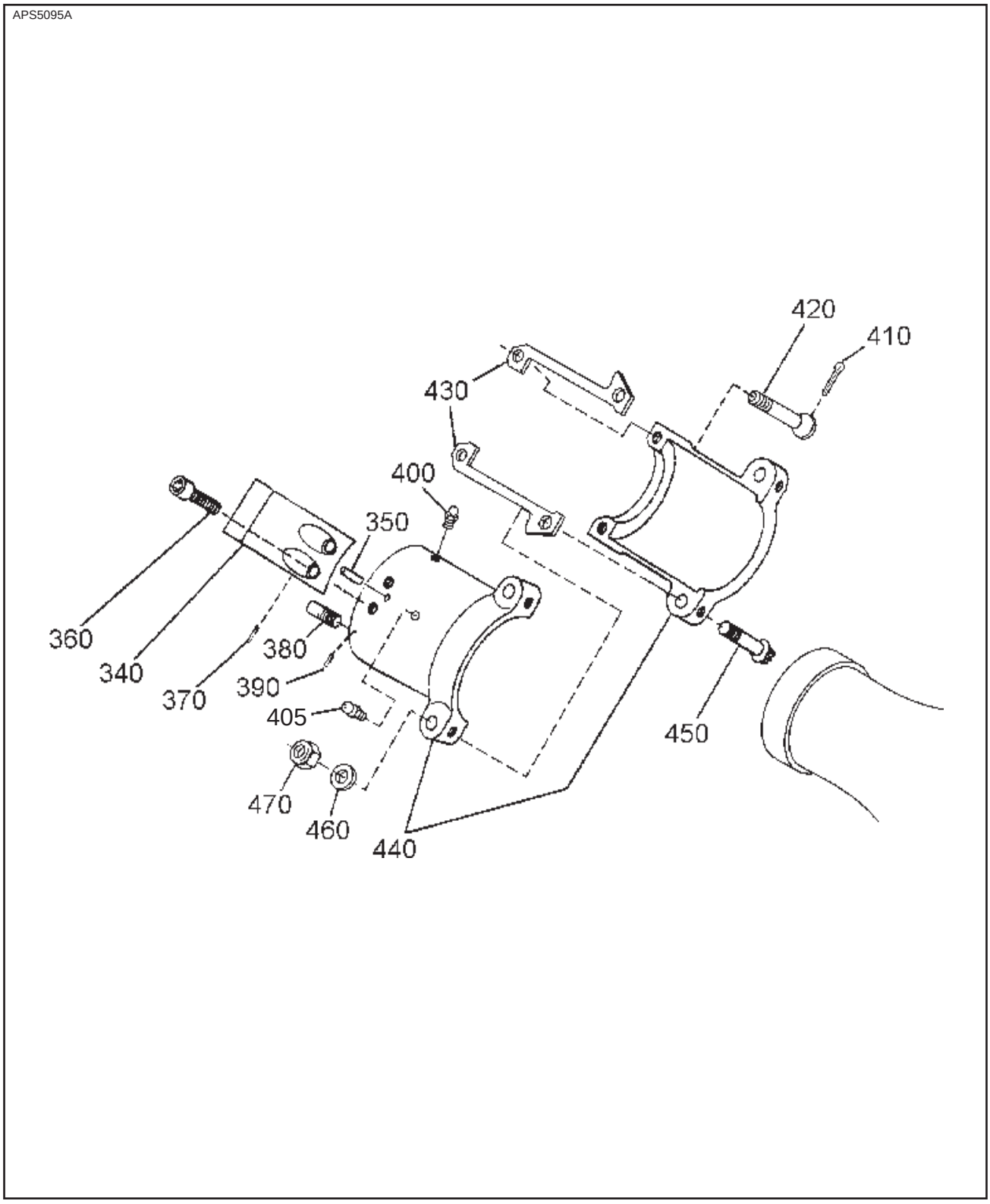


HC-D2MV20-7, -8 Propeller Assembly
Figure 10-22

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-22						
-1	HC-D2MV20-7,-8		PROPELLER ASSEMBLY		RF	
10	840-123		• HUB UNIT		1	
20	A-1496-( )		• • PILOT TUBE -SUPERSEDED BY ITEM 20A		2	
20A	D-7080-( )		• • PILOT TUBE -SUPERSEDES ITEM 20		2	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		2	Y
40	A-116-A1		• • BUSHING		2	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		2	Y
80	A-972		• GUIDE RING		2	
-90	A-971		• SPLIT BEARING UNIT		2	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		2	Y
140	A-2027		• BEARING RETENTION RING		2	Y
150	C-3317-230		• O-RING		2	Y
160	A-156		• PULLER RING		1	
170	A-46		• SNAP RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB LOCK SAFETY		1	Y
200	A-50-1		• REAR CONE		1	
210	A-186		• CONE SPACER		1	
220	A-95-A		• BLOCK, PITCH CHANGE		2	Y
-250	C-175-2		• SPINNER ADAPTER RING	C, D, E	1	
-250A	C-175-1		• SPINNER ADAPTER RING	C, D, E	1	
-250B	A-165-2		• SPACER RING	C, D, E	1	
-250C	A-165-3		• SPACER RING	C, D, E	1	
-260	B-3977-11		• HEX HEAD BOLT		4	Y
-270	B-6652-7		• NUT		4	Y
			NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGHT SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL.REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).			
			NOTE 3: PROPS NOT USING A C-175-(1, 2) OR A-165-(2, 3) RING ON THE BACK OF THE HUB MUST USE THE B-109-9 JACK ASSY.			

