DEPOT MAINTENANCE WORK REQUIREMENT FOR

HYDRAULIC PUMP ASSEMBLY

Model No.	NSN No.
PVB-044-1	
PVB-044-2	4320-00-872-8798
PV3-044-8	4320-00-937-1443

This is a reprint of DMWR 55-1650-159, dated 1 April 1968,
Basic through Change 4, including new Change 5.

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U.S. ARMY AVIATION
AND TROOP COMMAND
1 APRIL 1968

U. S. Army Aviation
Systems Command
1 June 1985

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for
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DMWR 55-1650-159, 1 April 1968 is changed as follows:

1. Title is changed as shown above.

2. Throughout this publication, wherever "TSARCOM DMWR 55-1650-159 appears, it is changed to read "USAAVSCOM DMWR 55-1650-159."

3. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

4. Retain this sheet in front of manual for reference purposes.

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LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original	01 Apr 68
Change 1	15 Feb 74
Change 2	01 Apr 75
Change 3	01 Jun 85
Change 4	15 Sep 87
Change 5	30 Sep 94

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DEPOT MAINTENANCE
WORK REQUIREMENT
NO. 55-1650-159

U.S. ARMY AVIATION AND
TROOP COMMAND
St. Louis, MO. 63120-1798
1 April 1968

DEPOT MAINTENANCE WORK REQUIREMENT

FOR

HYDRAULIC PUMP ASSEMBLY

Model Number	National Stock Number
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PV3-044-8	4320-00-937-1443

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter, or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

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CHAPTER 1

INTRODUCTION

1-1. INTRODUCTION. This Work Requirement is self-contained within the scope of overhaul for Models VB-044-1, PVB-044-2 and PV3-044-8, Hydraulic Pump Assemblies as illustrated in figure 1-1.

1-2. PURPOSE AND SCOPE. This Work Requirement establishes the requirements for disassembly, cleaning, inspection, repair, reconditioning, rehabilitation, modification, reassembly, servicing, testing, and storage of specified equipment.

a. Parts, components, subassemblies, or assemblies found worn or defective beyond the reparable limits established by this Work Requirement will be condemned and disposed of as directed in supply provisions of the contract.

b. The repair and/or rehabilitation and reconditioning of equipment and their components specified herein shall be accomplished in accordance with specific instructions set forth in this Work Requirement. Tolerances and limits set forth herein are the minimum acceptable standards; however, the repair procedures are not mandatory if the contractor is able to develop satisfactory procedures for repair. Any repair procedures developed by the contractor shall be subject to approval by the Contracting Officer or his designated representative.

c. This Work Requirement requires repair and renovation of parts to within the dimensional and tolerance specifications noted herin.

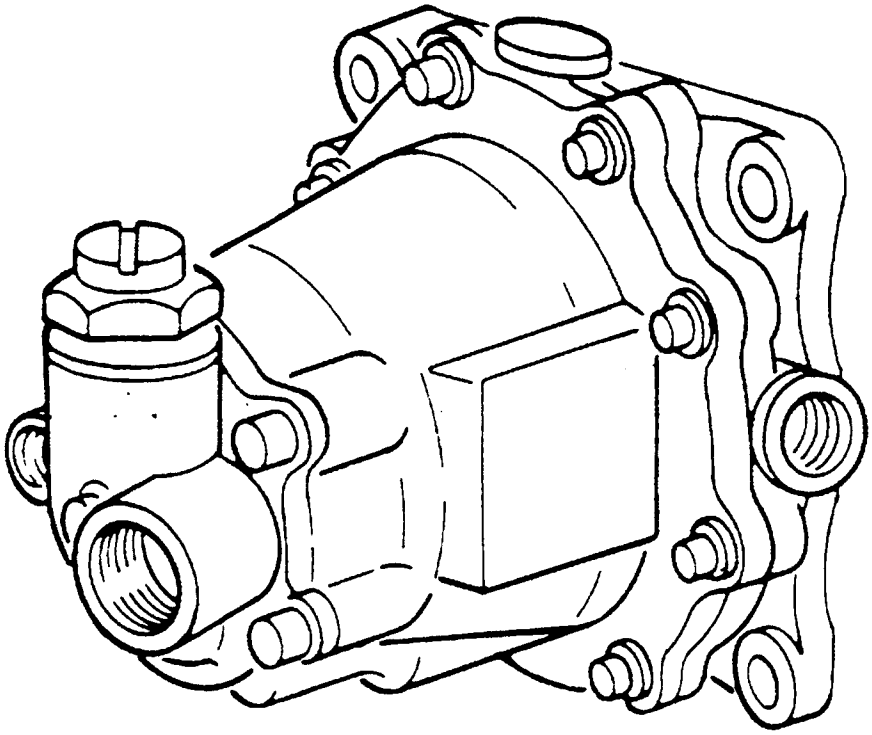


Figure 1-1. External View

1-3. GENERAL INFORMATION. Technical publications, pertinent to equipment set forth in this Work Requirement, have been integrated in the specific overhaul requirements outlined. Any errors or omissions found within this Work Requirement during compliance shall be reported as follows:

a. Contractors report shortcomings to Contracting officer.

b. Reports of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to DA Publications) and forwarded direct to: Commander, U.S. Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO. 63120-1798. A reply will be furnished directly to you.

1-4. DEFINTIONS. To avoid misinterpretation of the intent of the instructions in this Work Requirement, phrases and terms used herein which are peculiar to the equipment or its rehabilitation are defined below:

a. Assembly. A group of two or more physically connected and related parts, which is capable of disassembly, and when combined with other assemblies and parts, creates a component.

b. Component. A group of physically connected assemblies and parts, which is capable of independent operation but may be externally controlled, or derives its power from another source and, when combined with other components, assemblies, and/or parts, forms a functional group or end item.

c. Consumable Items. Parts or materials which are consumed by usage or have a one-time usage, normally losing identity upon application with, and/or assembled into, the equipment.

d. Contracting Officer. (CO) is used herein to indicate the Department of the Army individual responsible for overall administration of the contract.

e. Disassembly. As used herein, describes the operations necessary to reduce an assembly or subassembly to its separate components and parts.

f. Federal stock number (FSN). The Federal Stock Number for an item of supply consists of the applicable 4-digit Federal Supply Classification (FSC) code number, plus the applicable 7-digit Federal Item Identification Number (FIIN). The FSC code number relates the item to other like items of supply; the FIIN merely identifies the item as a unit. The FSN is incomplete unless both of these numbers are included.

g. Modification. An alteration and/or integral change affecting the configuration of the equipment or its respective parts, components, subassemblies, and assemblies.

h. Reassembly. The assembling and aligning of all subassemblies and parts into a complete assembly to effect a serviceable item of equipment.

i. Recondition. As used herein, means the disassembly, cleaning, treating, lubrication, repair and or replacement of defective parts or components, and reassembly in accordance with the instructions contained in this Work Requirement.

j. Rehabilitation. The repair, modification, or reconditioning necessary to return the equipment to a serviceable condition equivalent to new.

k. Repair. To restore a defective part, component, subassembly, or assembly to a serviceable condition in accordance with the instructions contained in this Work Requirement.

l. Servicing. The lubrication, treating, cleaning, and/or preservation necessary to maintain the equipment and/or other respective parts in serviceable condition.

m. USAATCOM. U.S. Army Aviation and Troop Command.

n. Test. As used herein, is the testing of equipment using shop test equipment to determine that the unit functions properly within the limits set forth in this Work Requirement.

o. Quality audit. A teardown inspection and evaluation of an overhauled and/or modified item for the purpose of Government verification that all work directed in this Work Requirement has been properly accomplished, and to establish the continued effectiveness of the contractor's quality control system including workmanship, materials used, and repair procedures. The quality audit shall include correction of any dificiencies, reassembly, test, and calibration to assure serviceable end items in accordance with the requirements of this Work Requirement.

p. Overhaul. To restore an item to a completely serviceable condition as prescribed by serviceability standards developed and published by USAAVSCOM.

Page 1-3/(1-4 deleted).

CHAPTER 2

GENERAL ADMINISTRATIVE REQUIREMENTS

2-1. HANDLING AND INVENTORY. The contractor shall exercise the greatest possible care to prevent damage and deterioration to Government equipment while undergoing movement, unpacking, test, and repair operations, and to prevent damage after Government acceptance. Equipment shall be stored in a controlled location approved by the Contracting Officer or his designated representative.

2-2. COMPLIANCE WITH TECHNICAL DIRECTIVES. When the Work Requirement incorporates other Army directives which in themselves require a form entry to indicate compliance, such directives are identified by title, number, and date and require applicable component form entry upon compliance. Further, when such directives are incorporated into the Work Requirement, each specific paragraph pertaining thereto is identified as being part of such directives. For example, "Remove horizontal hinge pins, part No. 167419-1, and replace with horizontal hinge pins, part No. 167419-2 (MWO 55-1520-203-34/8)."

2-3. QUALITY CONTROL PERSONNEL. Quality control personnel shall insure complete compliance with Quality Program and/or Inspection System Requirements specified in the contract and this Work Requirement. Any deviations from the established requirements shall be approved by the Contracting Officer or his designated representative.

2-4. WORK REQUIREMENT OMISSIONS OR DEVIATIONS. When it becomes evident that any item(s) of work as set forth in this Work Requirement will not be accomplished, or which will be accomplished in a manner other than that specified, for whatever reason, a written notice will be submitted immediately to the Contracting Officer stating:

a. Serial number(s) if applicable, part number, and NSN of affected equipment.

b. Item(s) of work which will not be accomplished or which will not be accomplished as specified herein.

c. Reason for non-accomplishment or deviation.

d. Contractor's action taken to correct condition causing non-accomplishment or need for deviation.

e. Data relative to availability of parts required, if applicable.

f. Estimated man-hours required to accomplish item(s).

2-5. FLIGHT SAFETY PARTS PROGRAM. This DMWR is not impacted by the Flight Safety parts Program.

CHAPTER 3

GENERAL WORK REQUIREMENTS

3-1. DETERMINATION OF WORK REQUIREMENTS. Work requirements will be determined in the following manner:

a. The contractor will physically check all tags and forms attached to the equipment to determine:

(1) Reason for removal from service.

(2) Open items of work on delayed discrepancies, including any Time Compliance TM's, TB's, or MWO's not accomplished.

b. Disassemble equipment in order to perform a complete evaluation of the components or subassemblies to determine the repair, modification, and replacements required to rehabilitate the equipment as specified in this Work Requirement.

c. Equipment removed from stock for modification only shall be disassembled by the contractor only to the extent required to accomplish the modification(s).

3-2. CLEANING AND CORROSION TREATMENT.

a. Detail methods to be used for cleaning and corrosion treatment of equipment should be used as applicable, in this Work Requirement.

b. Immediately after disassembled parts are cleaned and are not immediately processed, utmost care shall be exercised to prevent damage or deterioration, due to corrosion or decay.

3-3. GENERAL DISASSEMBLY PROCEDURE.

a. When the equipment to be overhauled was removed from service for any of the following reasons, complete dissambly is required:

(1) Internal failure.

(2) Overspeeding.

(3) Expiration of approved operating time interval; or time unknown or estimated.

b. Check and record gear pattern and backlash, when applicable.

c. Check and tag shims, when applicable.

d. Separate and index all parts for reassembly in proper positions.

e. Record and tag parts that are defective with reason for rejection. (Exclude parts which are normally replaced at every overhaul such as gaskets, preformed packings, etc.)

3-4. GENERAL REPAIR, REPLACEMENT, AND/OR MODIFICATION CRITERIA.

a. Repair or replace as applicable any parts which are not within tolerances or show evidence of failure by measurement or special inspection methods specified herein.

b. Replace all parts that have scratches or galls too deep to be repaired as specified herein.

c. Replace all seals such as gaskets, preformed packings, etc., with new serviceable items.

d. All equipment shall be modified as specified in this Work Requirement unless otherwise specified within the contract.

e. When specific tolerances and/or repairs are not specified herein, replace all bearings having galls, scratches, or burrs which would cause binding.

f. Welding shall not be accomplished on equipment in areas other than specified by this Work Requirement or authorized by USAAVCOM.

3-5. GENERAL REASSEMBLY PROCEDURE. General precautions shall be adhered to during reassembly to insure that all internal parts have been properly installed and necessary tolerance checks performed.

3-6. LUBRICATION. Lubricate parts during reassembly as required using lubricants specified in this Work Requirement.

3-7. STAMPING AND/OR REPLACEMENT OF DATA PLATE. When applicable, to provide a convenient record of overhaul or modification and operating time that will at all times accompany equipment, stamping shall be done as follows:

a. The stamping of equipment data plates shall include initials of the facility performing the overhaul or modification, date of overhaul or modifications, and part number. Total operating time since new shall be included if applicable. The data shall be stamped on the data plate using letters and figures 1/8 inch high, placed in the area adjacent to the manufacturer's data. In the event overhaul or modification has exceeded stamping spaces on the data plate, the plate shall be replaced and all pertinent data will be transferred to the new plate.

CAUTION

Stamping directly on the surface, or installed data plate of any assembly or item of equipment is prohibited.

b. If required, locally manufacture replacement data plate using name plate (item 1, table 8-1) one inch wide by two inches long. Stamped data plate shall be attached with adhesive (items 18 and 19, table 8-1).

3-8. COMPONENT OPERATING HOUR HISTORY. Unless otherwise prescribed, the following procedures will be adhered to in the event operating hour history of the component or its integral fatigue life parts is unknown.

a. When equipment (time change or retirement interval item) is received for overhaul or modification(s) and total hours since last overhaul or modification(s) or total operating time is not available, every effort shall be made to obtain this information from the shipping activity. In the event the time cannot be obtained, the contractor shall request instructions from the Contracting Officer.

b. If the equipment received for overhaul or modification(s) contains integral finite fatigue life parts and total operating time of these parts is not available, the contractor shall request instructions from the Contracting Officer.

CHAPTER 4

DETAIL WORK REQUIREMENTS

Section 1 - General Requirements

4-1. SCOPE. This chapter contains specific overhaul instructions including disassembly, cleaning, repair and replacement, modification criteria, reassembly and testing of assemblies, run-in and test procedures.

4-2. ILLUSTRATED PARTS BREAKDOWN. This Illustrated Parts Breakdown is composed of a group assembly parts list and illustrations (figure 4-1) in exploded form to provide complete identification for all parts comprising the In-Line Variable Displacement Hydraulic Pump assembly models PVB-044-1, PVB-044-2 and PV3-044-8. The group assembly breakdown lists all parts in their sequence of disassembly and parts are indexed and shown on the illustration.

4-3. USABLE ON CODE. Part number applicability to hydraulic pump assemblies is indicated by a letter symbol in the USABLE ON CODE column of the group assembly parts list. When no symbol is shown, the part is used on all hydraulic pump assemblies listed in the corresponding parts list.

CODE	MODEL NUMBER
A	PVB-044-1
B	PVB-044-2
C	PV3-044-8

4-4. VENDOR'S CODE. The following vendors' code with the vendors name and address is used in the DESCRIPTION column to indicate vendors' parts:

CODE	NAME AND ADDRESS
60995	Tubing Seal Cap Ind. San Gabriel, Calif.
62983	Vickers Aerospace Division Sperry Rand Corp. P.O. Box 302 Troy, Michigan

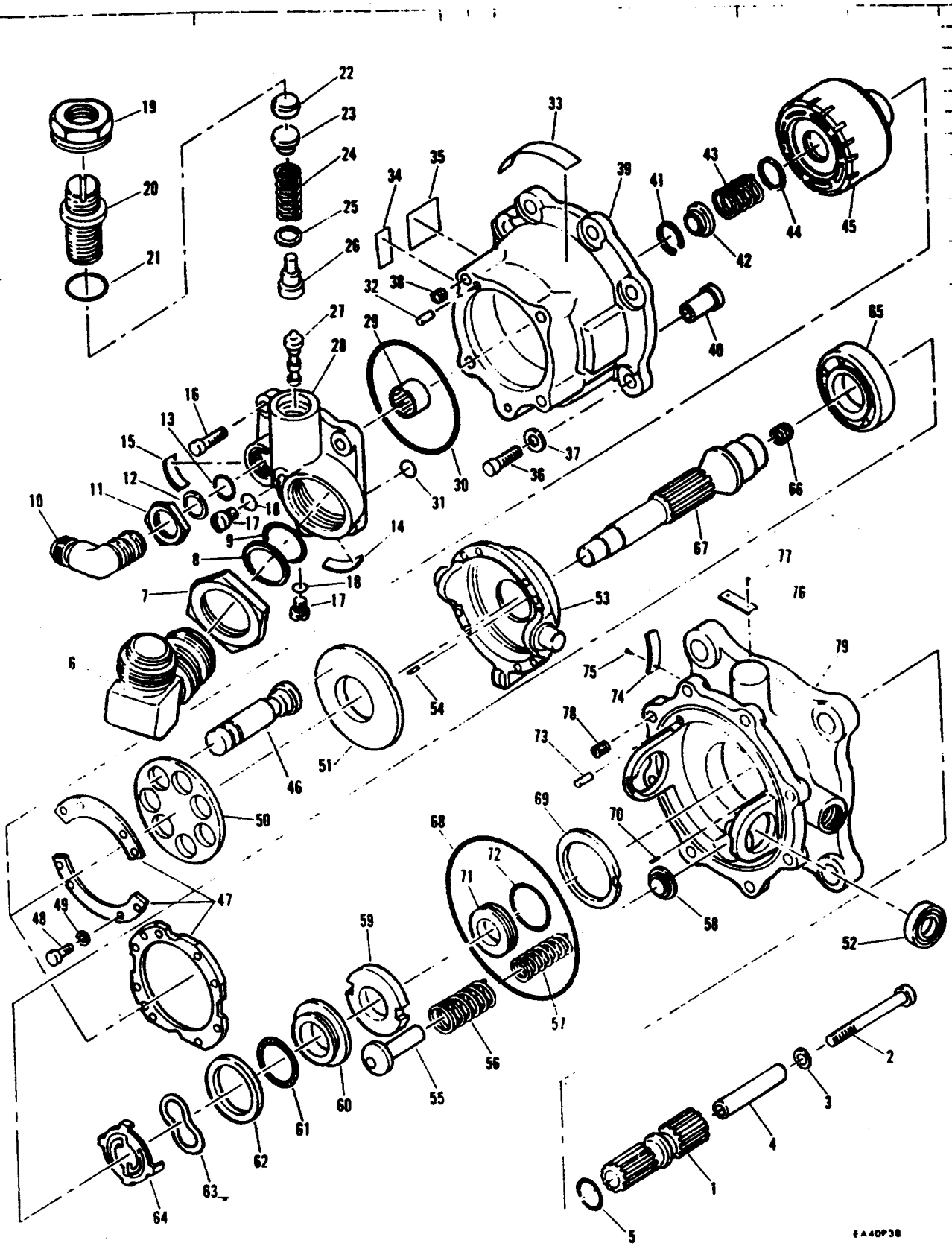


Figure 4-1. In-Line, Variable Displacement Hydraulic Pump Assembly, Exploded View

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY.	USABLE ON CODE
4-1-	PVB-044-1	PUMP ASSEMBLY, Variable delivery hydraulic	1	A
	PVB-044-2	PUMP ASSEMBLY, Variable delivery hydraulic	1	B
	PV3-004-8	PUMP ASSEMBLY, Variable delivery hydraulic	1	C
-1	297037	. SHAFT, Coupling	1	
-2	MS16998-34	. SCREW, Mounting (AP) (62983, 224952)	1	A
	MS16998-35	. SCREW, Mounting (AP) (62983, 224953)	1	BC
-3	297056	. WASHER, Screw	1	
-4	297057	. SLEEVE, Coupling shaft screw	1	
-5	MS28775-014	. PACKING, Shaft (62983, 198336)	1	
-6	325473	. FITTING, Inlet elbow	1	C
-7	AN6289D16	. NUT, Jam (62983, 145253)	1	C
-8	MS28777-16	. RING, Backup (62983, 134099)	1	C
-9	MS28778-16	. PACKING, Inlet elbow (62983, 81951)	1	C
-10	MS21926-6	. FITTING, Outlet elbow (62983, 325477)	1	C
-11	AN6289D6	. NUT, Jam (62983, 131537)	1	C
-12	MS28777-6	. RING, Backup (62983, 130972)	1	C
-13	MS28778-6	. PACKING, Outlet elbow (62983, 62029)	1	C
-14	262815	. PLATE, Inlet	1	
-15	262816	. PLATE, Outlet	1	AB
	297023	. VALVE PLATE AND CONTROLS SUB-ASSEMBLY	1	
-16	MS16998-28	. SCREW, Mounting (AP) (62983, 224946)	4	
-17	170498	SCREW, Sealing	2	
-18	MS28775-008	. PACKING, Screw (62983, 151122)	2	
-19	279326	. . NUT, Locking	1	
-20	279325	SCREW, Adjusting	1	
-21	MS28775-015	. . PACKING, Adjusting screw (62983, 195045)	1	
-22	310725	. . SPACER	1	
-23	297059	. . GUIDE, Spring	1	
-24	297060	. . SPRING, Control	1	
-25	310730	. . WASHER	1	
-26	310598	. . GUIDE, Spring	1	
	297024	. . VALVE PLATE AND SPOOL SUB-ASSEMBLY	1	
-27	*311476	. . . VALVE, Pilot	1	
-28	*297008	. . . VALVE PLATE AND BEARING SUBASSEMBLY	1	
-29	297010	. . . BEARING, Valve plate needle	1	
-30	MS28775-137	. PACKING, Valve plate (62983, 195076)	1	
-31	208830	. PACKING, Valve plate	1	
-32	209559	. PIN, Locating	1	
-33	307483	. PLATE, Name	1	A
	316343	. PLATE, Name	1	BC
-34	262816	. PLATE, Outlet	1	C
-35	325476	. PLATE, Caution	1	C
	297012	. HOUSING AND INSERTS SUBASSEMBLY	1	A
	297089	. HOUSING AND INSERTS SUBASSEMBLY	1	BC
-36	MS16997-33	. SCREW, Mounting (AP) (62983, 225016)	8	A
	MS16998-28	. SCREW, Mounting (AP) (62983, 224946)	8	BC
-37	AN960C8	. WASHER, Screw (AP) (62983, 51918)	8	A
	309699	. WASHER, Screw (AP)	8	BC
-38	MS21209F1-15	. . INSERT, Valve plate screw (62983, 186159)	4	

*Not procurable separately, see NHA

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY.	USABLE ON CODE
4-1-39	*297007	. . HOUSING, (Casting)	1	A
	*297088	. . HOUSING (Casting)	1	BC
-40	297022	. PISTON, Control	1	
-41	194018	. RING, Retaining	1	
-42	297036	. RETAINER, Retaining ring	1	
-43	297035	. SPRING, Cylinder block	1	
-44	297034	. SPACER, Spring	1	
	297021	. BLOCK, PISTON AND SHOE SUBASSEMBLY	1	A
	319052	. BLOCK, PISTON AND SHOE SUBASSEMBLY	1	BC
-45	*297013	. . BLOCK, Cylinder	1	A
	*314545	. . BLOCK, Cylinder	1	BC
-46	*297015	. . PISTON AND SHOE SUBASSEMBLY	7	A
	*314482	. . PISTON AND SHOE SUBASSEMBLY	7	BC
-47	297020	. RETAINER, Shoe holddown plate	2	A
	312469	. RETAINER, Shoe holddown plate	1	BC
-48	NAS1350-04H4	. SCREW, Mounting (AP) (62983, 297055)	8	A
	208938	. SCREW, Mounting (AP)	10	BC
-49	297070	. WASHER, Screw (AP)	8	A
	147391	. WASHER, Screw (AP)	10	BC
-50	297019	. PLATE, Shoe holddown (standard)	1	
	341659	. PLATE, Shoe holddown (0.005" Oversize)	1	
	341660	. PLATE, Shoe holddown (0.077" Oversize)	1	
	341661	. PLATE, Shoe holddown (0.010" Oversize)	1	
-51	297018	. PLATE, Shoe wear	1	
-52	297064	. BEARING, Pintle	2	A
	297009	. BEARING, Pintle	2	BC
-53	297002	. YOKE SUBASSEMBLY	1	A
	297090	. YOKE SUBASSEMBLY	1	BC
-54	230822	. . PIN, Locating	1	
-55	297048	. GUIDE, Control spring	1	AB
	323008	. GUIDE, Control spring	1	C
-56	297051	. SPRING, Control (outer)	1	
-57	297050	. SPRING, Control (inner)	1	AB
-58	297049	. SEAT, Control spring	1	
	297026	. SHAFT SEAL SUBASSEMBLY	1	
-59	297032	. . SEAL, Carbon	1	
-60	297030	. . GROMMET, Seal	1	
-61	297028	. . SPRING, Garter	1	
-62	297029	. . SPACER	1	
-63	297031	. . SPRING, Wave	1	
-64	297027	. . RETAINER, Seal	1	
	297038	. SHAFT, INSERT AND BEARING SUB-ASSEMBLY	1	
-65	297011	. . BEARING, Drive shaft	1	
-66	MS21209F1-15	. . INSERT, Coupling shaft (62983,186159)	1	
-67	297014	. . SHAFT, Drive	1	
-68	297006	. PACKING, Mounting flange	1	
-69	297040	. RING, Thrust	1	
-70	248760	. PIN, Retaining	1	
-71	297033	. RING, Mating	1	
-72	NAS1593-022	. PACKING, Mating ring (62983, 206856)	1	
-73	248820	. PIN, Locating	2	
-74	164432	. PLATE, Instruction	1	
-75	AN535-0-2	. SCREW, Mounting (AP) (62983, 98759)	2	
-76	52488	. PLATE, Rotation	1	
-77	AN535-0-2	. SCREW, Mounting (AP) (62983, 98759)	2	

*Not procurable separately, see NHA

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY.	USABLE ON CODE
4-1-77	297004	. MOUNTING FLANGE AND INSERTS SUBASSEMBLY	1	A
	297082	. MOUNTING FLANGE AND INSERTS SUBASSEMBLY	1	BC
-78	MS21209C08-20	. . INSERT, Housing screw (62983, 188332)	8	A
	MS21209F1-15	. . INSERT, Housing screw (62983, 186159)	8	BC
-79	*297003	. . FLANGE, Mounting (casting)	1	
	SP-16	. PLUG, Shipping (1-5/16-12) (60995) (62983, 212665)	1	AB
	SP-6	. PLUG, Shipping (9/16-18) (60995) (62983, 212662)	2	AB
	SP-6	. PLUG, Shipping (9/16-18) (60995) (62983, 212662)	1	C
	SP-4	. PLUG, Shipping (7/16-20) (60995) (62983, 186104)	1	
	164131	. GASKET, 1-5/16 shipping plug	1	AB
	161312	. GASKET, 9/16 shipping plug	2	AB
	161312	. GASKET, 9/16 shipping plug	1	C
	155317	. GASKET, 7/16 shipping plug	1	
	SC-16	. CAP, Inlet port shipping (60995) (62983, 176009)	1	C
	SC-6	. CAP, Outlet port shipping (60995) (62983, 200374)	1	C
	914362	REPAIR PARTS KIT, Major overhaul	1	

*Not procurable separately, see NHA

SECTION II - DISMANTLING

(Not applicable)

SECTION III - DISASSEMBLY

NOTE

Disassembly, overhaul and test procedures outlined in this chapter are for the PVB-044-1, -2, and PV3-044-8 pumps. Section VI contains modification data to convert PVB-044-1 to PVB-044-2. Section X contains significant physical and procedural differences between models PVB-044-1 and -2 and model PV3-044-8.

4-5. DISASSEMBLY.

NOTE

Provide a clean, dust free area in which to perform the overhaul and test operations outlined in this manual.

CAUTION

During disassembly, prevent damage to all sealing areas of parts removed. Such damage, if not possible to remove at time of inspection and repair, will necessitate replacing the part with new.

NOTE

Disassemble hydraulic pump assembly according to numerical sequence of index numbers assigned to exploded view, figure 4-2, observing the following:

WARNING

Care should be taken when cutting and removing lockwire to prevent personal injury.

CAUTION

Forcefully pulling lockwire out of retained parts may cause damage.

a. Cut and remove all external lockwire.

b. Remove case drain, seepage drain, inlet and outlet port shipping plugs to drain oil from unit.

c. Remove mounting screw (1, figure 4-2) to release coupling shaft (4).

d. Secure power arm adapter T-181246 to power arm (Wilton Model 301 or equivalent). In turn, secure mounting flange end of pump to adapter as shown in figure 4-3 to facilitate disassembly.

CAUTION

Do not clamp pump mounting flange between vise jaws.

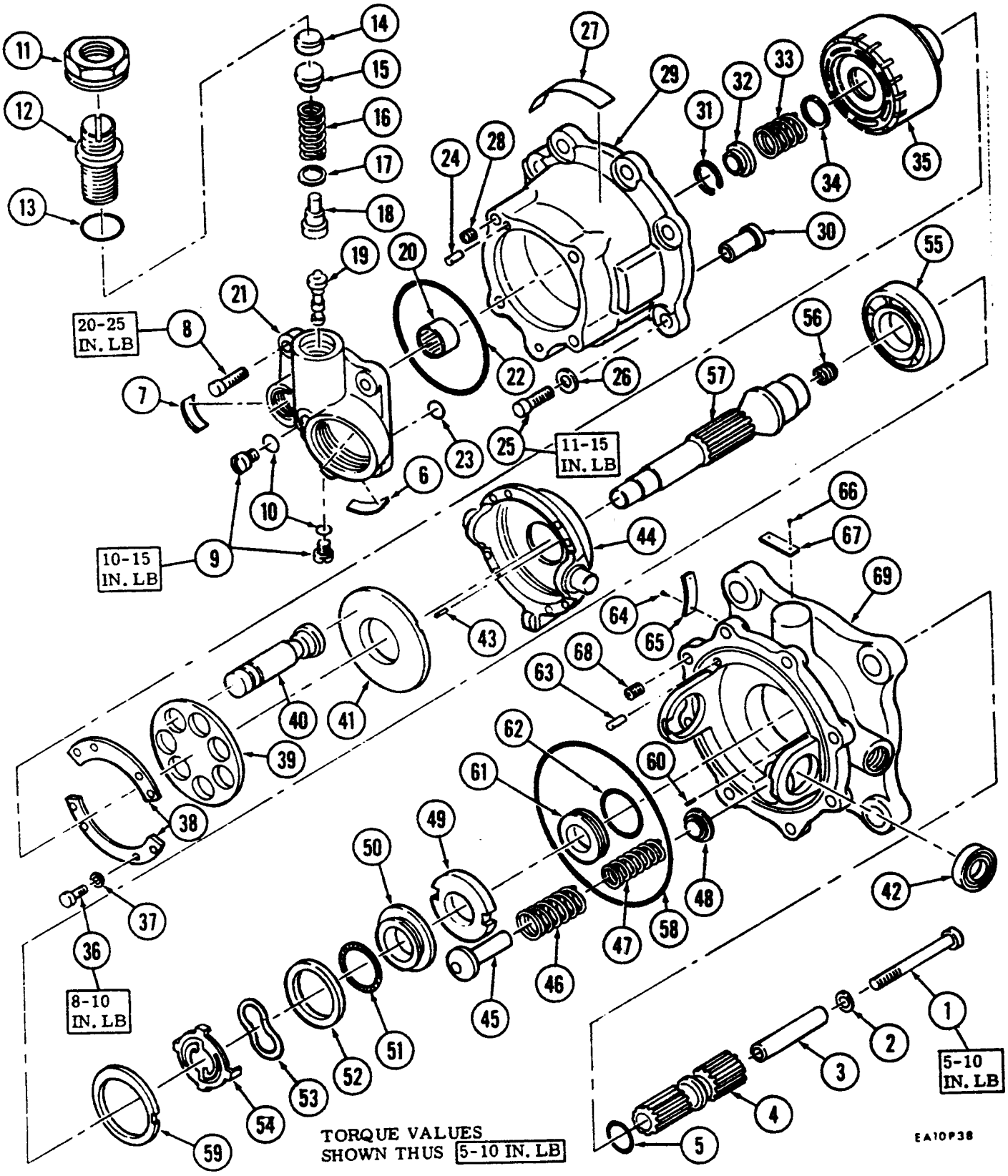


Figure 4-2. Variable Displacement Hydraulic Pump Assembly Exploded View (Sheet 1 of 2)

1. Mounting Screw
2. Washer
3. Sleeve
4. Coupling Shaft
5. Shaft Packing
6. Inlet Plate
7. Outlet Plate
8. Mounting Screw
9. Sealing Screw
10. Screw Packing
11. Locking Nut
12. Adjusting Screw
13. Packing
14. Spacer
15. Spring Guide
16. Control Spring
17. Washer
18. Spring Guide
19. Pilot Valve
20. Needle Bearing
21. Valve Plate
22. Packing
23. Packing
24. Locating Pin
25. Mounting Screw
26. Washer
27. Name Plate
28. Insert
29. Housing
30. Control Piston
31. Retaining Ring
32. Retainer
33. Spring
34. Spring Spacer
35. Cylinder Block
36. Mounting Screw
37. Washer
38. Plate Retainer
39. Hold Down Plate
40. Piston and Shoe Subassembly
41. Shoe Wear Plate
42. Pintle Bearing
43. Locating Pin
44. Yoke
45. Spring Guide
46. Control Spring
47. Control Spring
48. Spring Seat
49. Carbon Seal
50. Seal grommet
51. Garter Spring
52. Spacer
53. Wave Spring
54. Retainer
55. Shaft Bearing
56. Insert
57. Drive Shaft
58. Packing
59. Thrust Ring
60. Retaining Pin
61. Mating Ring
62. Packing
63. Locating Pin
64. Mounting Screw
65. Instruction Plate
66. Mounting Screw
67. Rotation Plate
68. Insert
69. Mounting Flange

Figure 4-2. Variable Displacement Hydraulic Pump Assembly Exploded View (Sheet 2 of 2)

4-6. REMOVAL AND DISASSEMBLY OF VALVE PLATE AND CONTROLS SUBASSEMBLY.

CAUTION

In the following operation, make certain cylinder block (35, figure 4-2) is not pulled away from piston and shoe subassemblies (40) when valve plate (21) is removed from housing (29).

a. Remove valve plate and controls subassembly from housing.

b Disassemble valve plate and controls subassembly in the order of index numbers (9 through 20). Do not remove item (6 or 7) unless damaged.

CAUTION

Pilot valve (19) and valve plate (21) of valve plate and controls subassembly are matched components. Do not intermix these parts with like parts of other subassemblies. Prevent damage to these parts. Pilot valve (19) may adhere to bore because of the close tolerance. Use a dowel and gently push pilot valve out of bore. Tag for remating with valve plate.

CAUTION

Prevent damage to valving face of valve plate during the following operation.

c. Use bearing puller T-300582 and holding fixture T-410447 as shown in figure 4-4 to remove needle bearing (20, figure 4-2).

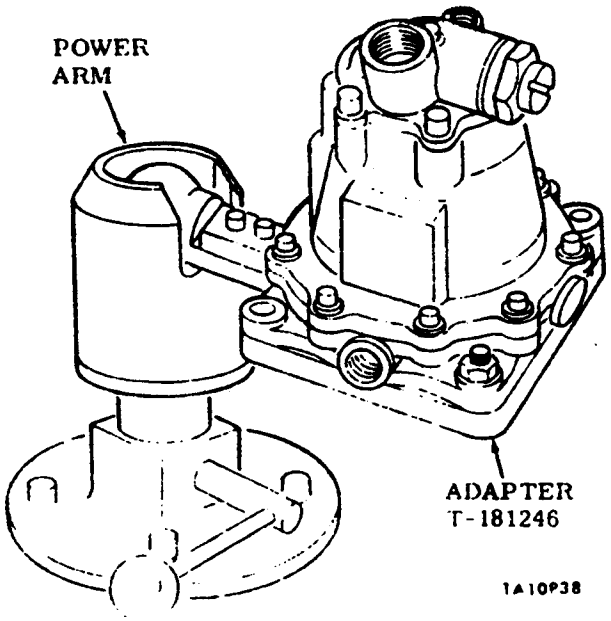


Figure 4-3. Pump/Power Arm Assembly

4-7. REMOVAL AND DISASSEMBLY OF HOUSING AND PLATES SUBASSEMBLY.

CAUTION

When removing housing (29, figure 4-2), control springs (46 and 47) will exert sufficient force to push housing away from mounting flange (69). Hold down on housing while removing the last two screws to counteract force of control springs (46 and 47).

a. Remove mounting screws (25) and washers (26) on side of housing away from control springs (46 and 47) first and then work around either side of housing toward control piston location.

CAUTION

In the following operation, do not allow control piston (30) to fall out of housing. Hold finger over pressure passage port on housing to prevent piston dropout.

b. Remove housing (29) and remove control piston (30) from housing. Do not remove name plate (27) or inserts (28) from housing unless loose or damaged.

4-8. REMOVAL AND DISASSEMBLY OF CYLINDER BLOCK.

CAUTION

In the following step, use caution when removing cylinder block (35, figure 4-2) to prevent damage to valving face of cylinder block.

a. Carefully pull cylinder block (35) away from drive shaft (57).

b. Use spring compressor T-410872 as shown in figure 4-5 to compress cylinder block spring (33, figure 4-2) for removal of retaining ring (31).

c. Remove retaining ring retainer (32), cylinder block spring (33) and spring spacer (34) from cylinder block (35).

4-9. REMOVAL AND DISASSEMBLY OF YOKE AND ASSOCIATED COMPONENTS.