EFFECTIVITY	MODEL
A	HC-D2V20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2V20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2V20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2V20-7 BONANZA, WITH GOVERNOR
E	HC-D2V20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2V20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2V20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2V20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED



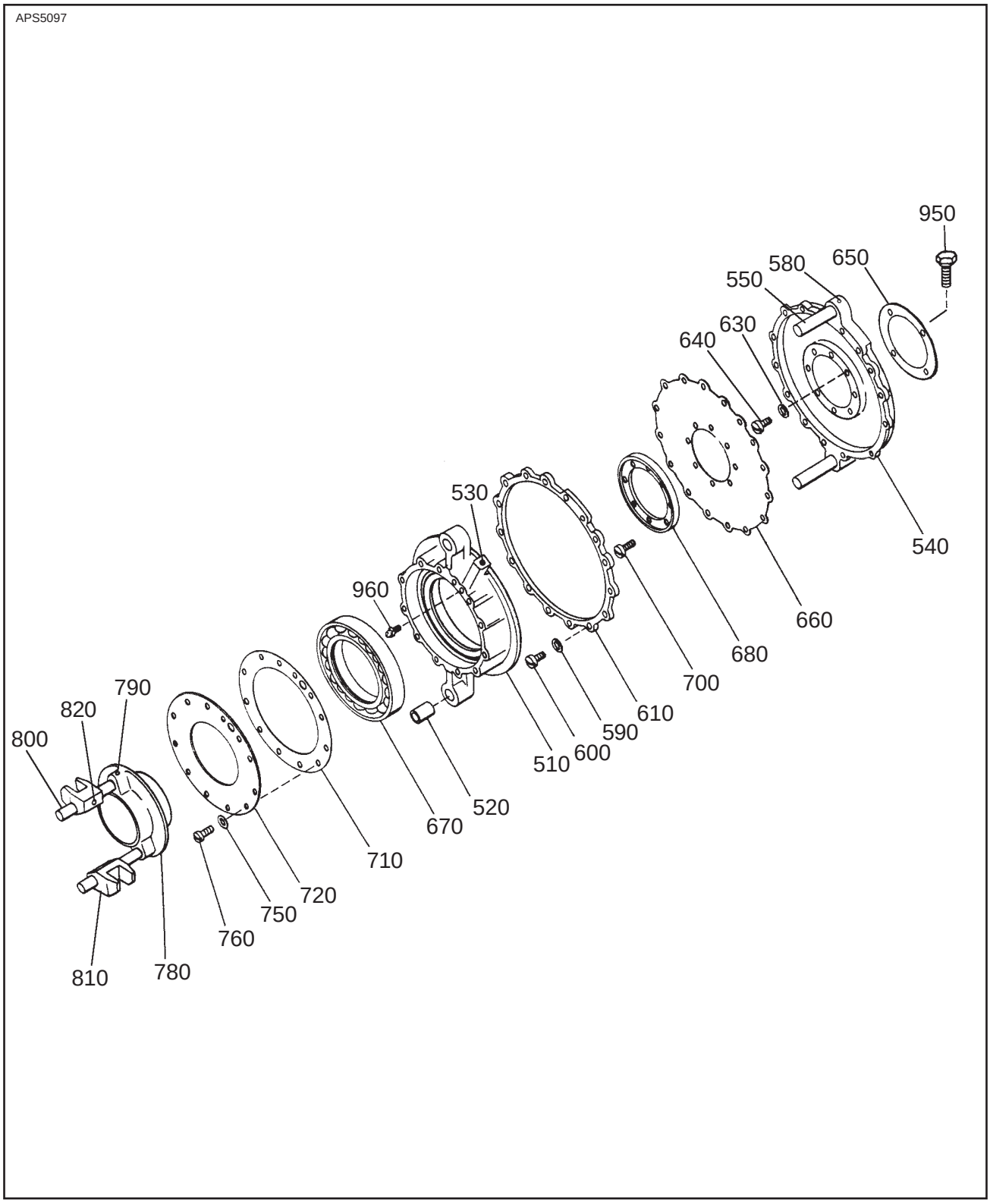
HC-D2MV20-7, -8 Clamp Assembly
Figure 10-23

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-23						
-330	838-1012		• CLAMP ASSEMBLY		2	
340	B-17-6A		• • COUNTERWEIGHT		1	
350	A-65		• • COUNTERWEIGHT DOWEL PIN		1	Y
360	A-2036-12		• • SOCKET HEAD CAP SCREW		2	Y
370	A-285		• • STAKING PIN, CAP SCREW		2	Y
380	A-295		• • LINK SCREW		1	Y
390	A-285		• • STAKING PIN		1	Y
400	B-6588-1		• • LUBRICATION FITTING		1	Y
405	B-6588-1		• • LUBRICATION FITTING		2	Y
410	B-3838-3-2		• • COTTER PIN		2	Y
420	A-321		• • SOCKET SCREW		2	Y
430	A-6871-1		• • GASKET		2	Y
440	D-6831-1A		• • CLAMP		1	
450	A-2017		• • CLAMP BOLT		2	Y
460	A-2031		• • WASHER		2	Y
470	A-2043-1		• • CLAMP NUT		2	Y
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y
-483	B-3840-( )		• WEIGHT SCREW		AR	Y
-484	A-48		• BALANCE WEIGHT		AR	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D2MV20-7, -8 Clamp Assembly