WARNING

Care shall be taken in the removal of lockwire to prevent personal injury.

a. Cut and remove lockwire.

b. Remove mounting screws (36, figure 4-2) and washers (37) to remove plate retainer (38), hold down plate (39), piston and shoe subassemblies (40) and shoe wear plate (41) from yoke (44).

c. Use holding clamp T-410871 as shown in figure 4-6 to compress control springs (46 and 47, figure 4-2) until yoke is free of spring force.

d. Remove both yoke pintle bearings (42) from trunnions of yoke (44) and mounting flange bores. Remove yoke and holding clamp T-410871 from mounting flange.

NOTE

It may be necessary to lift up on drive shaft to allow room for yoke removal.

e. Do not remove locating pin (43) from yoke (44) unless loose or damaged.

f. Remove yoke spring guide (45), control springs (46 and 47) and yoke spring seat (48) from mounting flange (69).

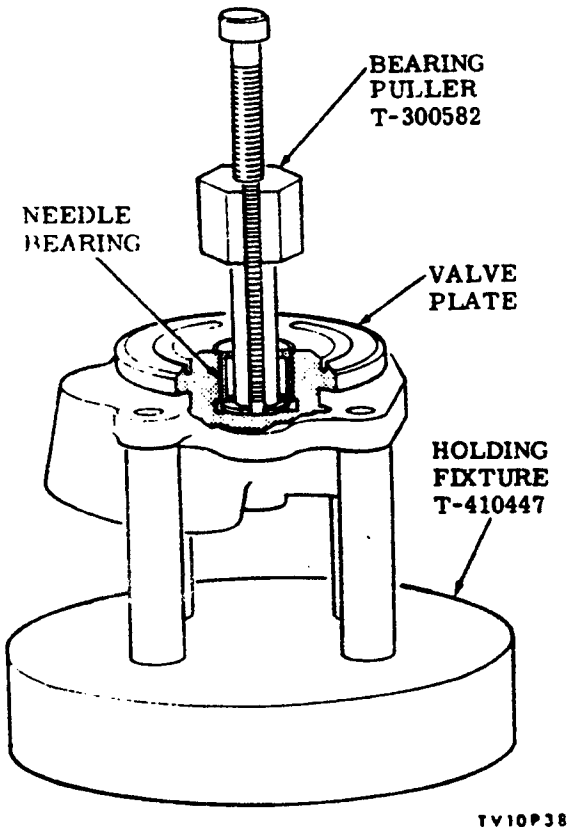


Figure 4-4. Removal of Needle Bearing

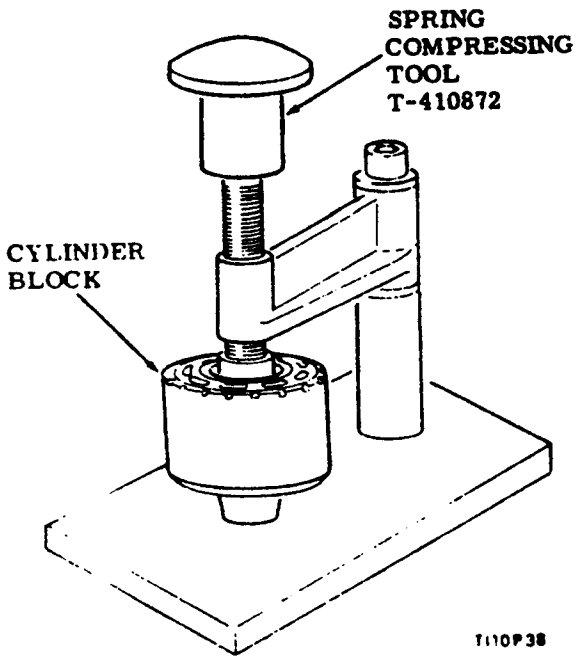


Figure 4-5. Removal of Spring Retaining Ring

4-10. REMOVAL AND DISASSEMBLY OF SHAFT SEAL SUBASSEMBLY.

CAUTION

In the following steps, use caution to prevent damage to carbon seal (49, figure 4-2) and mating ring (61). Damage to sealing faces will render parts unserviceable.

a. Carefully remove drive shaft (57) with drive shaft bearing (55) and shaft seal subassembly from mounting flange (69).

CAUTION

Prevent axial scratching of drive shaft when removing tang type retainer (54) during the following operations.

b. Remove components of shaft seal subassembly from drive shaft (57) or from bore in mounting flange (69).

NOTE

Retainer (54) has two detents which snap into corresponding holes in drive shaft (57). Lift these detents before attempting to remove retainer. In the operation, prevent damage to that area on drive shaft that corresponds with seal grommet (50).

c. Use snap ring pliers to carefully remove retainer (54) from drive shaft (57).

4-11. REMOVAL OF DRIVE SHAFT BEARING FROM DRIVE SHAFT. Use bearing driver T-410445 and bearing removing plate T-162016 as shown in figure 4-7 to press drive shaft (57, figure 4-2) out of drive shaft bearing (55). Do not remove insert (56) unless damaged.

4-12. DISASSEMBLY OF MOUNTING FLANGE.

a. Remove thrust ring (59, figure 4-2) and mating ring (61) from central bore of mounting flange (69) and packing (62) from mating ring.

b. Do not remove retaining pin (60), rotation plate (67), instruction plate (65), or inserts (68) unless loose or damaged.

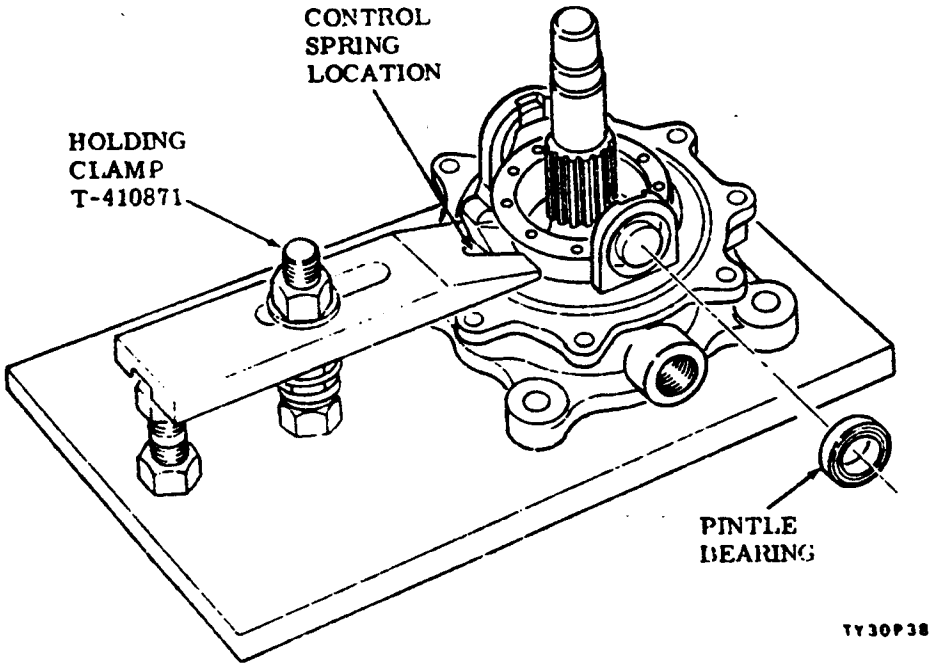


Figure 4-6. Compressing Control Spring

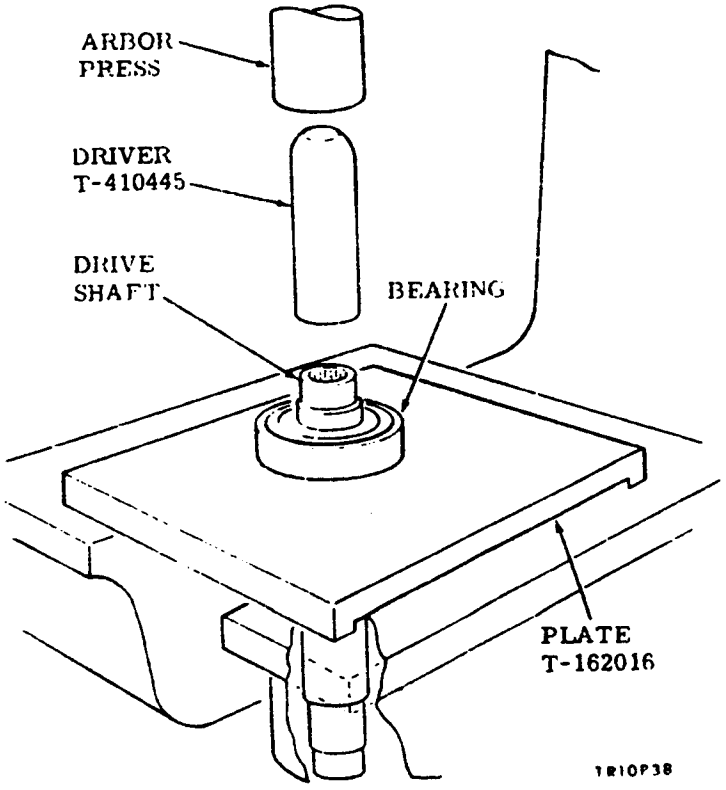


Figure 4-7. Removal of Drive Shaft Bearing

Section IV - Cleaning

4-13. CLEANING.

WARNING

Provide a well ventilated area when using cleaning solvent (item 3, table 8-1). Avoid prolonged breathing of fumes. Keep solvent away from open flame.

a. Sonic or ultrasonic clean all parts (except parts that contain or are composed of non-metal material).

b. Remove all old grease from splined bore in coupling shaft end of drive shaft. Pay particular attention to all hydraulic passages in housing and valve plate subassembly. Make certain all passages are clean and free from obstructions.

c. Clean parts that contain or are composed of non-metal material in cleaning solvent (item 3, table 8-1).

d Unless cleaned parts are used immediately, they must be oiled with clean hydraulic oil (items 2 or 4, table 8-1) (oil should be filtered through a 10 micron nominal filter) and placed in heat sealable polyethylene bags or other suitable contaminant free sealed containers until ready for use.

NOTE

A good practice is to reclean and oil parts just prior to assembly if they have been placed in storage after initial cleaning.

e. If compressed air is used in any cleaning operation, make certain source of supply is filtered to remove all impurities.

4-14. INSPECTION.

a. In most cases, a visual parts inspection will disclose damage necessitating repair or replacement. However, because of very close tolerances that must be maintained in certain parts of the unit, the following inspection (table 4-2) must also be performed. All dimensions contained in table 4-2 are in inches unless otherwise specified

b. In addition to a visual inspection, a magnetic particle inspection of steel parts containing areas where fatigue is suspected should be made in accordance with Specification MIL-I-6868A. Any evidence of cracks is cause for rejection.

NOTE

All parts that have passed this inspection must be demagnetized and cleaned as instructed in paragraph 4-13.

c. Parts composed of or containing non-metal material and non-magnetic metal parts suspected of fatigue should be fluorescent penetrant inspected as instructed in Specification MIL-I-6866. Any evidence of fatigue is cause for rejection

d Use optical flat equipment to check flatness of lapping operations where specified. Clean parts as instructed in paragraph 4-13 before checking for flatness. Flatness will be measured in light bands and is applicable to the following components: valve plate (21, figure 4-2), control piston (30), cylinder block (35), hold down plate retainer (36), also hold down plate (39), piston and shoe subassembly (40), shoe wear plate (41), carbon seal (49) and mating ring (61).

e If optical flat equipment is not available to check accuracy of lapping operation, use surface plate method. When using a surface plate, spread an extremely thin film of clean hydraulic fluid (item 2, table 8-1) over a clean checking plate. Place part, face down, on plate and rotate it through a small arc. Lift part

vertically and examine impression left on surface of plate. A perfect impression of entire lapped surface must be visible. Clean part as instructed in paragraph 4-13.

NOTE

When using a surface plate, the film of oil on the plate must be extremely thin. An excessive amount of oil will produce a false impression of the true condition of the lapped surface.

f. When checking I.D. and O.D. of parts, the use of Sheffield air column and Sheffield amplifier (or equivalent) is advisable. To check bores of cylinder block (35, figure 4-2), use air gage spindle T-300583, air gage ring T-300584 and air gage ring T-300585. See figure 4-10. To check pistons of piston and show subassemblies (40, figure 4-2), use a Sheffield amplifier (or equivalent). To check bore for pilot valve (19, figure 4-2), use air gage spindle T-401667, air gage ring T-200063 and air gage ring T-401668.

g. Refer to table 4-1 for classification of typical defects found in inspection of the variable displacement hydraulic pump assembli and table 4-2 for a listing of detail inspection items for the Model PVB-044-1.

Table 4-1. Classification of defects

MAJOR DEFECTS

1. Cracks, scoring, pitting, distortion or discoloration of surface which could affect function.
2. Damage to protective coatings.
3. Damaged threads essential to function
4. All other dimensions affecting function.
5. Concentricity, perpendicularity or flatness.
6. Surface finish below manufacturing standards.
7. Film deposit on polished surfaces.

MINOR DEFECTS

100. All other scoring and scratches
101. Broken housing lockwire holes.

Table 4-2. Detail inspection requirements after cleaning (Sheet 1 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	39	Housing	1	Cracks	Fluorescent Penetrant				1-para 4-15b
			4	Wear. I.D. for control piston (30, figure 4-2) shall not exceed 0.3754. Surface finish, 32 micro inch.	Visual				4-para 4-15c
			5	Face of housing that mates with shoulder of control piston shall be perpendicular to bore within 0.001	Visual				5-para 4-15c
			3	Loose or damaged inserts (28) Replace inserts	Visual				3-para 4-15f
			5	Flatness of mating faces for valve plate and mounting flange. Faces shall be flat within 0.0002 and parallel to each other within 0.002. Surface finish, 125 micro inch.	Visual and surface finish analyzer	100	Damaged surface finish on areas for packings (22, 23 and 58)		5-para 4-15c 100-para 4-16a
						100	Damaged protective coating		100-para 4-17b
			4	Hole for locating pin (24) distorted. Diameter shall not exceed 0.087.	Visual				4-para 4-15d

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 2 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	69	Mounting flange	1	Cracks	Fluorescent Penetrant				1-para 4-14c para 4-15b
			4	Wear. I.D. for pintle bearings (42, figure 4-2) shall not exceed 0.8667. Surface finish, 125 micro inch.	Visual				4-para 4-15c
			4	Wear. I.D. for shaft bearing (55, figure 4-2) shall not exceed 1.6540. Surface finish, 63 micro inch.	Visual	100	Damaged protective coating		4-para 4-15c 100-para 4-17b
			3	Damaged port threads	Visual				3-para 4-15b
			3	Loose or damaged inserts (68, figure 4-2)	Visual				3-para 4-15f
			4	Hole for locating pins (63, figure 4-2) distorted. Diameter shall not exceed 0.130.	Visual				4-para 4-15d
			4	Wear. I.D. for mating ring (61) shall not exceed 1.119. Surface finish, 32 micro inch.	Visual and surface finish analyzer				4-para 4-15c
			4	Damage to mounting bolt holes. Holes shall be 0.339/0.354 dia.	Visual				4-para 4-15d

*SIR = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 3 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	21	Valve Plate	1	Cracks	Magnetic Particle				1-para 4-14b para 4-15b
			5	Inspect valve plate per figure 4-8. Flatness. Valving face shall be flat within 3 light bands.	Optical flat tester				5-para 4-18
			6	Surface finish, 4 micro inch.	*SIE and surface finish analyzer		1		6-para 4-18
			4	Wear. I.D. for pilot valve (19) not to exceed 0.0005 that of pilot valve. Max out-of-round 0.000075 and taper 0.0002. Use air gage spindle T-401667, and air gage rings T-200063 and T-401668	*SIE				4-para 4-15c
			4	Wear. Corners on drilled passages crossing I.D. for pilot valve (19) shall be square and free of erosion.	*SIE				4-para 4-15c
			1	Scoring. Bore shall be free of linear score marks. Surface finish, 4 micro inch.	*SIE				1-para 4-15,b

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 4 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	21	Valve plate (Cont.)	3	Damaged port threads	Visual				3-para 4-15,b
4-2	19	Pilot valve	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,b
			4	Wear. O.D. of end lands not to be less than 0.0005 that of pilot valve bore in valve plate. Corners on end lands to be square.	*SIE				4-para 4-15,c
			1	Scoring. O.D. shall be free of linear scoring. Surface finish, 4 micro inch.	Visual				1-para 4-15,b
			7	Check smoothness of operation - valve to bore. Caution - Do not lap any more than is necessary to improve operation.	Visual				7-para 4-16,b
4-2.		Block, piston and shoe subassembly		NOTE: This subassembly consists of cylinder block (46, figure 4-2) and 7 piston and shoe subassemblies (40).					
4-2	35	Cylinder Block	1	Cracks	Fluorescent Dye Penetrant				1-para 4-14,c para 4-15,b
			1	Scoring. I.D. of bores shall be free of linear scoring. Surface finish, 8 micro inch.	*SIE				1-para 4-15,d

*SIR = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 5 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	35	Cylinder Block (Continued)	4	Wear. Each piston and shoe subassembly mates with its corresponding bore with a tolerance of 0.0006 to 0.0015. A total of 7 shall not exceed 0.009 inch. Use air gage spindle T-300583 and air gage rings T-300584 and T-300585 as shown in figure 4-10. Check that maximum out-of-round and taper in any one bore shall not exceed 0.00015.	*SIE and special tools				4-para 4-15,c
			5	Flatness. Valving face shall be flat within 3 light bands.	Optical flat tester				5-para 4-20
			6	Surface finish, 4 micro inch.	*SIE and surface finish analyzer				6-para 4-20
			4	Wear. Measure wear on internal splines. Diameter between 0.0540 dia. pin gages shall not be more than 0.5519	*SIE				4-para 4-15,c

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 6 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	40	Piston and Shoe Subassembly	1	Inspect piston for fatigue	Magnetic Particle				1-para 4-14,b para 4-15,b
			1	Inspect shoe for fatigue	Fluorescent Penetrant				1-para 4-14,c para 4-15,b
			1	Scoring on piston. Surface shall be no rougher than 16 micro inch.	*SIE and surface finish analyzer				1-para 4-15,d
			4	Wear on piston shoe. Surface that mates with shoe wear plate (41, figure 4-2) shall be no rougher than 8 micro inch; side opposite, 16 micro inch. Refer to paragraph 4-20 and figure 4-10. After lapping, central bore on base of shoe must be no less than 0.010 inch. Also, all shoes shall be lapped to the same thickness within 0.0005 inch.	*SIE and surface finish analyzer				4-para 4-20
			4	Wear. Each piston and shoe subassembly mates with its corresponding bore in cylinder block with a	*SIE				4-para 4-15,

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 7 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	40	Piston and Shoe Subassembly (Continued)	4	tolerance of 0.0006 to 0.0015. Use equipment as illustrated in figure 4-11 for this operation.					
			4	End play between piston and shoe. End play shall not exceed 0.003 inch.	*SIE				4-para 4-15,c
4-2	39	Shoe Hold Down Plate	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,b
			4	Wear. Shoe surface shall be flat within 0.0005 inch and have a surface finish of 16 micro inch. Side opposite shall be parallel to this face within 0.005 inch.	*SIE and surface finish analyzer				4-para 4-18
4-2	41	Shoe Wear Plate	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,c
			4	Wear. Shoe surface shall be flat within 0.0005 inch and have a surface finish of 4 micro inch. Thickness shall be no less than 0.0886 inch.	*SIE and surface finish analyzer				4-para 4-18

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 8 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	38	Hold Down Plate Retainer for PVB-044-1 (two segment retainer)	1	Cracks	Fluorescent Penetrant				1-para 4-14,c para 4-15,b
			4	Wear. Each segment shall be flat within 0.001 inch, have a surface finish of 16 micro inch each side and be no thinner than 0.0825 inch.	*SIE and surface finish analyzer				4-para 4-20 para 4-15,c
4-2	38	Hold Down Plate Retainer for PVB-044-2 (one piece retainer)	1	Cracks	Fluorescent Penetrant				1-para 4-14,c para 4-15,b
			4	Wear. Bronze face shall be flat within 0.001 inch and have a surface finish of 16 micro inch. Minimum depth of sun burst grooves shall be 0.005 inch.	*SIE and surface finish analyzer				4-para 4-20
4-2	44	Yoke	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,b
			3	Damaged threads	Visual				3-para 4-15,b
			4	Loose or damaged locating pin (43, figure 4-2).	Visual				4-para 4-15,b
			4.	Wear. Check yoke trunnions for finish and minimum O.D. Finish, 32 micro inch:O.D. not less than 0.3929 inch	*SIE and surface finish analyzer				4-para 4-15,c

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 9 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	30	Control Piston	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,b
			4	Wear. Piston O.D. shall not be less than 0.3742 inch. Surface finish, 4 micro inch.	Visual and surface finish analyzer				4-para 4-15,c
			4	Wear. Piston face surface 16 micro inch.	Surface finish analyzer				4-para 4-18
4-2	57	Drive Shaft	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,b
			4	Wear. O.D. for needle bearing (20, figure 4-2) shall not be less than 0.3745 inch. Surface finish, 8 micro inch.	Visual and surface finish analyzer				1-para 4-15,c
			4	Wear. O.D. for shaft bearing (55, figure 4-2) shall be no less than 0.7875. Surface finish, 16 micro inch.	Visual and surface finish analyzer				1-para 4-15,c
			4	Spline wear. I.D. splines for coupling shaft (4, figure 4-2) shall not exceed 0.4885 inch when measured over 0.0540 inch diameter pins.	*SIE				1-para 4-15,c

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 10 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OR INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	57	Drive Shaft (Continued)		NOTE: Observe that major diameter of spline for cylinder block (35, figure 4-2) is crowned each way from approximate midpoint on the length of the spline. Spline wear shall be measured at this point.					
			4	Spline wear. O.D. splines for cylinder block (35, figure 4-2) shall not be less than 0.7112 inch when measured over 0.0600 inch diameter pins.	*SIE				1-para 4-15,c
			3	Damaged insert (56, figure 4-2). Replace insert.	Visual				3-para 4-15,f
4-2	49	Carbon Seal	1	Cracks	Fluorescent Penetrant				1-para 4-14,c para 4-15,b
			5	Sealing face flatness. Face that mates with mating ring (61, figure 4-2) shall be flat within 3 light bands. Surface finish, 4 micro inch.	Optical flat tester and surface finish analyzer				5-para 4-19
			4	Wear. Boss height of sealing face shall not be less than 0.005 inch.	*SIE				4-para 4-15,c
			5	Surface finish. Face opposite sealing face shall have a finish of 4 micro inch.	Surface finish analyzer				5-para 4-19

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 11 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	54	Retainer	3	Damaged tabs. Re-form all tabs if bent out of shape.	Visual				3-para 4-15,b
4-2	61	Mating Ring	1	Cracks	Magnetic Particle				1-para 4-14,b para 4-15,b
			5	Mating face for carbon seal (49, figure 4-2) shall be flat within 3 light bands and have a surface finish of 4 micro inch.	Optical flat tester and surface finish analyzer				5-para 4-18 para 4-15,b
4-2	4	Coupling Shaft	1	Cracks	Fluorescent Penetrant				1-para 4-14,c para 4-15,b
			1	Chipped splines	Visual				1-para 4-15,b
			4	Spline wear. Small diam. no less than 0.6486 inch when measured over 0.0600 inch diam. pins.	*SIE				4-para 4-15,c
			4	Large diam. no less than 0.7340 inch when measured over 0.0960 diam. pins.					
4-2	46	Control Spring	1	Cracks	Magnetic Particle				1-para 4-15,b
			4	Spring fatigue Load at 1.560 inch, 6 lbs ± 0.6 lb. Load at 1.100 inch, 74.2 ± 7.4 lb.	Spring load tester				4-para 4-15,c

*SIE = Standard Inspection Equipment

Table 4-2. Detail inspection requirements after cleaning (Sheet 12 of 12)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	47	Control Spring	1	Cracks	Magnetic Particle				1-para 4-15,b
			4	Spring fatigue. Load at 1.498 inch, 2.5 lb ± 0.25 inch. Load at 1.038 inch, 33.1 lb ± 3.3 lb.	Spring load tester				4-para 4-15,c
4-2	33	Cylinder Block Spring	1	Cracks	Magnetic Particle				1-para 4-15,b
			4	Spring fatigue. Load at 1.003 inch, 80 lb ± 8.0 lb	Sping load tester				4-para 4-15,c

*SIE - Standard Inspection Equipment

INSPECTION NOTES

1. Scratches that will not stop a 0.020 inch stylus and are non-continuous from kidney slot to the edges of circle A or B shall not be cause for rejection.

2. Voids, pits, nicks and other surface irregularities are permitted in non-critical areas. Critical area is defined as the area between circle A and circle B.

3. No surface irregularities allowed around kidney slots.

4. Valve plates that do not pass inspection may be salvaged by lapping (reference Repair and Replacement, Section V).

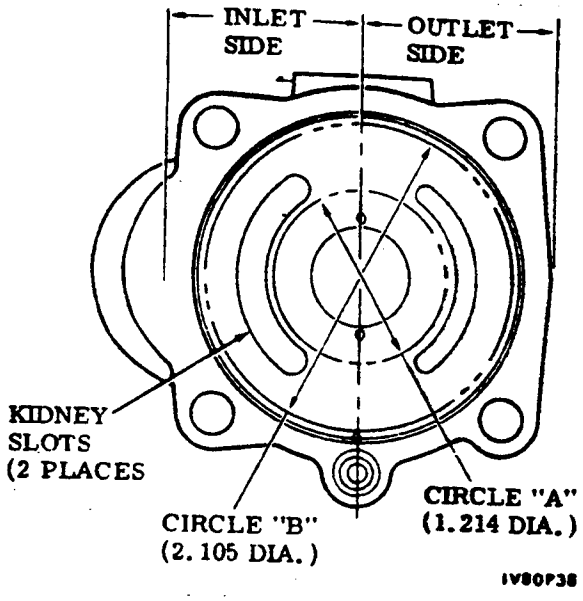


Figure 4-8. Valve Plate Inspection Details

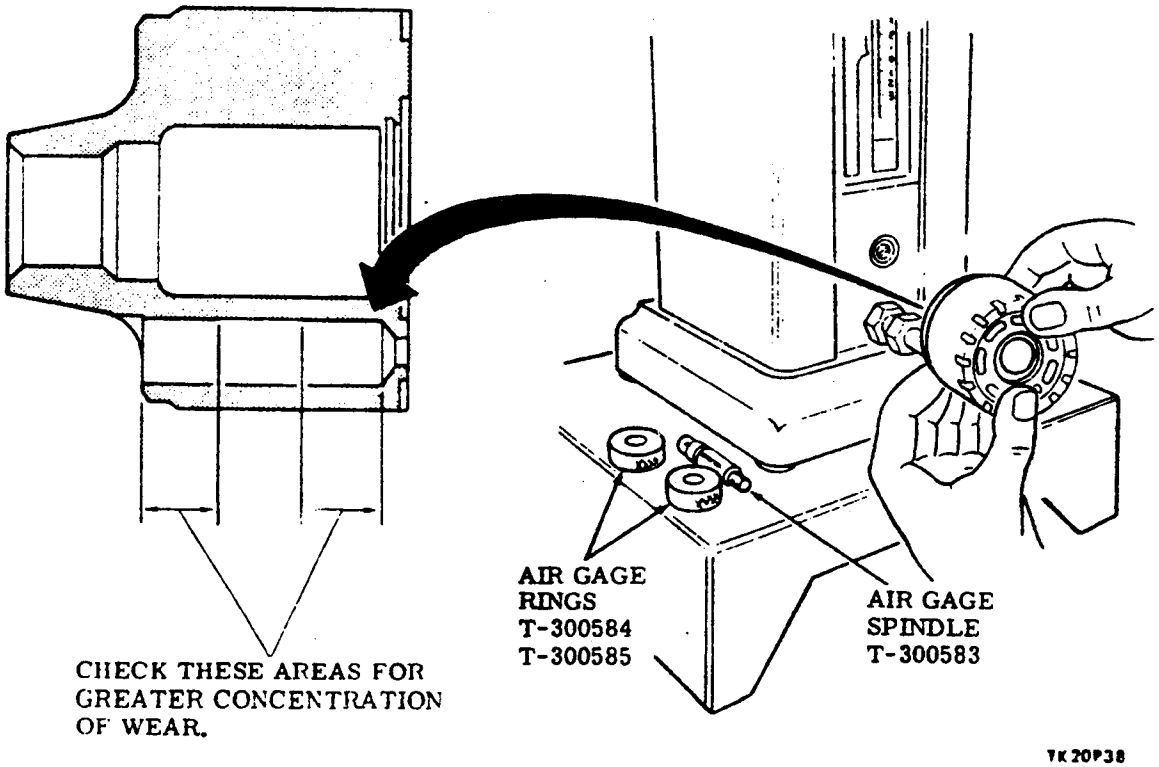


Figure 4-9. Measuring Cylinder Block Bores

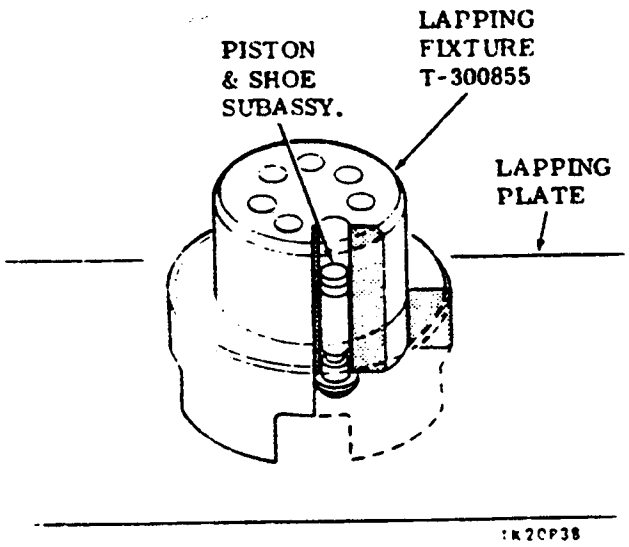


Figure 4-10. Gang Lap of Piston Shoes

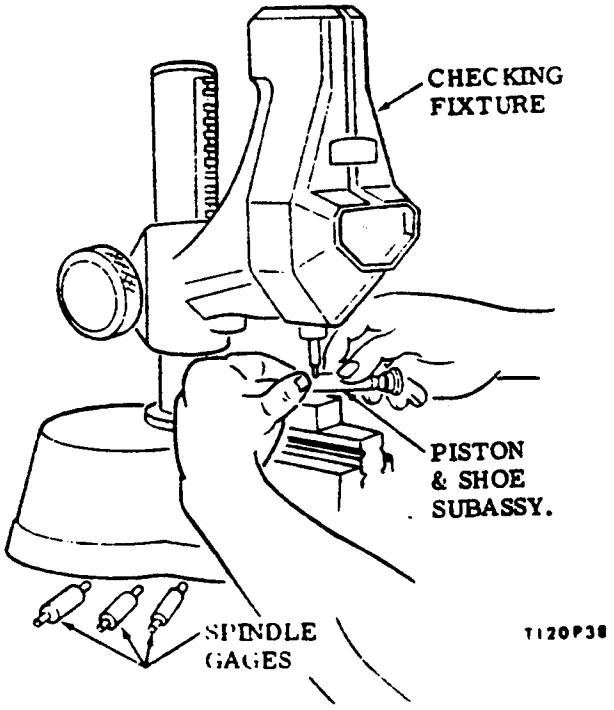


Figure 4-11. Measuring Piston Size

Section V - Repair or Replacement

4-15. REPAIR OR REPLACEMENT.

a. Replace all packings and drive shaft bearings (20 and 55, figure 4-2).

b. Replace parts that are cracked, chipped, warped, distorted or have malformed threads.

c. Replace all parts out of tolerance range given in table 4-2.

d. Replaced nicked, pitted, scratched or dented parts that are impractical to repair.

e. Replace parts tat do not meet inspection criteria.

f. Replace loose damaged inserts per Specification MS33646.

g. Replacement and rematching of piston and shoe sub-assemblies to piston bores is permissible provided that piston to bore clearance, taper, out of round and end play tolerance are maintained.

CAUTION

When polishing paper is used, do not polish non-steel metal parts on paper that has been used for steel because steel particles retained in paper will damage a non-steel part.

4-16. GENERAL.

a. Dress down minor scratches or burrs with polishing paper (item 5, table 8-1) or lapping stone (item 14, table 8-1). Clean part as instructed in paragraph 4-13.

b. Polish surface with a lapping compound consisting of levigated alumina (item 20, table 8-1) and lubricant (item 8, table 8-1) or jewelers rouge (item 21, table 8-1). Clean part as instructed in paragraph 4-13.

4-17. WELDING.

a. Repair of aluminum alloy castings may be made by aluminum welding per Specification MIL-W-8604 and finishing to size.

b. Aluminum surfaces that have had their protective coating removed may be refinished by alodizing per Specification MIL-C-5541. After alodizing, wash prime the surface per Specification MIL-C-8514 followed by a zinc chromate prime (item 6, table 8-1).

4-18. LAPPING OF VALVE PLATE (21, figure 4-2), SHOE WEAR PLATE (41), HOLD DOWN PLATE (39) AND MATING RING (61) .

a. If the surface is badly scored or worn and sufficient surface stock is available (refer to table 4-2), lightly grind it before lapping.

b. If part is to be lapped by hand, use a grooved lapping plate. If it is to be lapped on a lapping machine, use a lapping plate without grooves.

c. The lapping compound consists of one part lapping compound 1500 grit (item 7, table 8-1), one part lubricant (item 8, table 8-1) and six parts kerosene (item 9, table 8-1).

d. Apply a small amount of compound to the surface and lap it using a circular motion in such a manner that the whole working face of the lapping plate is used. In addition, change the hand hold on part every few circles.

e. Thoroughly clean the part after lapping as instructed in paragraph 4-13 and inspect for flatness of lapping operation as instructed in paragraphs 4-14, d or e. After this inspection, check edges of lands or other openings in lapped face for possible burrs or feather edges raised by the lapping operation. Remove these burrs but leave edge square. Clean again after this operation.

4-19. LAPPING OF SERVICEABLE CARBON SEAL 49, FIGURE 4-2).

CAUTION

Do not polish carbon parts on a stone that has been used for metal parts. Metal particles retained in such a stone will damage a carbon part.

a. Imperfections or the results of normal wear on the shaft carbon seal may be removed by lapping on a flat, clean lapping stone (item 10, table 8-1).

b. Clean the part as instructed in paragraph 4-13 and check flatness of the lapping operation as instructed in paragraphs 4-14, d or e.

4-20. LAPPING OR CYLINDER BLOCK (35, figure 4-2) AND PISTON AND SHOE SUBASSEMBLIES (40).

a. If scoring or wear pattern on valving surface of cylinder block (that face that mates with valve plate (21), is evidenced, rough lap part prior to finish lapping. Rough lap as follows:

(1) Lap part on polishing paper (item 11, table 8-1) tightly drawn over a clean grooved lapping plate. Move part in a straight line across plate and rotate part 90 degrees at end of each stroke.

(2) Clean part thoroughly as called for in paragraph 4-13.

b. Finish lap part as follows:

(1) Lap part on polishing paper (item 5, table 8-1) tightly drawn over a clean surface plate.

(2) Clean part thoroughly as called for in paragraph 4-13.

c. Check applicable sections of table 4-2 for dimensional requirements for parts after lapping procedures.

d. Inspect flatness of lapped surface as instructed in paragraph 4-14, d or e.

4-21. REPLACING INSERTS. When required, replace inserts (28, 56 and 68, figure 4-2) in accordance with Specification MS33646 - remove tang.

Table 4-3. Detail inspection requirements after repair or replacement (Sheet 1 of 2)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	21	Valve Plate	5	Flatness. Valving face shall be flat within 3 light bands and have a surface finish of 4 micro inch.	*SIE, optical flat flat tester and surface finish analyzer				5-para 4-15,b
4-2	19	Pilot Valve	7	Check smoothness of operation of pilot valve in bore. Caution - do not lap any more than is necessary to improve operation.	Visual				7-para 4-15,c
4-2	35	Cylinder Block	5	Flatness. Valving face shall be flat within 3 light bands and have a surface finish of 4 micro inch.	*SIE, optical flat tester and surface finish analyzer				5-para 4-15,b
4-2	40	Piston and Shoe Subassembly	4	Wear on piston shoe surfaces. Refer to table 4-2.	*SIE and surface finish analyzer				4-para 4-15,d
4-2	39	Shoe Hold Down Plate	4	Wear. Shoe surface shall be flat within 0.0005 inch and have a surface finish of 16 micro inch.	*SIE and surface finish analyzer				4-para 4-15,c
4-2	41	Shoe Wear Plate	4	Wear. Shoe surface shall be flat within 0.0005 inch and have a surface	*SIE and surface finish analyzer				4-para 4-15,c

*SIE = Standard Inspection Equipment

Table 4-3. Detail inspection requirements after repair or replacement (Sheet 2 of 2)

FIG. NO.	INDEX NO.	NOMENCLATURE	REF. NO.	MAJOR DEFECTS	METHOD OF INSPECTION	REF. NO.	MINOR DEFECTS	METHOD OF INSPECTION	REMARKS
4-2	41	Shoe Wear Plate (Continued)	4	of 4 micro inch. Thickness shall be no less than 0.0886 inch.					
4-2	38	Hold Down Plate Retainer for PVB-044-2 (one piece retainer)	4	Wear. Bronze face shall be flat within 0.001 inch and have a surface finish of 16 micro inch.	*SIE and surface finish analyzer				4-para 4-15,c
4-2	30	Control Piston	4	Wear. Piston face surface finish, 16 micro inch.	Surface finish analyzer				4-para 4-15,c
4-2	49	Carbon Seal	5	Sealing face flatness. Face that mates with mating ring (61, figure 4-2) shall be flat within 3 light bands. Surface finish, 4 micro inch.	Optical flat tester and surface finish analyzer				5-para 4-15,d
4-2	49	Carbon Seal	5	Surface finish. Face opposite sealing face shall have a finish of 4 micro inch.	Surface finish analyzer				5-para 4-15,d

*SIE = Standard Inspection Equipment

Section VI - Modification Criteria

4-22. MODIFICATION CRITERIA. Modify major assemblies and/or associated parts of model PVB-044-1 to convert to model PVB-044-2 in accordance with figure 4-12. Modification is accomplished by removing the old part number component or subassembly and replacing it with new part number component or subassembly. After modifications have been accomplished, reidentify the pump to the proper model number PVB-044-2.