HC-D2MV20-7, -8 91-7DS, -8DS Hydraulic Unit
Figure 10-24

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-24						
-500	C-91-7DS		• HYDRAULIC UNIT	A,B,C,D,H	1	
-500A	C-91-8DS		• HYDRAULIC UNIT	E,F,G	1	
510	C-112-2		• • PISTON		1	
520	A-116-B1		• • • BUSHING		2	
530	B-6711-0500		• • • HELICOIL		1	
540	C-111-7		• • CYLINDER	A,B,C,D,H	1	
540A	C-111-8		• • CYLINDER	E,F,G	1	
550	A-122		• • • GUIDE ROD		2	
580	A-114-B		• • • STAKING PIN		2	
590	B-3864-39		• • LOCKWASHER		18	Y
600	B-3840-12		• • SCREW		18	Y
610	B-120		• • OUTER RING		1	
630	A-128		• • WASHER	A,B,C,D,H	4	
640	A-2037		• • SOCKET HEAD CAP SCREW REPLACED BY ITEM 640A	A,B,C,D,H	4	Y
640A	A-2037-2C		• • SOCKET HEAD CAP SCREW REPLACES ITEM 640	A,B,C,D,H	4	Y
650	A-135		• • GASKET	A,B,C,D,H	1	Y
650A	A-181		• • GASKET	E,F,G	1	Y
660	B-119-2		• • DIAPHRAGM		1	Y
670	A-38B		• • THRUST BEARING		1	
680	A-113-2		• • INNER RING		1	
700	B-3840-10		• • SCREW		8	Y
710	B-73		• • GASKET		1	Y
720	B-12-7		• • COVER PLATE		1	
-730	A-2043-1		• • NUT	E,F,G	6	Y
750	B-3864-39		• • LOCK WASHER		12	Y
760	B-3840-6		• • SCREW		12	Y

EFFECTIVITY	MODEL
A	HC-D2MV20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2MV20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2MV20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2MV20-7 BONANZA, WITH GOVERNOR
E	HC-D2MV20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2MV20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2MV20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2MV20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2MV20-7,-8 91-7DS,-8DS Hydraulic Unit

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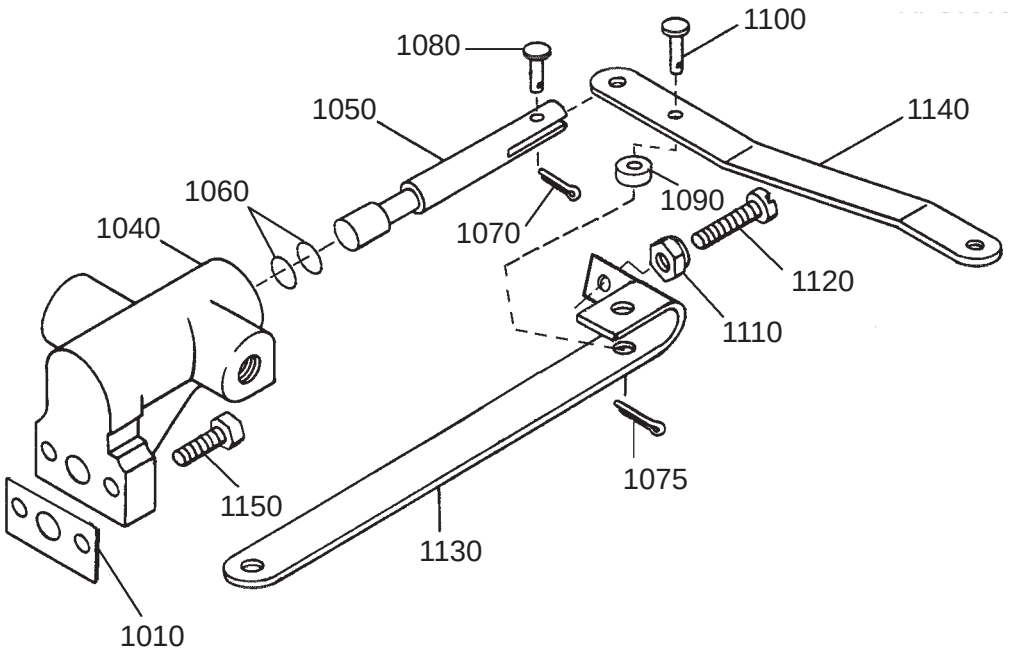
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-24						
-770	B-109-9A		• • JACK PLATE ASSEMBLY		1	
-770A	B-109-9		• • JACK PLATE ASSEMBLY		1	
780	B-87C-1		• • • JACK		1	
790	A-114F		• • • STAKING PIN		2	
800	A-97-7		• • • PUSH ROD		2	
810	A-821		• • • FORK		2	
820	A-114-8		• • • STAKING PIN		2	
-940	C-3317-012		• • O-RING	E,F,G	6	Y
950	A-121		• • SCREW		1	Y
960	B-6588-1		• • LUBRICATION FITTING (SEE NOTE 1)		1	Y
-963	B-6855		• • PLUG (SEE NOTE 1)		1	
			NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 BEARING LUBRICATION FITTING WITH THE B-6855 PLUG.			
			NOTE 2: PROPS NOT USING A C-175-(1, 2) OR A-165-(2, 3) RING ON THE BACK OF THE HUB MUST USE THE B-109-9 JACK ASSY.			