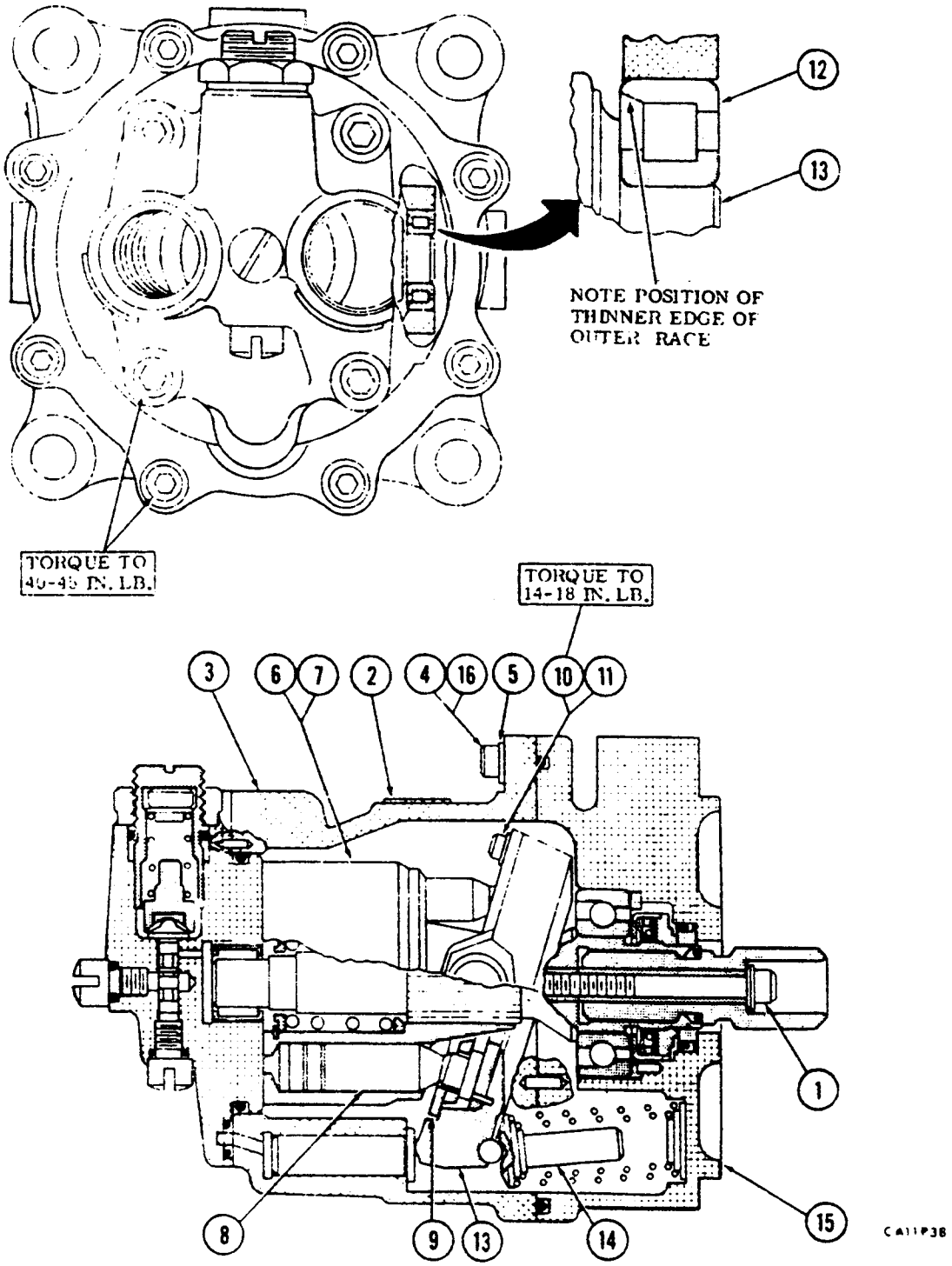


Figure 4-12. Modification of PVB-044-1 to PVB-044-2 (Sheet 1 of 2)

REMOVE	ITEM	FIGURE	PER ASSY.	DESCRIPTION	REPLACE WITH
MS16998-34	1	4-2	1	SCREW, Coupling shaft mounting	MS16998-35
307483	2	4-2	1	PLATE, Name	316343
297012	3	4-2	1	HOUSING AND INSERTS SUBASSEMBLY	297089
MS16997-33	4	4-2	8	SCREW, Housing mounting	MS16998-28
AN960C8	5	4-2	8	WASHER, Screw	309699
297021	6	4-2	1	BLOCK, PISTON AND SHOE SUBASSEMBLY	319052
297013	7	4-2	1	. BLOCK, Cylinder	314545
297015	8	4-2	7	. PISTON AND SHOE SUBASSEMBLY	314482
297020	9	4-2	-	RETAINER, Shoe hold down plate (Replace 2 with 1)	312469
NAS1350-04H4	10	4-2	-	SCREW, Retainer (Replace 8 with 10)	208938
297070	11	4-2	-	WASHER, Screw (Replace 8 with 10)	147391
297064	12	4-2	2	BEARING, Pintle	297009
297002	13	4-2	1	YOKE SUBASSEMBLY	297090
297048	14	4-2	1	GUIDE, Control spring	323008
297004	15	4-2	1	MOUNTING FLANGE AND INSERTS SUBASSEMBLY	297082
MS21209C08-20	16	4-2	8	INSERT, Housing screw	MS21209F1-15

Figure 4-12. Modification of PVB-044-1 to PVB-044-2 (Sheet 2 of 2)

Section VII - Reassembly and Testing of Assemblies

Not Applicable

Section VIII - Final Reassembly

4-23. REASSEMBLY.

NOTE

Figure 4-13 provides a cross section for this pump. Use this figure for parts location and figure 4-2 for parts identification.

4-24. ASSEMBLY OF MOUNTING FLANGE SUBASSEMBLY.

a. If inserts (68) were removed, install new inserts per Specification MS33646.

b. If rotation plate (67) or instruction plate (65) were removed, secure new plates to mounting flange (69) with screws (66 and 64) respectively.

c. If locating pins (60 and 63) were removed, install new locating pins. Make certain pins are completely bottomed in mounting flange.

4-25. ASSEMBLY OF DRIVE SHAFT BEARING TO DRIVE SHAFT.

a. If insert (56) was removed from drive shaft (57), install per new Specification MS33646.

b. Place drive shaft bearing (55) in an electric oven, preheated to 200°F to 225°F (93°C to 105°C). Heat for one hour.

WARNING

In the following steps, use protective gloves to prevent injury.

CAUTION

Make certain drive shaft bearing is assembled on drive shaft with side marked "Thrust Here" toward short end of shaft.

c. Use bearing plate T-162016 and a light arbor press as shown in figure 4-14 to install drive shaft (57, figures 4-2 and 4-13) in heated drive shaft bearing (55).

d. Allow assembly to slowly cool to room temperature and then slowly rotate outer race to make certain bearing rotates freely

4-26. DELETED.

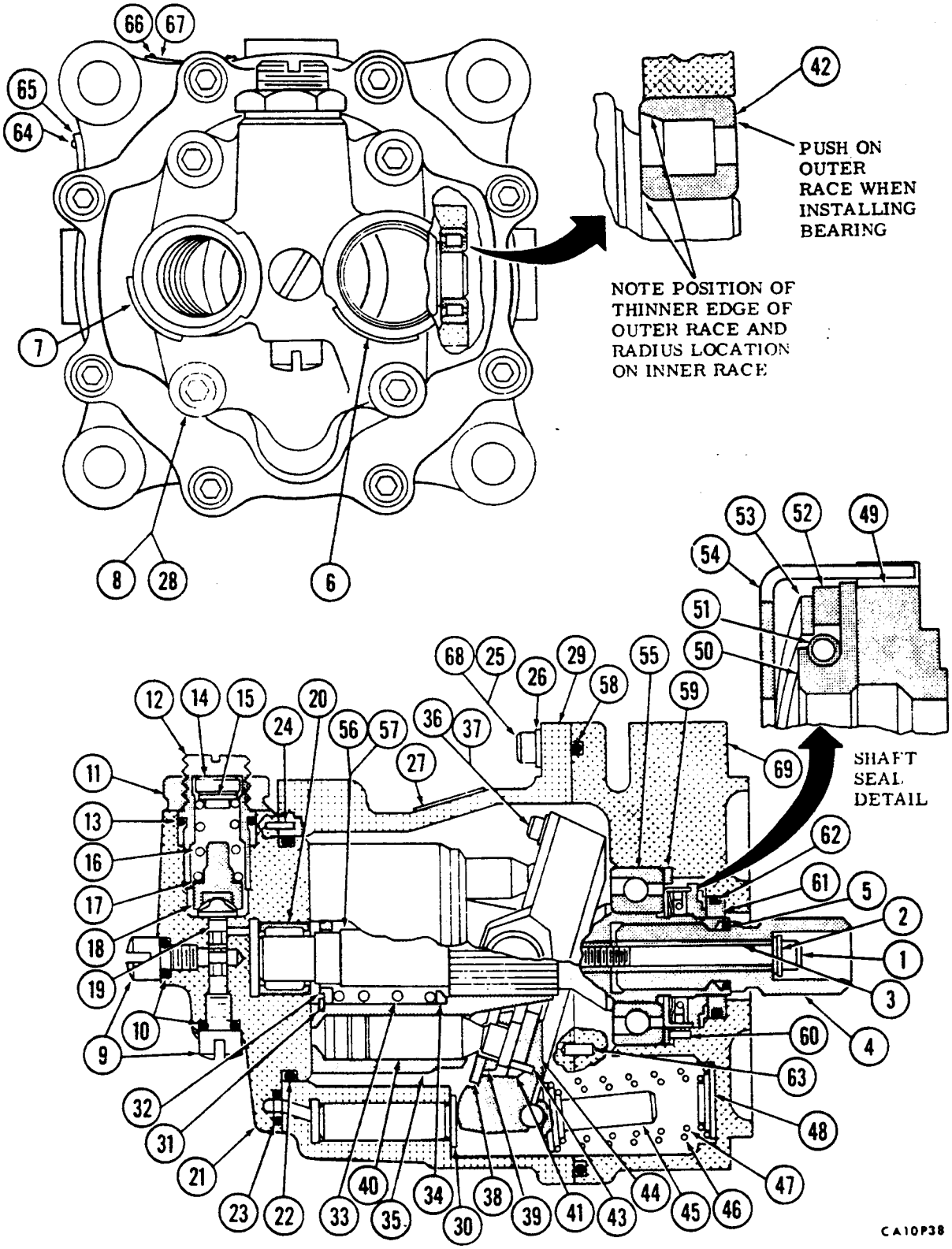


Figure 4-13. Cross Section View of Hydraulic Pump (Sheet 1 of 2)

1. Mounting Screw	24. Locating Pin	47. Control Spring
2. Washer	25. Mounting Screw	48. Spring Seat
3. Sleeve	26. Washer	49. Carbon Seal
4. Coupling Shaft	27. Name Plate	50. Seal Grommer
5. Shaft Packing	28. Insert	51. Garter Spring
6. Inlet Plate	29. Housing	52. Spacer
7. Outlet Plate	30. Control Piston	53. Wave Spring
8. Mounting Screw	31. Retaining Ring	54. Retainer
9. Sealing Screw	32. Retainer	55. Shaft Bearing
10. Screw Packing	33. Spring	56. Insert
11. Locking Nut	34. Spring Spacer	57. Drive Shaft
12. Adjusting Screw	35. Cylinder Block	58. Packing
13. Packing	36. Mounting Screw	59. Thrust Ring
14. Spacer	37. Washer	60. Retaining Pin
15. Spring Guide	38. Plate Retainer	61. Mating Ring
16. Control Spring	39. Hold Down Plate	62. Packing
17. Washer	40. Piston and Shoe Assembly	63. Locating Pin
18. Spring Guide	41. Shoe Wear Plate	64. Mounting Screw
19. Pilot Valve	42. Pintle Bearing	65. Instruction Plate
20. Needle Bearing	43. Locating Pin	66. Mounting Screw
21. Valve Plate	44. Yoke	67. Rotation Plate
22. Packing	45. Spring Guide	68. Insert
23. Packing	46. Control Spring	69. Mounting Flange

Figure 4-13. Cross Section View of Hydraulic Pump (Sheet 2 of 2)

4-27. END PLAY CALCULATIONS FOR PISTON AND SHOE SUBASSEMBLIES.

NOTE

To obtain correct end play for piston and shoe subassemblies, a selection from three oversize shoe hold down plates (39) can be made that will provide 0.002 to 0.004 inch end play for piston shoes between hold down plate retainer (38), hold down plate (39) and shoe wear plate (41). These shoe hold down plates range in 0.005, 0.007 and 0.010 inch oversize from the standard thickness plate.

a. If, on inspection of parts, it was found necessary to lap piston and shoe assemblies, make certain the seven individual shoes were lapped to a thickness within 0.0005 inch of each other. See figure 4-10.

CAUTION

During the following operation, use caution to prevent damage to critical parts.

b. Install the seven piston and shoe subassemblies (40, figure 4-2 and 4-13) and hold down plate (39) in piston holder portion of lapping fixture T-300855. Measure "X" dimension from top of shoes to face of piston holder and record.

c. Measure "Y" dimensions depth of yoke (44, figures 4-2 and 4-13) from the face for hold down plate retainer (38) to the face of shoe wear plate (41).

d. Subtract dimension "X" from "Y". The difference shall fall within a tolerance of 0.002 to 0.004 inch; preferably on the 0.002 inch end of the tolerance. If tolerance is greater than that specified, select the next size thicker shoe hold down, plate and measure again.

e. Tag correct shoe hold down plate (39, figures 4-2 and 4-13) for assembly as described in paragraph 4-30, f.

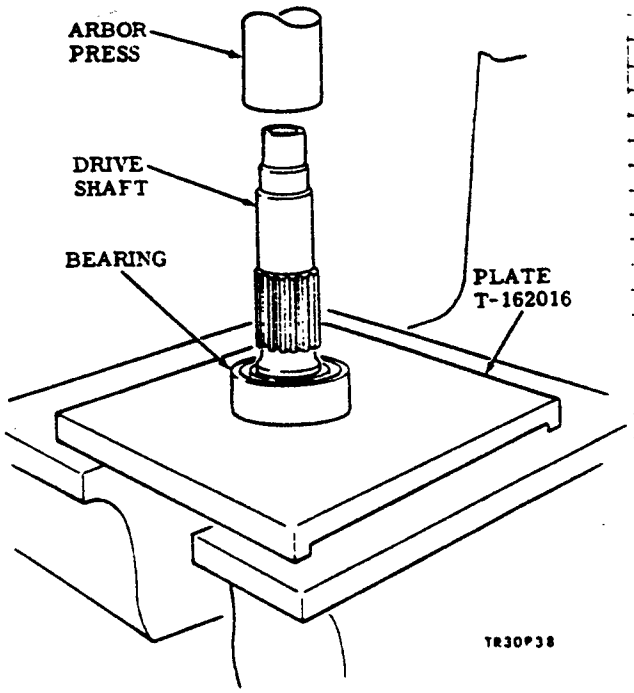


Figure 4-14. Assembly of Drive Shaft Bearing to Drive Shaft

4-28. INSTALLATION OF MATING RING INTO MOUNTING FLANGE SUBASSEMBLY.

CAUTION

In the following operation, make certain lapped face of mating ring (61, figures 4-2 and 4-13) is not damaged when ring is installed in mounting flange.

a. Assemble packing (62) into groove on mating ring (61).

b. Install the mating ring in mounting flange (69) with the lapped face out.

NOTE

The lapped face of mating ring (61) is on the side away from the hole for retaining pin (60).

4-29. ASSEMBLY OF SHAFT SEAL SUBASSEMBLY.

NOTE

Figure 4-17 provides a cross section of shaft seal subassembly. Use this figure for parts location and figure 4-2 for parts identification.

Figure 4-15. DELETED

Figure 4-16. DELETED

CAUTION

Prevent damage to carbon seal (49) during assembly.

a Install assembled drive shaft in shaft holder T-300504 as shown in figure 4-17.

b. Use snap-ring pliers to install retainer (54, figures 4-2 and 4-17) on drive shaft (57). Make certain it seats firmly against drive shaft bearing (55). Make sure tangs on retainer engage proper slots on drive shaft.

c. Insert wave spring (53) and spacer (52) in retainer (54) and attach guide T-415042 to drive shaft (57). Install garter spring (51) around seal grommet (50) and install both in retainer (54).

d. Remove guide T-415042 from drive shaft (57) and install carbon seal (49) with flat side down in retainer (54) on drive shaft.

e. Use lubricant (item 12, table 8-1) to "stick" thrust ring (59) with chamfer side toward shaft seal cavity in mounting flange (69).

f. Carefully lower mounting flange (69) squarely over this assembly, making certain drive shaft bearing (55) enters the counterbore in mounting flange.

CAUTION

To prevent separation of shaft seal subassembly do not allow drive shaft to leave its bore in mounting flange.

4-30. ASSEMBLY OF YOKE AND ASSOCIATED COMPONENTS.

a. Turn drive shaft and mounting flange over and install yoke spring seat (48, figures 4-2 and 4-13), control springs (47 and 46), and yoke spring guide (45) into position in mounting flange (69).

CAUTION

Use care when handling yoke (44) and yoke pintle bearings (42) in the following procedure to prevent damage to yoke trunnions and separation of pintle bearings.

CAUTION

If locating pin (43) was removed from yoke (44), install a new pin, making certain it is securely seated in place.

b Place yoke assembly into mounting flange and use holding clamp T-410371 as shown in figure 4-6 to install yoke bearings over yoke trunnions. Position yoke bearings on yoke trunnions so that thinner edge of outer race faces yoke. See figure 4-13. Observe that the ball in yoke will mate with yoke spring guide (45).

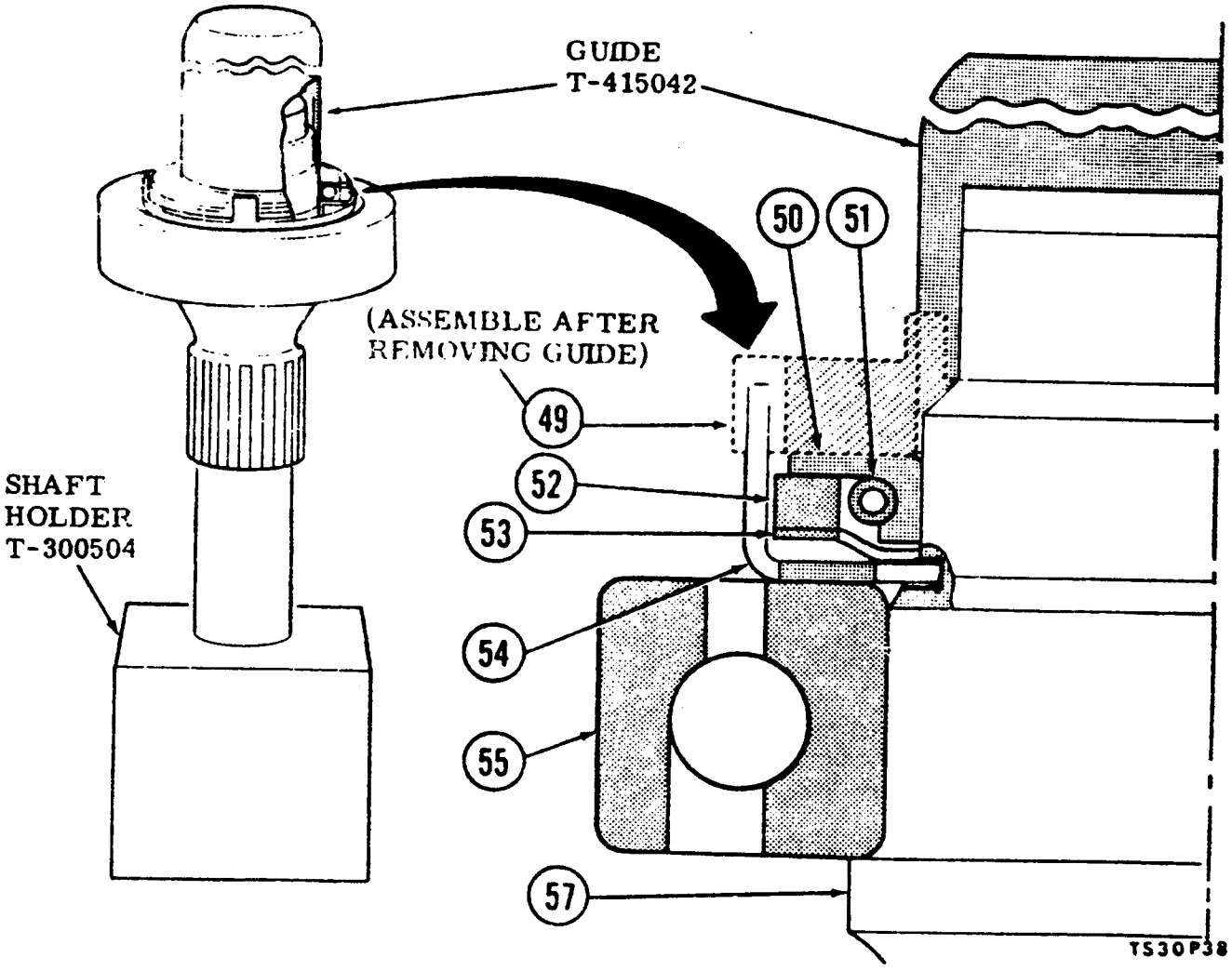
c. Remove holding clamp T-410871.

d. Attach power arm adapter T-181241 to mounting flange. Secure power arm adapter to power arm as shown in figure 4-3.

e. Assemble shoe wear plate (41, figures 4-2 and 4-13) into base of yoke and observe that notch in plate (41) mates with locating pin (43). Try to make plate (41) rock. If plate rocks, locating pin (43) is protruding farther than the maximum 0.055 inch.

NOTE

In the following operation, the correct thickness of shoe hold down plate (39) was determined in operations called for in paragraph 4-27.



NOTE: INDEX NUMBERS ARE SAME AS SHOWN ON FIGURE 4-2

49. Carbon Seal
50. Seal Grommet
51. Garter Spring
52. Spacer
53. Wave Spring
54. Retainer
55. Bearing
57. Drive Shaft

Figure 4-17. Assembly of Shaft Seal Subassembly

CAUTION

Because piston and shoe subassemblies (40) mate with their respective bores in cylinder block (35), care shall be taken in the following operation to assure correct assembly when cylinder block is installed.

f. Carefully assemble piston and shoe subassemblies (40), hold down plate (39) and two hold down plate retainers (38) as shown in figure 4-13. Secure parts with mounting screws (36) and washers (37). Torque screws 8 to 10 inch pounds for Model PVB-044-1 and 14 to 18 inch pounds for Model PVB-044-2.

NOTE

Model PVB-044-1 incorporates a two segment hold down plate retainer. These have been replaced by a one piece retainer in model PVB-044-2.

g. Lockwire mounting screws (36) in accordance with Specification MS33540. Use lockwire (item 13, table 8-1).

4-31. ASSEMBLY OF CYLINDER BLOCK.

CAUTION

When handling cylinder block (35, figures 4-2 and 4-13), be careful not to damage its valving face. Surface flatness of three light bands must be maintained.

a. Install spring spacer (34) (chamfer on I.D. down), cylinder block spring (33) and retaining ring retainer (32) into cylinder block (35).

NOTE

Correct thickness of retaining ring retainer (32) was obtained in operations called for in paragraph 4-26.

b. Use spring compressor T-410872 as shown in figure 4-5 to compress cylinder block spring (33, figure 4-2) to facilitate assembly of retaining ring (31).

c. Assemble cylinder block (35) to piston and shoe subassemblies (40).

NOTE

When all pistons are installed in cylinder block, push and pull cylinder block several times to observe that pistons slide smoothly in cylinder bores.

4-32. ASSEMBLY AND INSTALLATION OF HOUSING SUBASSEMBLY.

a. If inserts (28, figures 4-2 and 4-13) were removed, install new inserts per Specification MS33646.

b. If name plate (27) was removed, transfer data from the old to new and install in the following manner:

(1) Form plate to the contour of the surface it will be attached to.

(2) Thoroughly clean attaching surfaces with a solvent (item 3, table 8-1).

(3) Apply primer (item 17, table 8-1) by brush or spray to surfaces to be bonded. Allow primer to dry at least 30 minutes before applying adhesive.

(4) Mix part (by weight) of adhesive (item 18, table 8-1) to ten parts of catalyst (item 19, table 8-1).

(5) Use a knife or spatula to apply a thin coating of the prepared adhesive to both surfaces.

(6) Join surfaces immediately. Apply pressure to force excessive adhesive out around all edges of plate. Wipe off excess adhesive.

(7) Allow assembly to air cool at room temperature for a minimum of 24 hours.

c. Install packing (58) into its groove in mounting flange (69).

d. Install control piston (30) into its bore in housing (29).

e. Place a finger over pressure passage port of housing to prevent dropout of control piston and carefully install housing assembly on mounting flange (69). Make certain locating pins (63) are properly aligned with housing.

f Press housing and mounting flange together to compress control springs (46 and 47).

CAUTION

Do not pull housing and mounting flange together with mounting screws (25). Damage to housing and mounting flange may result

g. Secure housing (29) to mounting flange (69) with mounting screws (25) and washers (26). Torque screws 11 and 15 inch-pounds for Model PVB-044-2 to 45 inch-pounds for Model PVB-044-2.

h. If locating pins (24) was removed, install a new pin in housing (29). Make sure pin is seated solidly in position.

4-33. ASSEMBLY OF VALVE PLATE AND CONTROLS SUBASSEMBLY.

CAUTION

During installation of needle bearing (20, figure 4-2 and 4-13) into bearing bore of valve plate (21), an even, steady applied pressure is recommended to prevent deflection of valving face of valve plate

a. Use holding fixture T-410447 and bearing driver T-410448 as shown in figure 4-18 to install needle bearing (20, figure 4-2 and 4-13) in bearing bore of valve plate (21). Press needle bearing in flush to 0.010 inch below valving face. Do not bottom bearing in bore.

b. Rotate rollers of needle bearing (20) after installation. Rotation of all rollers shall be free.

c. Inspect valving face of valve plate (21) for flatness as called for in paragraphs 4-14, d., or e. Valving face shall be flat within 3 light bands. If valving face flatness cannot be met, lap face as called for in paragraph 4-18. Measures must be taken to prevent contamination of needle bearing (20).

CAUTION

In the following operation, be extremely careful while handling valve plate and pilot valve (19) to prevent damage to valving surface of valve plate, lands on pilot valve and or pilot valve bore. The movement of the pilot valve must not be impaired

d. Install pilot valve (19) into pilot valve bore of valve plate (21), as shown in figure 4-13.

e. Install spring guide (18) and washer (17) over pilot valve.

f. Compress pilot valve control spring (16) to solid height just prior to assembly. Install control spring (16), spring guide (15), and spring spacer (14).

g. Install packing (13) in groove on adjusting screw (12) and install adjusting screw into bore over spring (14). Turn adjusting screw (12) into bore until packing (13) is no longer visible.

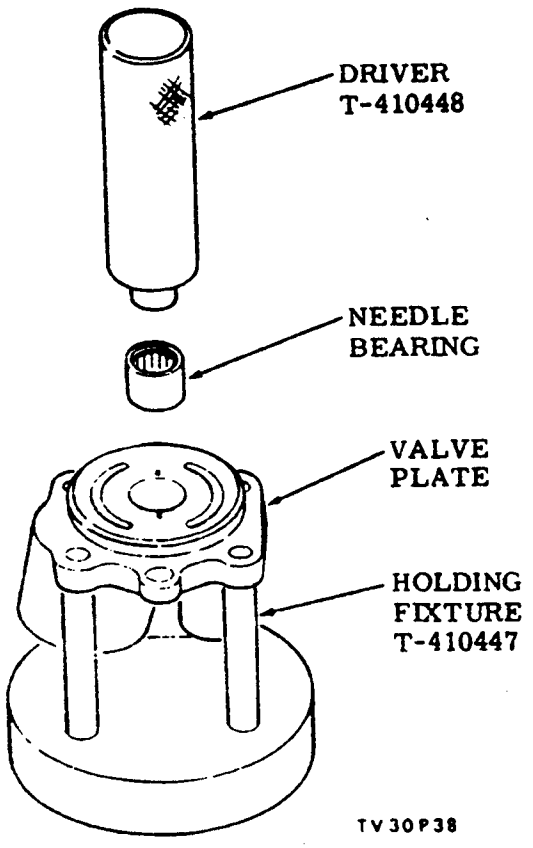


Figure 4-18. Assembly of Needle Bearing in Valve Plate

NOTE

Final adjustment of adjusting screw will be made on test, paragraph 4-38, c(2).

h. Assemble locking nut (11) over adjusting screw and tighten locking nut finger tight.

i. Install packing (10) in its groove on sealing screw (9) and install sealing screw in two locations on valve plate. Torque screws (9) 10 to 15 inch-pounds.

4-34. ASSEMBLY OF VALVE PLATE AND CONTROLS SUBASSEMBLY TO HOUSING SUBASSEMBLY.

a. Install packing (23) into its groove in pressure hole in mating face of housing (29).

b. Install packing (22) in its groove on valve plate and controls subassembly.

c. Secure valve plate and controls subassembly to housing with mounting screws (8) torqued to 20 to 25 inch-pounds for Model PVB-044-1 and 40 to 45 inch-pounds for Model PVB-044-2.

d. If outlet plate (7) and inlet plate (6) were removed from valve plate, secure new plates using the same process as that called for name plate (27). Refer to paragraph 4-32,b.

4-35. INSTALLATION OF COUPLING SHAFT.

a. Install packing (5) on coupling shaft (4).

b. Slide sleeve (3) on mounting screw (1) and washer (2) and install this assembly in coupling shaft.

c. Liberally lubricate splines of coupling shaft with graphite grease (item 15, table 8-1) and install coupling shaft. Torque mounting screw (1) 5 to 10 inch-pounds. Wipe off excess lubricant.

d. Rotate drive shaft through several turns. Rotation must be smooth and without binding at any point. Torque required to rotate shall not exceed 15 inch-pounds. If binding is evident, disassemble pump to determine cause.

e. Install inlet and outlet fittings (6), outlet elbow fitting (10), and shipping caps.

f. Install seepage and case drain plugs.

g. Fill the unit approximately 2/3 full with clean hydraulic fluid (item 4, Table 8-1).

h. Record status of pump on applicable forms.

Section IX - Run-In and Test Procedures

4-36. TEST CONDITIONS.

a. Use clean hydraulic fluid (item 4, table 8-1). Maintain temperature of fluid at 115°F to 125°F (46°C to 51°C) at the pump inlet port.

b. Use a test stand capable of supplying the following:

(1) Maximum of 30 drive horsepower.

(2) Drive speed of 6000 rpm.

(3) Capable of recording 4000 psi.

(4) Control fluid temperature within plus or minus 5°F.

(5) Filtration to 10 micron nominal.

(6) Oil reservoir vented to atmosphere.

4-37 PRELIMINARY TESTS

a Binding

(1) Remove inlet and outlet plugs

(2) Rotate drive shaft and check for binding, stickiness or roughness. Torque required to rotate must not exceed 15 inch-pounds. If binding is evident, disassemble pump to determine and correct the cause.

b. Proof Test. With the unit at a standstill and the inlet and outlet ports plugged, apply 150 psig to case drain connection for ten minutes. Observe all areas for external leakage. There shall be no external leakage other than a slight wetting insufficient to form a drop through any gasket or seal except the shaft seal. Shaft seal leakage shall not exceed five drops in ten minutes (one drop is equal to 1/20 cc approximately).

c. Flushing Operation

(1) Use flushing set T-233248 to thoroughly flush the unit through the case fill connection for five minutes. During the flushing operation, case pressure must not exceed 150 psig.

(2) After flushing operation, install the unit in a hydraulic test setup as shown in figure 4-19.

4-38. PERFORMANCE TESTS.

NOTE

All subsequent items of test must be conducted with 15 plus or minus 1 psia inlet pressure except as noted, 15 plus or minus 3 psia case pressure and a minimum of 500 psig outlet pressure. Regulate by-pass valve (6, figure 4-19) to obtain correct case pressure and restriction valve (24) to obtain outlet pressure.

a. Fill test unit and test circuit with clean hydraulic fluid (item 4, table 8-1). Allow all trapped air to escape from unit and circuit.

b. Run In

(1) Open restriction valve (24, figure 4-19) and start power drive (16) to drive test unit at 2000 rpm.

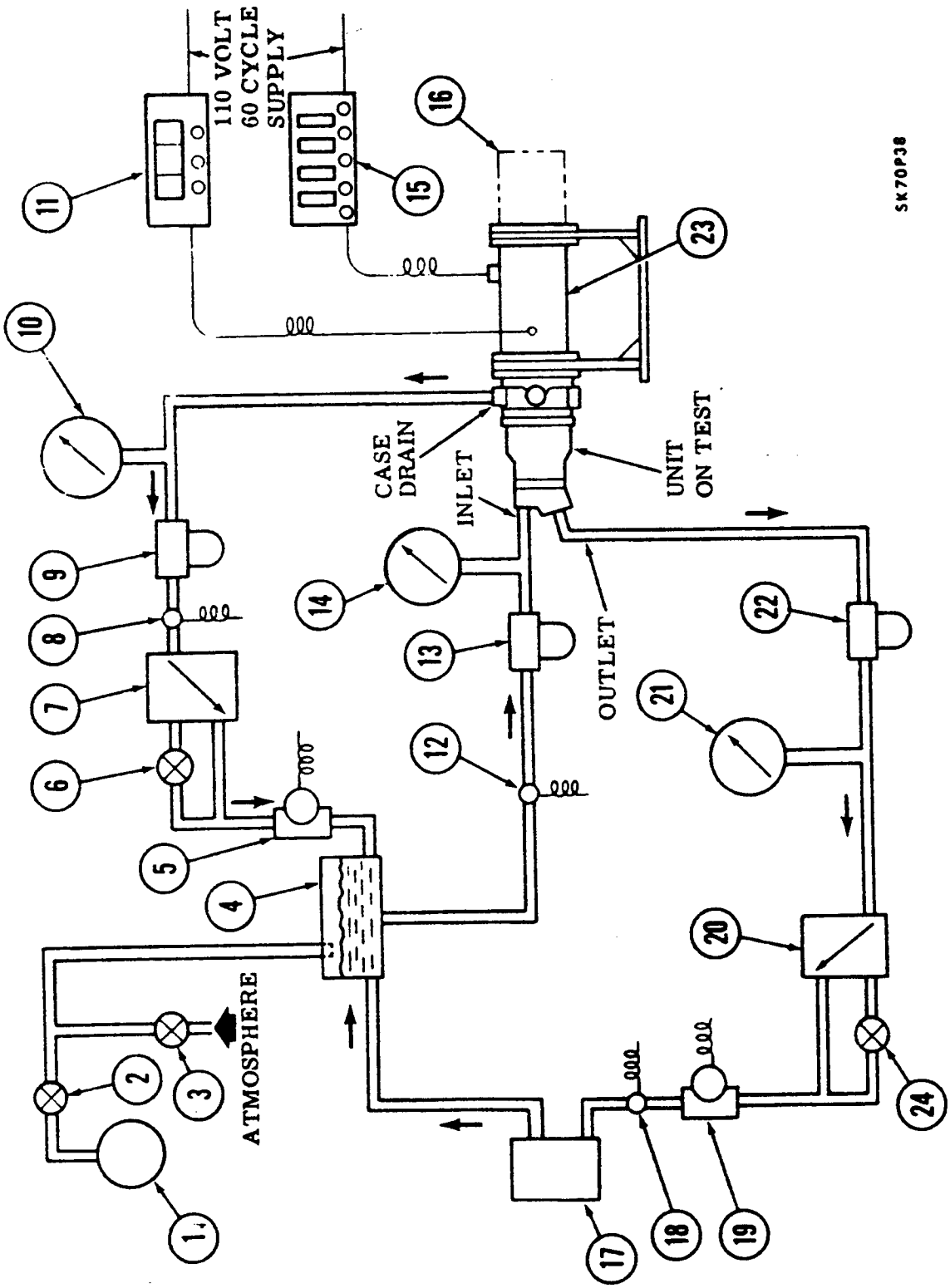


Figure 4-19. Schematic Test Setup (Sheet 1 of 2)

INDEX NO	TEST EQUIPMENT	REQUIREMENT
1	Vacuum Pump	0-30 in. Hg
2	Shut-off Valve	
3	Shut-off Valve	
4	Reservoir	30 gallons
5	Turbine Flowmeter	Range 0.10 to 5.0 gpm
6	By-Pass Valve	
7	Relief Valve	Adjustable. Set for 15 psig
8	Temperature Probe	
9	Filter	Low pressure, 10 micro (nominal). capacity 5 gpm
10	Pressure Gage	0-100 psi ± 1/2% of full scale
11	Frequency Counter	
12	Temperature Probe	
13	Filter	Low pressure, 10 micron (nominal), capacity 24 gpm
14	Vacuum-Pressure Gage	0-30 in. Hg and 0-100 psi
15	Torque Indicator	
16	Power Drive	15 hp minimum, variable to 6000 rpm
17	Heat Exchanger	Capacity 25 gpm
18	Temperature Probe	
19	Turbine Flowmeter	Range 0.5 to 50.0 gpm
20	Relief Valve	Adjustable, set for 2000 psig
21	Pressure Gage	Range 0-5000 psi, accuracy ± 1/2% of full scale
22	Filter	High pressure, 10 micro (nominal), capacity 24 gpm
23	Torque Pickup	
24	Restriction (Load) Valve	

Figure 4-19. Schematic Test Setup (Sheet 2 of 2)

(2) Adjust restriction valve (24) to develop an outlet pressure of 500 psig on the test unit. Run test unit for five minutes under these conditions.