EFFECTIVITY	MODEL
A	HC-D2MV20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2MV20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2MV20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2MV20-7 BONANZA, WITH GOVERNOR
E	HC-D2MV20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2MV20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2MV20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2MV20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

APS5099



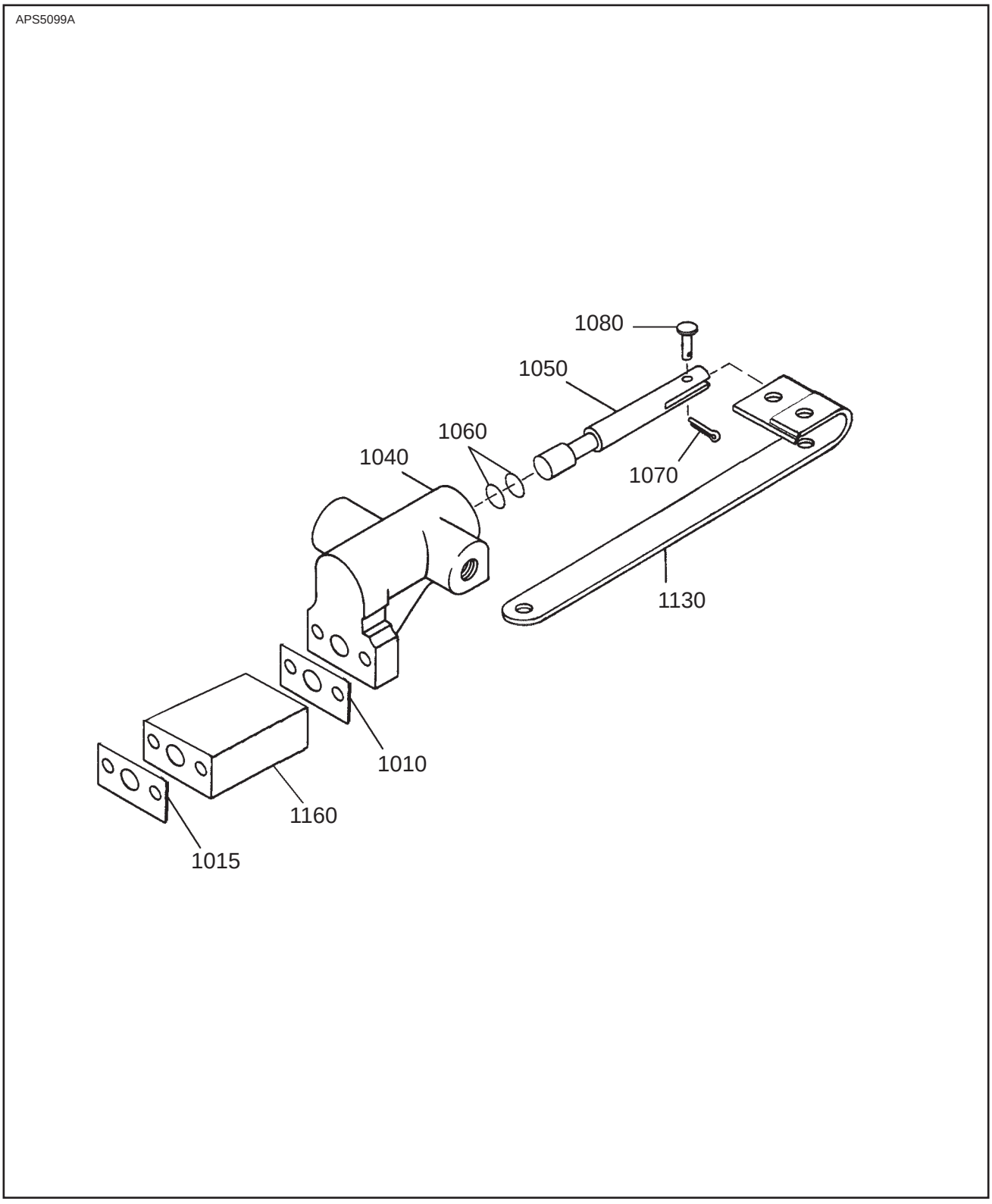
HC-D2MV20-7, -8 93-A,-B,-C Valve Assembly
Figure 10-25

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-25						
-1000	B-93-A		• VALVE ASSEMBLY	A	1	
-1000A	B-93-B		• VALVE ASSEMBLY	C,H	1	
-1000B	B-93-C		• VALVE ASSEMBLY	F	1	
1010	A-71-2		• • GASKET		1	Y
-1020	B-3837-0463		• • WASHER		2	Y
-1030	B-166		• • VALVE UNIT		1	
1040	A-167		• • • BODY		1	
1050	A-168		• • • SPOOL		1	
1060	C-3317-112		• • • O-RING		2	Y
1070	B-3838-2-2		• • COTTER PIN		2	Y
1080	B-6646-17		• • CLEVIS PIN		1	
1090	A-126		• • SPACER		1	
1100	B-6646-23		• • CLEVIS PIN		1	
1110	B-3870-1032		• • STOP NUT		1	Y
1120	B-3840-10		• • STOP SCREW		1	Y
1130	A-184-6		• • LINK,CONTROL VALVE		1	
1140	A-180		• • LINK,CONTROL VALVE	A	1	
1140A	A-187		• • LINK,CONTROL VALVE	C	1	
-1150	A-2038-10		• • SOCKET HEAD CAP SCREW		2	Y

EFFECTIVITY	MODEL
A	HC-D2MV20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2MV20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2MV20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2MV20-7 BONANZA, WITH GOVERNOR
E	HC-D2MV20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2MV20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2MV20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2MV20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2MV20-7, -8 93-A,-B,-C Valve Assembly