(3) During the next five minutes of operation, increase test unit speed to 5000 rpm. Make certain outlet pressure remains at 500 psig.

c. Pressure Control Adjustment.

CAUTION

In the following operation, if outlet pressure of test unit exceeds 1900 psig with adjusting screw (12, figure 4-2) turned out to a low pressure adjustment, remove test unit and check for unit malfunction.

(1) With test unit operating at 5000 rpm, gradually close restriction valve (24, figure 4-19) to build up pressure on outlet port. Continue to close restriction valve (24) until completely closed. Outlet pressure as read on pressure gage (21) will be setting of test unit pressure control if less than 2000 psig or the setting of relief valve (20) if pressure control has been set too high.

NOTE

When setting pressure control, make all adjustments on rising pressure.

(2) With restriction valve (24) completely closed, zero output volume (flowmeter 19), and 15 plus or minus 3 psia case pressure as read on gage (10), turn in adjusting screw (12, figure 4-2) until an outlet pressure of 1500 to 1525 psig registers on pressure gage (21, figure 4-19). Temporarily tighten locking nut (11, figure 4-2) at this setting.

CAUTION

Do not tighten locking (11) in excess of 40 inch-pounds.

(3) Alternately open and close restriction valve (24, figure 4-19). This will purge any air that may have become trapped in the pressure control. Take another reading of pressure gage (21) after this operation to recheck pressure setting. Reset if necessary.

(4) Regulate restriction valve (24) and note rise in pressure as yoke is stroked from maximum to minimum delivery. This pressure rise shall not exceed 100 psig. Sudden changes in output volume must not initiate "hunting" of yoke for position. Hunting will be evidenced by rapid oscillation of needle on pressure gage (21). If this condition is noted, remove unit from test and return it to overhaul for repair.

(5) In five minutes of continued operation with restriction valve (24) closed, pressure must not creep more than 25 psig above or below value established at minimum delivery (zero flow). Refer to paragraph 4-38, c(2).

CAUTION

Maintain 15 plus or minus 3 psia case pressure on pressure gage (10) at minimum delivery.

(6) At minimum output volume, the pressure setting shall not vary more than 30 psig when the speed is changed slowly from 5000 rpm to 2600 rpm.

d. Delivery.

(1) With test unit operating at 5000 rpm and an inlet pressure of 5 plus or minus 1/2 inch Hg vacuum, adjust restriction valve (24) to provide an outlet pressure of 1350 psig.

(2) Delivery as measured by turbine flowmeter (19) shall not be less than 6.6 gpm.

e. Internal Leakage.

NOTE

Run test unit at full discharge flow for two to five minutes to stabilize internal temperature immediately prior to checking internal leakage.

(1) With test unit operating at 5000 rpm and an inlet pressure of 15 plus or minus 3 psia, close restriction valve (24) to provide 1500 to 1525 psig outlet pressure.

(2) Measure case drain flow over turbine flowmeter (5). This case drain flow must not exceed 425 cc/min.

4-39. FRICTION TEST. After test unit has passed performance tests satisfactorily, remove it from its drive pad and check torque required to rotate drive shaft. Torque required to rotate drive shaft must not exceed 15 inch-pounds.

4-40. TROUBLE SHOOTING. The following trouble shooting chart, table 4-4, has been prepared to assist personnel in locating cause for unit malfunction on test. It lists possible trouble, probable cause for it, and the steps necessary to remedy it.

Table 4-4. Trouble Shooting Chart (Sheet 1 of 3)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
PUMP NOT DELIVERING OIL (NO FLOW)	Pump driven in wrong direction of rotation	Pump must be driven in left-hand direction of rotation as viewed from coupling shaft end.
	Incorrect hook-up at port flanges	Reverse connections at port flanges.
	Coupling shaft not installed or is sheared.	Install coupling shaft. Check drive torque of pump if coupling shaft is sheared. Return unit to overhaul shop to determine cause of shear.
	Yoke (44, figure 4-2) stuck in minimum delivery position.	Disassemble pump and inspect for binding of yoke pintle bearings (42) and/or control piston (30).
INSUFFICIENT FLOW (LOW FLOW)	Pressure control in valve plate adjusted incorrectly.	Set pressure control as instructed in paragraph 4-38, c.
	Damaged valving faces of valve plate (21, figure 4-2) and cylinder block (35)	Disassemble pump and lap valve plate as described in paragraph 4-18 and cylinder block as described in paragraph 4-20.
	Worn or damaged rotating components; excessive clearance between piston and shoe subassembly (40) and bores of cylinder block (35).	Disassemble pump and perform inspection of these parts as instructed in table 4-2. Control piston 297022 stop thickness dimension of .176-.181 inch may be shortened as required to minimum thickness of .130 inch to meet flow requirements.
	Flow measurement equipment worn or out of calibration	Check accuracy of flow measurement equipment.
	Drive speed of varidrive set low and/or speed recording equipment inaccurate.	Check accuracy of speed recording equipment and/or set speed varidrive.
	Cylinder block (35, figure 4-2) separation from valve plate (21).	Disassemble pump and lap valve plate as described in paragraph 4-18 and cylinder block as described in paragraph 4-20.
	Excessively high fluid temperature.	Adjust temperature control for specified fluid temperature. Check for adequate fluid flow through oil cooler.
YOKE REMAINS IN MINIMUM STROKE POSITION	Yoke binding or misalignment of control piston (30, figure 4-2) and/or control springs (46 and 47)	Disassemble pump and check for worn or binding yoke pintle bearings (42). Inspect control piston, piston bore and control springs as instructed in table 4-2.
	Pressure compensation inoperative, caused by foreign matter in bore of pilot valve (19, figure 4-2).	Disassemble valve plate and controls subassembly and clean parts per instructions in paragraph 4-13.
YOKE HUNTING FOR POSITION	Lands of pilot valve (19, figure 4-2) not sharp. Possible burr on lands.	Disassemble valve plate and controls subassembly and inspect pilot valve (19). If pilot valve is damaged replace valve plate and pilot valve subassembly.

Table 4-4. Trouble Shooting Chart (Sheet 2 of 3)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
YOKE HUNTING FOR POSITION (Continued)	Pilot valve control spring (16) bowed or bent.	Disassembly valve plate and controls subassembly and inspect spring as described in table 4-2.
	Excessive clearance between pilot valve (19) and pilot valve bore in valve plate and controls subassembly.	Disassemble valve plate and controls subassembly and inspect pilot valve to bore clearance as instructed in table 4-2. If clearance exceeds specified tolerance, replace valve plate and pilot valve subassembly with new.
	Sticky control piston (30) operation.	Disassembly pump and inspect control piston, piston bore in housing (29) and control springs (46 and 47). Repair or replace where necessary.
	Trapped air in test system.	Bleed air from test circuit.
	Cylinder block (35) lifting from valve plate subassembly.	Disassemble pump and lap valve plate as described in paragraph 4-18 and cylinder block as described in paragraph 4-20.
YOKE REMAINS IN MAXIMUM STROKE POSITION	Yoke binding, or misalignment of control piston (30, figure 4-2) and control springs (46 and 47).	Disassemble pump and check for worn yoke pintle bearings (42). Inspect control piston, piston bore and control springs as instructed in table 4-2.
	Valve plate and controls subassembly inoperative caused by foreign matter in bore of pilot valve (19).	Disassemble valve plate and controls subassembly and clean per instructions in paragraph 4-13.
PUMP OVERHEATS	Drive shaft binding caused by worn or defective bearings or incorrect assembly.	Disassemble pump and check all bearings. Check clearance of piston and shoe subassembly (40) to shoe wear plate (41) as instructed in paragraph 4-27.
	Excessive internal leakage.	Disassemble pump and inspect moving components for wear and damage.
EXCESSIVE INTERNAL LEAKAGE	Valving faces of valve plate (21, figure 4-2) and/or cylinder block (35) scored or damaged.	Disassemble pump and lap valve plate as described in paragraph 4-18 and cylinder block as described in paragraph 4-20.
	Excessive clearance between pilot valve (19) and pilot valve bore in valve plate and controls subassembly.	Disassemble valve plate and controls subassembly and inspect pilot valve to bore clearance as instructed in table 4-2. If either is defective, replace both with new.
	Worn or damaged bores of cylinder block (35) and piston and shoe subassemblies (40).	Disassemble pump and inspect these parts per instructions in table 4-2. Repair and replace as necessary.

Table 4-4. Trouble Shooting Chart (Sheet 3 of 3)

INDICATION OF TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
EXTERNAL LEAKAGE	Worn or defective carbon seal (40, figure 4-2) and/or mating ring (61)	Disassemble pump and inspect sealing faces of these parts as described in table 4-2.
	Defective packings.	Observe which part of pump is leaking and replace the applicable packing.

4-41. LOCKWIRING. After the pump has been tested and found satisfactory, lockwire the pressure control locking nut to the center sealing screw and, in turn, to the remaining sealing screw on the valve plate using lockwire (item 22, table 8-1).

Section X - Difference Data Sheet PV3-044-8 Hydraulic Pump Assembly

NOTE

The instructions contained in preceding sections of this manual apply except for the differences given in this data sheet.

4-42. DISASSEMBLY. Same as for Model PVB-044-1 and -2 except for the following.

a. Inlet and outlet port fittings (6 through 13, figure 4-1) are incorporated in the port openings of the valve block. Disassemble these parts in the order of index numbers assigned to the exploded view.

b. A caution plate (35, figure 4-1) is incorporated on the housing. Do not remove this plate unless damaged

c. Shoe hold down plate (50, figure 4-1) is a single piece construction and is retained on yoke subassembly (53) by 10 mounting screws and washers.

d. A single control spring (, figure 4-1) is incorporated.

4-43. CLEANING. Same as for Model PVB-044-1 and -2.

4-44. INSPECTION. Same as for Model PVB-044-1 and -2.

4-45. REPAIR OR REPLACEMENT. Same as for Model PVB-044-1 and -2.

4-46. REASSEMBLY. Same as for Model PVB-044-1 and -2 except for the differences noted in DISASSEMBLY. Do not securely tighten inlet and outlet port fittings until pump assembly is installed in place on the aircraft. Torque screws to the tightness called for in figure 4-12.

4-47. RUN IN AND TEST PROCEDURES. Same as for Model PVB-044-1 and -2 except for the following:

a. Maintain inlet fluid temperature at 135°F to 145°F (57°C to 62°C).

b. When adjusting pressure control, set the control to fully retract the yoke to minimum stroke position at 1000 to 1025 psig.

c. When measuring delivery, run pump at 4170 rpm and 900 psig outlet pressure. Delivery on rising pressure shall not be less than 5.8 gpm.

d. When measuring internal leakage, run pump at 4170 rpm and 1000-1025 psig outlet pressure. Internal leakage shall not exceed 460 cc/min.

CHAPTER 5

PAINTING REQUIREMENTS

Not Applicable

CHAPTER 6

PACKAGING

6.1 Output components will be preserved, packed, and marked in accordance with the Delivery Order/Contract, Depot Maintenance Interservice Support Agreement (DMISA), Statement of Work (SOW), Memorandum of Agreement or other authorization document, and the accompanying AMSAT Form 6525 (Test).

6.2 Output components from organic depot maintenance and overhaul (M&O) programs will be packaged in accordance with the Army Master Data File Retrieval Microform System (ARMS) Packaging File and marked in accordance with MIL-STD-129. Components for which a special or multi-application container is specified will be packed in the assigned container. All other components will be packaged level A/B unless weight and dimension requirements of MIL-STD-2073-1 & 2 specify a wooden container. The level of packaging shall be level A/A when a special/multi-application reusable container or wooden container is specified. When components are received at the overhaul maintenance facility, the container will be inspected for serviceability in accordance with Chapter 2, TB 55-8100-200-24. Containers will be requisitioned as required to replace missing, improper, or unserviceable containers to insure availability of container when component is returned from the overhaul maintenance facility. Waivers, deviations, container substitution must be approved by the ATCOM Packaging and Transportability Branch. Written communication should be submitted to HQ ATCOM, AMSAT-I-SDP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. Telephone inquiries may be made to Commercial (314) 263-2372 or DSN 693-2372.

6.3 All contractual matters shall be through the assigned Contracting Officer (KO). Technical communications should be submitted to HQ ATCOM, AMSAT-I-SDP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. Telephone inquiries may be made to Commercial (314) 263-2372 or DSN 693-2372.

CHAPTER 7

MAINTENANCE OF FORMS AND RECORDS

Maintenance of forms and records will be in accordance with the contract.

CHAPTER 8

CONSUMABLE MATERIALS

Table 8-1 contains a listing of the consumable materials required for use in this Work Requirement. Consumable materials are that equipment and, or supply items identified as that which may be consumed in use or which loses its identity in an assembly.

Table 8-1. Consumable Materials

Item No.	NOMENCLATURE	SPECIFICATION NO.
1	Name Plate	MIL-L-19834, Type 2
2	Hydraulic Fluid	MIL-H-5606
3	Dry Cleaning Solvent	P-D-680
4	Hydraulic Fluid	MIL-H-6083A, Type 1
5	Polishing Paper (Grade 4/0)	Commercial
6	Zinc Chromate Prime	MIL-P-8585
7	Lapping Compound (1500 Grit)	Commercial
8	Lubricant	MIL-L-15016
9	Kerosene	VV-K-211
10	Lapping Stone	Commercial
11	Polishing Paper (Grade 500)	Commercial
12	Lubricant	VV-L-765, Grade 250
13	Lockwire	MS20995C-20
14	Lapping Stone (Arkansas)	Commercial
15	Graphite Grease	VV-G-671C
16	Paper (Grade A)	MIL-P-121
17	Primer (Silastic A 4094)	Dow Corning Corp.
18	Adhesive (RTV 1016)	General Electric Corp.
19	Catalyst (RTV 9910)	General Electric Corp.
20	Levigated Alumina (D-4766)	Norton Co. (or equivalent)
21	Jeweler's Rouge	Commercial
22	Lockwire	MS20995C-32

NOTE

Bond data plates onto housings using one of the following:

(1) Adhesives per MMM-A-132, Type I, Class 3
(2) Adhesives per MMM-A-134
(3) Epoxy Metalset A4
(4) Adhesive EC 2216

CHAPTER 9

TECHNICAL FACILITIES REQUIREMENTS

The contractor's facilities shall be equipped to perform all phases of operation prescribed by this Work Requirement.

CHAPTER 10

TOOLS AND EQUIPMENT

10-1. TOOLS AND EQUIPMENT. A tools and equipment checklist is outlined herein to provide a convenient list of tools and equipment considered essential for the requirements of this Work Requirement. This list is primarily intended to be a ready reference list for the Contracting Officer in determining if the required tools and equipment are available, without a detailed reference to specific manufacturer, model, type, part number, etc. Possession of all the items listed is not to be construed as mandatory. It is the contractor's responsibility to choose tools and equipment which are adequate and appropriate to accomplish all job functions in a competent and efficient manner. Conversely, possession of all of the itemized tools and equipment will not necessarily insure approval of a contractor.

10-2. COMMON TOOLS AND EQUIPMENT.

a. Handling equipment.

(1) Parts storage racks.

(2) Transportation dollies.

b. Disassembly and reassembly.

(1) Arbor press and adapters.

(2) Torque wrenches.

(3) Miscellaneous wrenches (box, socket, etc.).

(4) Wire cutters.

(5) Safety wire pliers.

(6) Plastic or rawhide mallets.

(7) Expansion or compression retainer ring pliers.

(8) Oven (controlled temperature)

(9) Power arm.

(10) Screw driver.

(11) Asbestos gloves.

(12) Spring checker.

c. Machine shop and welding shop equipment.

(1) Lathe (metal turning).

(2) Lapping machine.

(3) Lapping plate (grooved).

(4) Grinding machine.

(5) Welding torches (tips, hoses, etc.).

d. Cleaning and processing equipment.

(1) Miscellaneous tanks and pans for cleaning solvents, silver plating, sonic cleaning, zinc chromate primer, etc.

(2) Wire mesh baskets (acid resistant).

(3) Protective clothing (apron, gloves, etc.).

(4) Degreasing tank.

e. Quality and tolerance checking equipment.

(1) Fluorescent inspection equipment.

(2) Magnetic inspection equipment (with demagnetizer).

(3) Surface finish analyzer.

(4) Type A borescope (or equivalent).

(5) Micrometers (inside, outside and depth).

(6) Dial indicators.

(7) Amplifier (shadowgraph).

(8) Precision measuring blocks.

(9) Height gage.

(10) Telescoping gages.

(11) Inspection plate.

(12) Optical flat tester and monochromatic light.

(13) Feeler gages.

f. Identification and marking equipment.

(1) Metal stamps (letters and numbers).

(2) Hammers (as required).

g. Miscellaneous equipment.

(1) Work bench and vise.

(2) Air power source.

(3) Electrical power source.

(4) Air regulators

(5) CO_2 tanks and regulators.

10-3. SPECIAL TOOLS AND EQUIPMENT. Listed in table 10-1 are the special tools and equipment needed to accomplish the requirements of this Work Requirement. This table lists the tools by part number, nomenclature, and typical manufacturer. Possession of all of the tools listed is not to be construed as mandatory, when the contractor may have similar tools on the facility or can locally purchase or manufacture adequate tools to accomplish all job functions in a competent and efficient manner.

Table 10-1. Special Tools and Equipment

PART NUMBER	NOMENCLATURE
T-162016	Bearing removing plate
T-181246	Power arm adapter
T-200063	Air gage ring
T-233248	Flushing set
T-300504	Shaft holder
T-300582	Bearing puller
T-300583	Air gage spindle
T-300584	Air gage ring
T-300585	Air gage ring
T-300855	Gang lap fixture
T-401667	Air gage spindle
T-401668	Air gage ring
T-410445	Bearing driver
T-410447	Holding fixture
T-410448	Bearing driver
T-410871	Holding clamp
T-410872	Spring compressor
T-415042	Shaft seal guide

NOTE

All preceding items manufactured by Vickers Aerospace Division or equivalent.

CHAPTER 11

OVERHAUL INTERVAL AND RETIREMENT LIFE SCHEDULE

Not Applicable

CHAPTER 12

MILITARY AND FEDERAL SPECIFICATIONS

Table 12-1 lists Military and Federal Specifications used in the performance of this Work Requirement.

Table 12-1. Military and Federal Specifications

ITEM NO.	SPECIFICATION NUMBER	TITLE
1	MIL-I-6868	Inspection, Magnetic particle
2	MIL-I-6866	Inspection, Fluorescent penetrant
3	MIL-W-8604	Welding, Aluminum alloy
4	MIL-C-5541	Chemicals, films, and chemical film materials for aluminum and aluminum alloys
5	MS33646	Inserts, Standard dimensions for helical coil, assembly
6	MS33540	Safetywire, General practice for
7	MIL-P-116	Preservation, Method of
8	MIL-C-8514	Coating compound, metal compound
9	MIL-B-12113	Preservation packing
10	MIL-STD-130B	Identification marking of U.S. Military property.

CHAPTER 13

REFERENCE DATA

Table 13-1 lists all publications other than Military and Federal Specifications used in the performance of this Work Requirement.

Table 13-1. Reference Data

ITEM NO	PUBLICATION NUMBER	TITLE
1	DA PAM 738-751	Functional Users Manual for the Army Maintenance Management System-Aviation (TAMMS-A)
2	AR-95-1	Army Aviation, General Provisions
3	AR 70-10	Testing and Logistical Evaluation of Army Aircraft and Allied Equipment
4	AR 711-16	Installation, Stock Control and Supply Procedures
5	AR 715-50	Standardization, Specifications and Standards
6	AR 735-5	General Principle and Policies and Basic Procedures
7	AR 750-712	Modification of Army Aircraft and Transportation Air Items

CHAPTER 14

KIT DATA

Identification of kits and other supply parts which may be required during overhaul is contained in separate supply documents normally accompanying this Work Requirement, such as Material Requirements List (MRL), Government Furnished Equipment (GFE) List, or Contractor Furnished Equipment (CFE) List.

CHAPTER 15

PART NUMBER LISTING

Table 15-1 contains a listing of part numbers to serve as a reference to aid in properly relating manufacturer's part number to approved Federal Stock Number.

Table 15-1. Part Number Listing (Sheet 1 of 3)

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE	FEDERAL STOCK NUMBER
4-1-75	AN535-0-2	Mounting screw	5305-253-5622
4-1-77	AN535-0-2	Mounting screw	5305-253-5622
4-1-7	AN6289D16	Jam nut	4730-277-5095
4-1-11	AN6289D6	Jam nut	4730-277-5083
4-1-37	AN960C8	Washer	5310-685-3744
4-1-36	MS16997-33	Mounting screw	5305-978-4371
4-1-16	MS16998-28	Mounting screw	5305-983-7429
4-1-36	MS16998-28	Mounting screw	5305-983-7429
4-1-2	MS16998-34	Mounting screw	5305-887-3099
4-1-2	MS06998-35	Mounting screw	
4-1-78	MS21209C08-20	Insert	5340-721-6936
4-1-38	MS21209F1-15	Insert	5340-800-7874
4-1-66	MS21209F1-15	Insert	5340-800-7874
4-1-78	MS21209F1-15	Insert	5340-800-7874
4-1-10	MS21926-6	Outlet elbow fitting	
4-1-18	MS28775-008	Sealing screw packing	5330-579-3158
4-1-5	MS28775-014	Coupling shaft packing	5330-584-1840
4-1-21	MS28775-015	Adjusting screw packing	5330-618-5361
4-1-30	MS28775-137	Valve plate packing	5330-833-1429
4-1-8	MS28777-16	Backup ring	5330-805-6478
4-1-12	MS28777-6	Backup ring	5330-186-1295
4-1-9	MS28778-16	Inlet elbow packing	5330-804-5694
4-1-13	MS28778-6	Outlet elbow packing	5330-804-5695
4-1-48	NAS1350-04H4	Mounting screw	
4-1-72	NAS1593-022	Mating ring packing	
4-1	PVB-044-1	Hydraulic pump assembly	
4-1	PVB-044-2	Hydraulic pump assembly	1650-872-8798
4-1	PV3-044-8	Hydraulic pump assembly	1650-937-1443
4-1	SC-16	Shipping cap	
4-1	SC-6	Shipping cap	
4-1	SP-16	Shipping plug	
4-1	SP-4	Shipping plug	4130-489-0107
4-1	SP-6	Shipping plug	5340-292-3292
4-1-49	147391	Washer	
4-1	155317	Shipping plug gasket	5340-841-5540
4-1	161312	Shipping plug gasket	5330-945-3945
4-1	164131	Shipping plug gasket	5330-928-9040
4-1-74	164432	Instruction plate	1650-072-8998
4-1-17	170498	Sealing screw	
4-1-41	194018	Retaining ring	
4-1-31	208830	Valve plate packing	
4-1-48	208938	Mounting screw	
4-1-32	209559	Locating pin	
4-1-54	230822	Locating pin	
4-1-70	248760	Retaining pin	

Table 15-1. Part Number Listing (Sheet 2 of 3)

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE	FEDERAL STOCK NUMBER
4-1-73	248820	Locating pin	
4-1-14	262815	Inlet plate	1650-941-8788
4-1-15	262816	Outlet plate	1650-941-8787
4-1-34	262816	Outlet plate	1650-941-8787
4-1-20	279325	Adjusting screw	1650-928-5127
4-1-19	279326	Locking nut	5310-984-5708
4-1-53	297002	Yoke subassembly	
4-1-79	297003	Mounting flange	
4-1	297004	Mounting flange subassembly	
4-1-68	297006	Mounting flange packing	
4-1-49	297007	Housing	
4-1-28	297008	Valve plate subassembly	
4-1-52	297009	Pintle bearing	
4-1-29	297010 —	Valve plate bearing	
4-1-65	297011	Drive shaft bearing	3110-933-1362
4-1	297012	Housing subassembly	
4-1-45	297013	Cylinder block	
4-1-67	297014	Drive shaft	1650-840-5100
4-1-46	297015	Piston and shoe subassembly	
4-1-51	297018	Shoe wear plate	1650-936-8487
4-1-50	297019	Shoe hold down plate	1650-931-2342
4-1-47	297020	Plate retainer	
4-1	297021	Block, piston and shoe subassembly	
4-1-40	297022	Control piston	1650-891-3210
4-1	297023	Valve plate and controls subassembly	
4-1	297024	Valve plate and spool subassembly	1650-931-2349
4-1	297026	Shaft seal subassembly	1650-891-3207
4-1-64	297027	Seal retainer	
4-1-61	297028	Garter spring	
4-1-62	297029	Spacer	
4-1-60	297030	Seal grommet	
4-1-63	297031	Wave spring	
4-1-59	297032	Carbon seal	
4-1-71	297033	Mating ring	5340-839-0747
4-1-44	297034	Spring spacer	5310-891-8400
4-1-43	297035	Cylinder block spring	
4-1-42	297036	Retainer	
4-1-1	297037	Coupling shaft	1650-891-3206
4-1	297038	Shaft, insert and bearing subassembly	
4-1-69	297040	Thrust ring	5310-851-5618
4-1-55	297048	Control spring guide	5315-929-5818
4-1-58	297049	Control spring seat	5340-988- 856
4-1-57	297050	Control spring	
4-1-56	297051	Control spring	
4-1-3	297056	Washer	5310-929-8530
4-1-4	297057	Coupling shaft sleeve	5340-852-6728
4-1-23	297059	Spring guide	
4-1-24	297060	Control spring	
4-1-52	297064	Pintle bearing	
4-1-49	297070	Washer	
4-1	297082	Mounting flange subassembly	1650-891-3209
4-1-39	297088	Housing	
4-1	297089	Housing subassembly	1650-931-2344
4-1-53	297090	Yoke subassembly	1650-931-2343

Table 15-1. Part Number Listing (Sheet 3 of 3)

FIGURE AND INDEX NO.	PART NUMBER	NOMENCLATURE	FEDERAL STOCK NUMBER
4-1-33	307483	Name plate	
4-1-37	309699	Washer	5310-929-3692
4-1-26	310598	Spring guide	1650-993-5458
4-1-22	310725	Spacer	
4-1-25	310730	Washer	
4-1-27	311476	Pilot valve	
4-1-47	312469	Plate retainer	1650-840-5101
4-1-46	314482	Piston and shoe subassembly	
4-1-45	314545	Cylinder block	
4-1-32	316343	Name plate	1650-931-2345
4-1	319052	Block, piston and shoe subassembly	1650-021-2760
4-1-55	323008	Control spring guide	1650-878-6522
4-1-6	325473	Inlet elbow fitting	4730-878-6582
4-1-35	325476	Caution plate	1650-878-6523
4-1-10	325477	Outlet elbow fitting	4730-807-0691
4-1-50	341659	Shoe hold down plate	
4-1-50	341660	Shoe hold down plate	
4-1-50	341661	Shoe hold down plate	
4-1-76	52488	Rotation plate	1650-219-2824
4-1	914362	Repair parts kit	1650-931-2351

CHAPTER 16

QUALITY ASSURANCE/QUALITY CONTROL REQUIREMENTS

Section I. GENERAL

16-1. **Responsibility.** The contractor/depot quality assurance activity is responsible for the performance of the inspections specified in the DMWR. The contractor/depot may utilize their own facilities or any commercial laboratory acceptable to the procuring activity/commodity manager (PA/CM). The PA/CM reserves the right to perform any of the inspections specified in the DMWR, when such inspections are necessary to assure that supplies or services conform to the prescribed requirements.

16-2. **Quality Assurance Terms and Definitions.** For quality assurance terms and definitions refer to MIL-STD-109 and the glossary in the DMWR.

16-3. **Inspection and Test Equipment.** The overhaul facility is responsible for acquisitions, maintenance, calibration, and disposition of all inspection and test equipment. Test equipment to be used by AMC (Army) elements will be acquired in accordance with AR 750-43 and AMC Supplement 1 to AR 750-43. All instrumentation and inspection equipment used in compliance with this DMWR shall be calibrated and controlled in accordance with MIL-I-45607B and MIL-STD-45662 (Commercial facility) or DESCOM-R-702-1, Depot Quality System (Army facility), with all standards traceable to the National Bureau of Standards. Descriptions of inspecting and measuring equipment are left to the discretion of the overhauling facility to be considered as good shop practice.

16-4. **Certification of Personnel, Materials, and Processes.** The contractor/depot QA activity shall be responsible for ascertaining and certifying personnel skills, equipment, and materiel meet the requirements of the work to be accomplished. Unless otherwise specified in the contractor or by PA/CM representative, the contractor/depot QA activity shall provide the PA/CM with statements or other evidence that specifications for such special processes as welding, nondestructive testing, plating, and the like, have been complied with. Personnel performing magnetic particle and penetrant tests shall be certified in accordance with MIL-STD-410.

16-5. **Quality Assurance Plan.** The contractor/depot quality assurance activity shall insure compliance with MIL-I-45208A or AMC-R 702-4 which includes required quality assurance planning.

Section II. INSPECTION REQUIREMENTS

16-6. **General.**

a. Quality Inspectors (QI) are required to witness all tests and those inspections which are marked "QI" or otherwise designated by the PA/CM.

b. The Maintenance Technicians shall inspect, check, and determine the conditions of all other areas to insure compliance with the DMWR.

16-7. **First Article Inspection/Comparison Test.** The first item overhauled shall be inspected for conformance to the DMWR. If the contractor/depot has overhauled this type item for the Government within the last two years, this requirement may be waived by a written request to PA/CM.

16-8. In-Process and Acceptance Inspections.

a. Used components and refinished parts recovered as products of disassembly shall be examined 100% by the contractor/depot, to determine serviceability. A copy of this log shall be submitted to the PA/CM as a part of the overhaul contract. The log shall contain the Maintenance Technician's comments for all parts removed; such as, parts inspected, replaced, repaired, inspected by QI, tested by NDI, modified by MWO, or other notes or actions.

b. Diagnostic and nondestructive tests such as magnetic particle, penetrant, radiographic, and ultrasonic inspections as required by this DMWR shall be in accordance with referenced military specifications, and AVSCOM AA-STD-1 and AA-STD-2. A qualified QI shall either perform or witness these tests.

c. A list of inspection definitions, Table16-1, are included at the end of this chapter. Accept and reject criteria for these inspections and unique repair methods are found in applicable areas of this DMWR.

16-9. Test Check List. A check list indicating each required test shall be included as a part of this DMWR. The list shall show name of test and test set-up (per figure if applicable). List the input readings, such as position of valves, switches, etc. List the required readings, such as time, meter readings, etc. List the accept/reject criteria for each test as applicable.

Table 16-1 Inspection Definitions

TERM	DEFINITION	PROBABLE CAUSE
Abrasion	Roughened surface, varying from light to severe	Foreign material present between moving parts
Bend	Any change in the intended configuration	Application of severe or excessive force
Break	Separation of part	Severe force, pressure or overload
Burn	Loss of metal	Excessive heat
Burnishing	The smoothing of a metal surface by mechanical action, but without loss of material. Generally found on plain bearing surfaces. Surface discoloration is sometimes present around outer edges of burnished area. NOTE Normal burnishing from operational service is not detrimental if coverage approximates the carrying load and if there is no evidence of burns.	Excessive heat
Burr	A rough edge or sharp projection	Impact from foreign object, or poor machining
Chipping	Breaking away of small metallic particles	Heavy impact of foreign object
Corrosion	Surface chemical action that results in surface discoloration, a layer of oxide, rust, and removal of surface metal	Improper corrosion preventive procedures and excessive moisture

Table 16-1 Inspection Definitions (continued)

TERM	DEFINITION	PROBABLE CAUSE
Crack	A break in material	Severe stress from overloading or shock; possible extension of a scratch
Dent	A small smoothly rounded depression	A sharp blow or excessive pressure
Distortion	A change from original shape	Application of severe heat or irregular forces
Erosion	Wearing away of metal	Hot gases, corrosive liquids, or grit
Fatigue failure	Sharp indentions, cracks, toolmarks, and inclusions that result in progressive yielding of one or more local areas	Cyclic stress. As stress is repeated, cracks develop, then spread, usually from surfaces (or near surface) of the particular section. Finally, so little sound material remains that normal stress on part exceeds strength of the remaining material. This type of failure is not caused by metal crystalization. This condition can easily be determined by visual inspection of part. Striations will be evidence by several lines, more or less concentric. The center (or focus) of lines indicates origin of the failure
Flaking	Loose particles of metal or evidence of surface covering removal	Imperfect bond or severe load
Fracture	See break	
Gouging	Removal of surface metal. Typified by rough and deep depressions	Protruding objects, misalignment
Heat oxidizing	Characterized by a discoloring film Color varies from yellow to brown and blue to purple	High temperature operation
Indenting	Cavities with smooth bottoms and sides. Occurs on rolling contact surfaces of bearing components	Loose or foreign particles rolling between rotating elements of a bearing
Nick	A sharp-bottomed depression that may have rough outer edges	Dropping, banging

Table 16-1 Inspection Definitions (continued)

TERM	DEFINITION	PROBABLE CAUSE
Off-square or mis-alignment of Anti-Friction Bearing	Indicated by retainer deterioration, retainer bore erosion, and gouged retainer rolling element pockets of the inner and outer race. Two distinct rolling element paths may be seen on the race where off-square conditions exist	Caused by rolling element speed variation, which jams rolling elements into separator pockets
Pitting	Small indentions in a surface	Chemical pitting: Oxidation of surface or electrolytic action. Mechanical pitting: Chipping of loaded surfaces caused by improper clearances and overloading, and by pressure of foreign material
Scoring	Deep scratch following path of part travel	Result of localized lubrication breakdown between sliding surfaces
Scraping	A furrow	Rubbing with any hard, or rough pointed object
Scratch	A very shallow furrow or irregularity, usually longer than wide	Movement of a sharp object across the surface
Seizure	Fusion or binding of two adjacent surfaces preventing continued movement	Improper lubrication or wear
Stripped thread	Thread of a nut, stud, bolt, or screw damaged by tearing away part of thread	Improper installation or thread pitch or size
Tear	Parting of parent material	Excess tension, caused by an external force
Wear	Slow removal of parent material Frequently, wear is not visible to the naked eye	Result of abrasive substances contacting rolling surfaces, and acting as a lapping compound

DEPOT MOBILIZATION REQUIREMENTS

This DMWR pertains to an "on condition" item and is used as a guide during depot maintenance to perform only those corrective maintenance tasks essential to achieving serviceability. The exception is when mandatory convenience maintenance tasks, necessary to assure the inherent reliability and/or longevity of the item, are stipulated in the Preshop Analysis Section of the DMWR. All of the above are essential, even under a state of mobilization.

FOR THE COMMANDER:

BRIAN L. THOM
Colonel, AV
Chief of Staff

Official:

JOANNE M. MEYER
DA Publications Manager

REQUEST FOR ACTION	CONTRACT NO	PRIORITY OF REQUEST ☐ URGENT ☐ ROUTINE	DATE OF REQUEST

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PUBLICATION NO. AND TITLE

STATEMENT OF THE PROBLEM ☐ PUBLICATIONS PROCEDURES ☐ OTHER

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REASONS FOR URGENCY

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AMSAV-M Form
1 Oct 87

1379

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CDR, 1st Br, 65th ADA
ATTN: SP4 J. Brown
Key West, FL 33040

DATE SENT
10 Jun 79

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-1430-550-34-1	7 Sep 72 .	Unit of Radar Set AN/MPQ-50 Tested at the HFC

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
9-19		9-5	
21-2	step 1C	21-2	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

"B" Ready Relay K11 is shown with two #9 contacts. That contact which is wired to pin 8 of relay K16 should be changed to contact #10.

Reads: Multimeter B indicates 600 K ohms to 9000 K ohms.

Change to read: Multimeter B indicates 600 K ohms minimum.

Reason: Circuit being checked could measure infinity. Multimeter can read above 9000 K ohms and still be correct.

SAMPLE

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER
SP4 J.T. Brown, Jr.

SIGN HERE
SP4 James Brown, Jr.

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C