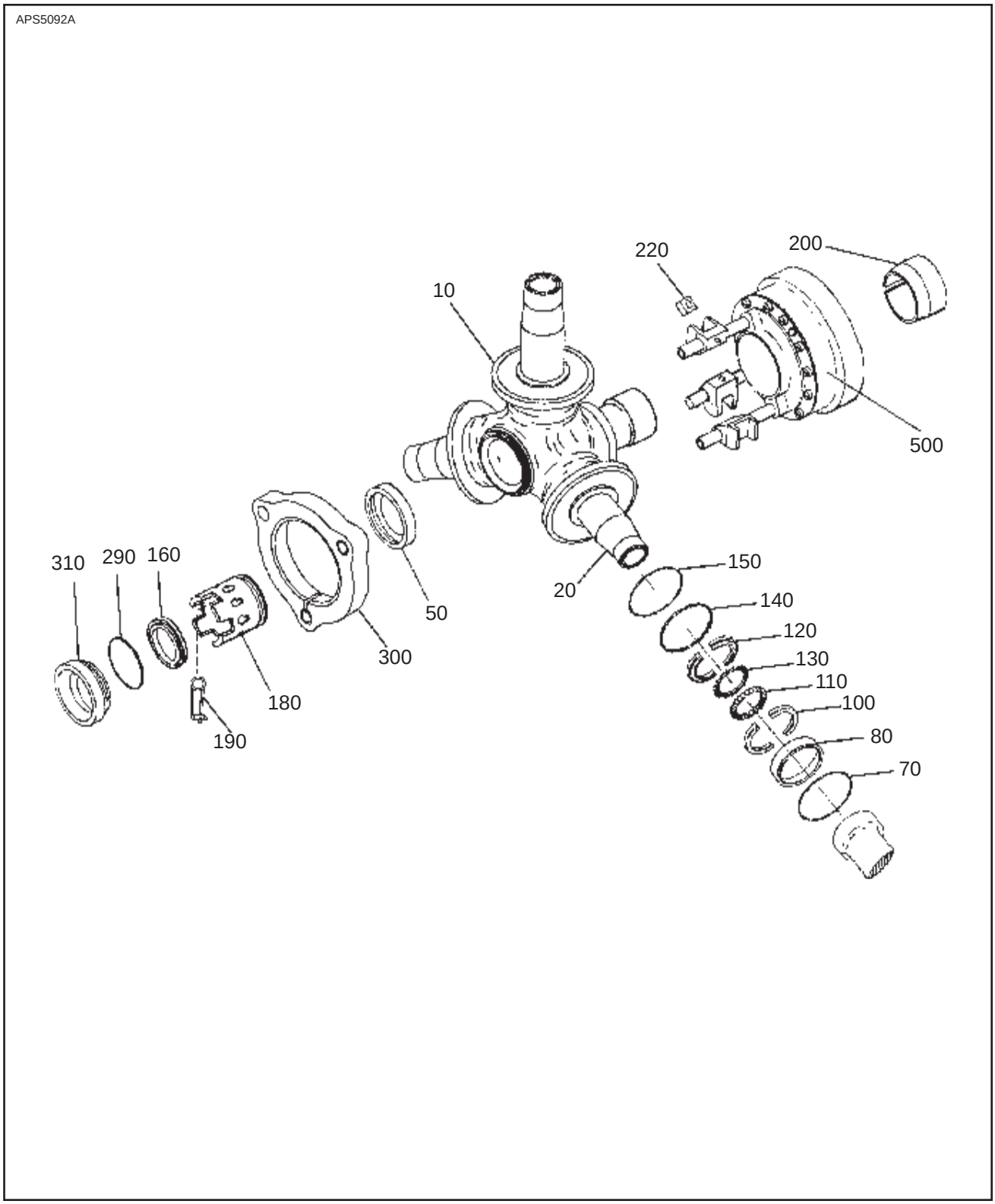
HC-D2MV20-7, -8 93-AG,-BG,-CG Valve Assembly
Figure 10-26

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-26						
-1000	B-93-AG		• VALVE ASSEMBLY	B	1	
-1000A	B-93-BG		• VALVE ASSEMBLY	D	1	
-1000B	B-93-CG		• VALVE ASSEMBLY	G	1	
1010	A-71-2		• • GASKET		1	Y
1015	A-71-2		• • GASKET	G	1	Y
-1020	B-3837-0463		• • WASHER		2	Y
-1030	B-166		• • VALVE UNIT		1	
1040	A-167		• • • BODY		1	
1050	A-168		• • • SPOOL		1	
1060	C-3317-112		• • • O-RING		2	Y
1070	B-3838-2-2		• • COTTER PIN		1	Y
1080	B-6646-17		• • CLEVIS PIN		1	
1130	A-173-2		• • LINK,CONTROL VALVE	B	1	
1130A	A-173-4		• • LINK,CONTROL VALVE	D	1	
1130B	A-173-5		• • LINK,CONTROL VALVE	G	1	
-1150	A-2038-10		• • SOCKET HEAD CAP SCREW		2	Y
1160	A-171		• • EXTENSION BLOCK	G	1	

EFFECTIVITY	MODEL
A	HC-D2MV20-7 NAVION ONLY, WITHOUT GOVERNOR
B	HC-D2MV20-7 NAVION ONLY, WITH GOVERNOR
C	HC-D2MV20-7 BONANZA, WITHOUT GOVERNOR
D	HC-D2MV20-7 BONANZA, WITH GOVERNOR
E	HC-D2MV20-8 ALL EXCEPT SUPER NAVION, WITHOUT GOVERNOR
F	HC-D2MV20-8 SUPER NAVION, WITHOUT GOVERNOR
G	HC-D2MV20-8 SUPER NAVION, WITH GOVERNOR
H	HC-D2MV20-7 LUSCOMBE IIA

- ITEM NOT ILLUSTRATED

HC-D2MV20-7, -8 93-AG,-BG,-CG Valve Assembly



HC-D3MV20-8D Propeller Assembly
Figure 10-27

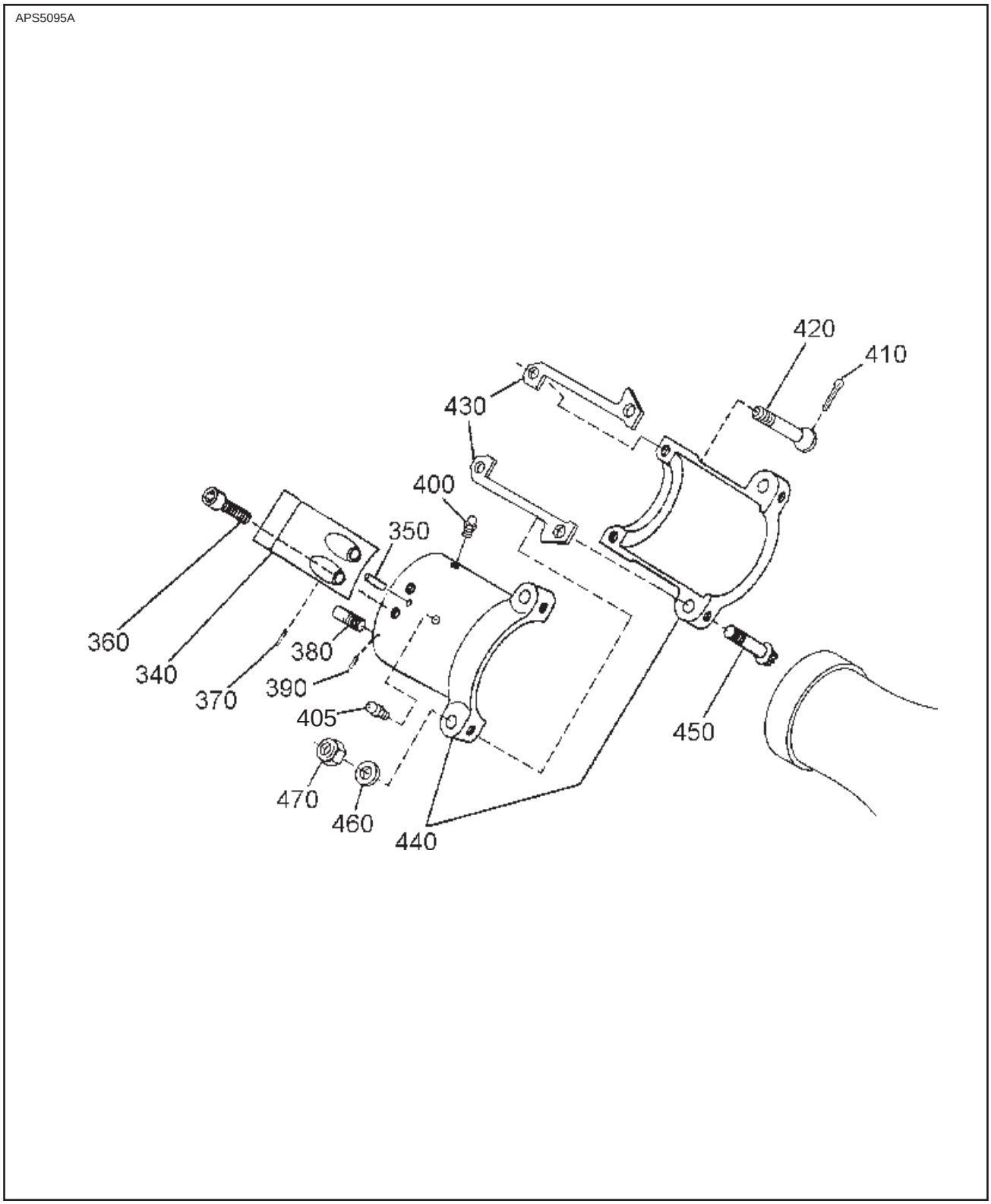
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-27						
-1	HC-D3MV20-8D		PROPELLER ASSEMBLY		RF	
10	840-85		• HUB UNIT		1	
20	A-1496-( )		• • PILOT TUBE (SUPERSEDED BY ITEM 20A)		3	
20A	D-7080-( )		• • PILOT TUBE (SUPERSEDES ITEM 20)		3	
-25	B-7070-17		• PLUG, EXPANSION (USED WITH ITEM 20A)		2	Y
50	A-155		• • BUSHING		1	
70	A-974		• WIRE RETENTION RING		3	Y
80	A-972		• GUIDE RING		3	
-90	A-971		• SPLIT BEARING UNIT		3	
100	A-971-B		• • RACE		1	
110	B-6144-2		• • BEARING, BALL		36	Y
120	A-971-A		• • RACE		1	
130	A-311		• BALL SPACER		3	Y
140	A-2027		• WIRE RETENTION RING		3	Y
150	C-3317-230		• O-RING		3	Y
160	A-870		• PULLER RING		1	
180	A-63B		• HUB NUT		1	
190	A-847		• HUB SAFETY PIN		1	Y
200	A-50-1		• REAR CONE		1	
220	A-95-A		• BLOCK, PITCH CHANGE		3	Y
290	C-3317-235		• O-RING		3	Y
300	D-7260		• GUIDE COLLAR UNIT		1	
-303	A-116-D1		• • PLASTIC BUSHING		3	
-305	A-2038-12		• • SOCKET HEAD CAP SCREW		1	Y
-307	A-114C		• • STAKING PIN		1	
-310	C-6033		• NUT, GUIDE COLLAR		1	
500	91-8DT		• HYDRAULIC UNIT		1	

NOTE 1: COUNTERWEIGHT SLUGS AND COUNTERWEIGHT SLUG MOUNTING HARDWARE ARE APPLICATION SPECIFIC. COUNTERWEIGHT SLUG MOUNTING HARDWARE MUST BE REPLACED AT OVERHAUL.REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).

NOTE 2: SPINNER ASSEMBLIES AND SPINNER MOUNTING HARDWARE ARE APPLICATION SPECIFIC. REFER TO HARTZELL APPLICATION GUIDE MANUAL 159 (61-02-59).

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED



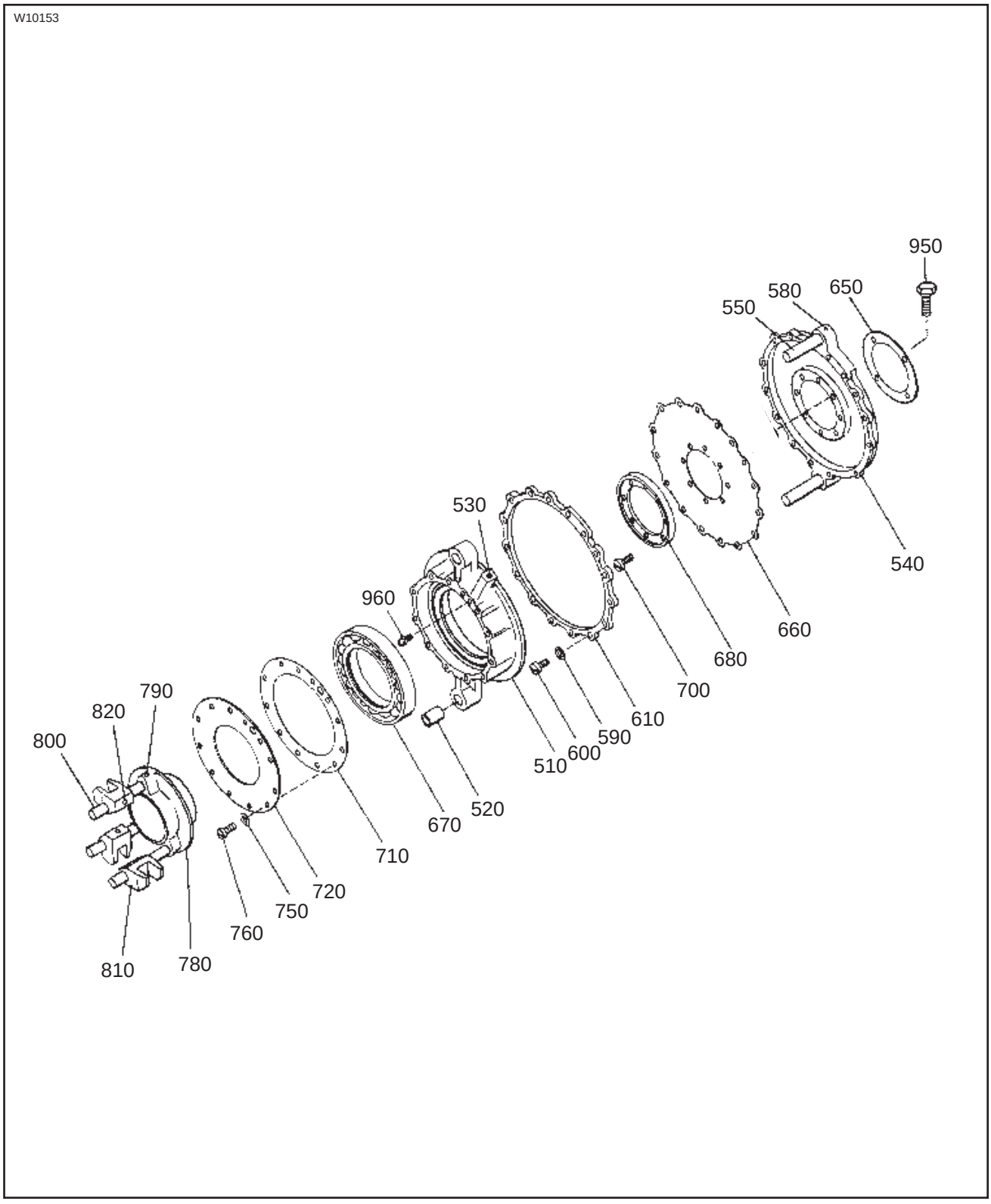
HC-D3MV20-8D Clamp Assembly
Figure 10-28

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1 2 3 4 5 6 7	EFF CODE	UPA	O/H	PCP
10-28							
-330	838-1012		• CLAMP ASSEMBLY		3		
340	B-17-6A		• • • COUNTERWEIGHT		1		
350	A-65		• • • COUNTERWEIGHT DOWEL PIN		1		
360	A-2036-12		• • • SOCKET HEAD CAP SCREW		2	Y	
370	A-285		• • • STAKING PIN, CAP SCREW		2	Y	
380	A-295		• • • LINK SCREW		1	Y	
390	A-285		• • • STAKING PIN, LINKSCREW		1	Y	
400	B-6588-1		• • • LUBRICATION FITTING		1	Y	
410	B-3838-3-2		• • COTTER PIN		2	Y	
420	A-321		• • SOCKET SCREW		2	Y	
430	A-6871-1		• • GASKET		2	Y	
-440	D-7838-1012		• • CLAMP UNIT		1		
450	A-2017		• • CLAMP BOLT		2	Y	
460	A-2031		• • WASHER		2	Y	
470	A-2043-1		• • CLAMP NUT		2	Y	
-480	B-6544		• • CAP, LUBRICATION FITTING		2	Y	
440	D-6831-1A		• • • CLAMP		1		
-483	B-3840-( )		• WEIGHT SCREW		AR	Y	
-484	A-48		• BALANCE WEIGHT		AR		

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-8D Clamp Assembly



HC-D3MV20-8D 91-8DT Hydraulic Unit
Figure 10-29

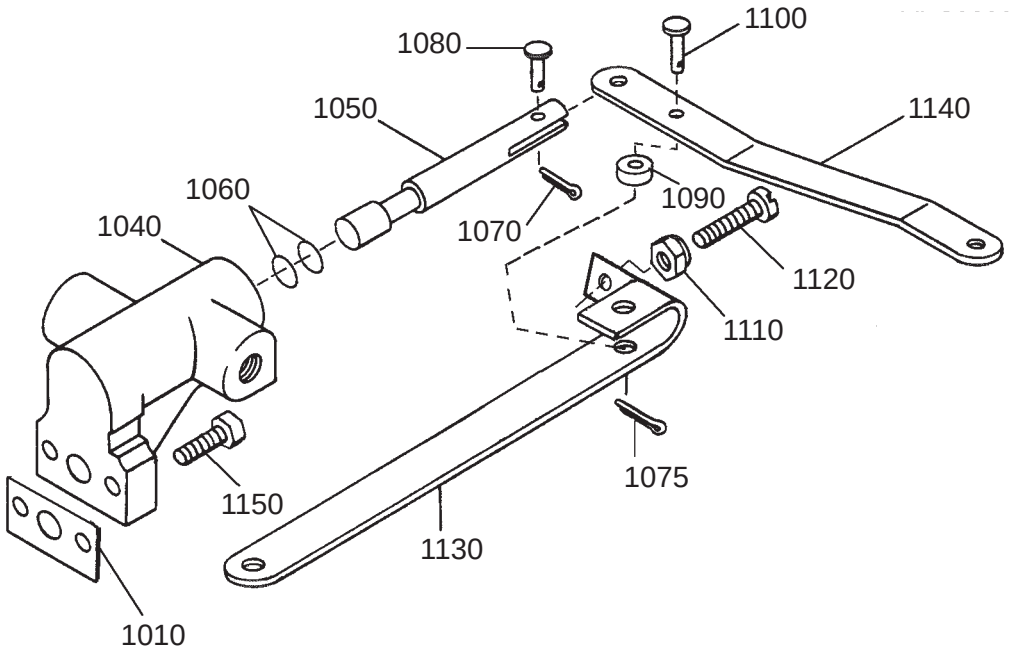
FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H
10-29						
-500	91-8DT		• HYDRAULIC UNIT		1	
510	C-112-2		• • PISTON		1	
520	A-116-B1		• • • BUSHING		2	
530	B-6711-0500		• • • HELICOIL		1	
540	C-111-8		• • CYLINDER		1	
550	A-122		• • • GUIDE ROD		2	
580	A-114-B		• • • STAKING PIN		2	
590	B-3864-39		• • LOCKWASHER		18	Y
600	B-3840-12		• • SCREW		18	Y
610	B-120		• • PLATE, OUTER DIAPHRAGM		1	
650	A-181		• • GASKET		1	Y
660	B-119-2		• • DIAPHRAGM		1	Y
670	A-38-B		• • THRUST BEARING		1	
680	A-113-2		• • PLATE, INNER DIAPHRAGM		1	
700	B-3840-10		• • SCREW		8	Y
710	B-73		• • GASKET		1	Y
720	B-12-7		• • PLATE, COVER		1	
-730	A-2043-1		• • NUT		6	Y
750	B-3864-39		• • WASHER		12	Y
760	B-3840-6		• • SCREW		12	Y
-770	C-7261		• • JACK ASSEMBLY		1	
780	C-7262		• • • JACK PLATE		1	
790	A-114-F		• • • STAKING PIN		3	
800	A-97-7		• • • PUSH ROD		3	
810	A-821		• • • FORK		3	
820	A-114-8		• • • STAKING PIN		3	
-940	C-3317-012		• • O-RING		1	Y
950	A-121		• • SCREW		6	Y
960	B-6588-1		• • LUBRICATION FITTING (SEE NOTE 1)		1	Y
-963	B-6855		• • PLUG (SEE NOTE 1)		1	
			NOTE 1: AFTER GREASING THE A-38( )( ) BEARING, REPLACE THE B-6588-1 LUBRICATION FITTING WITH THE B-6855 PLUG.			

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-8D 91-8DT Hydraulic Unit

APS5099



HC-D3MV20-8D 93-E Valve Assembly
Figure 10-30

FIG./ITEM NUMBER	PART NUMBER	AIRLINE STOCK NO.	DESCRIPTION 1234567	EFF CODE	UPA	O/H	PCP
10-30							
-1000	93-E		• VALVE ASSEMBLY		1		
1010	A-71-2		• • GASKET		1	Y	
-1020	B-3851-0463		• • WASHER		2	Y	
-1030	B-166		• • VALVE UNIT		1		
1040	A-167		• • • BODY		1		
1050	A-168		• • • SPOOL		1		
1060	C-3317-112		• • • O-RING		2	Y	
1070	B-3838-2-2		• • COTTER PIN		1	Y	
1075	B-3838-2-2		• • COTTER PIN		1	Y	
1080	B-6646-17		• • CLEVIS PIN		1		
1090	A-126		• • SPACER		1		
1100	B-6646-23		• • CLEVIS PIN		1		
1110	B-3870-1032		• • STOP NUT		1	Y	
1120	B-3840-10		• • STOP SCREW		1	Y	
1130	A-184-3		• • LINK,CONTROL VALVE		1		
1140	A-180		• • LINK,CONTROL VALVE		1		
-1150	B-3384-8H		• • SOCKET HEAD CAP SCREW		2	Y	

EFFECTIVITY	MODEL	EFFECTIVITY	MODEL

- ITEM NOT ILLUSTRATED

HC-D3MV20-8D 93-E Valve Assembly

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