

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

FOR

RIGHT ANGLE DRIVE, COOLING FAN

M113A1 FOV, M113A2 FOV — 2990-00-712-1280

M113A3 FOV — 3010-01-318-5670

GEARCASE, TRANSFER

M548, M548A1 — 2520-01-047-8613

SERVICE GEARCASE — 2520-01-087-0156

M113A1 FOV — 2520-00-572-8605

M113A2 FOV WITH 100 AMP GENERATOR — 2520-01-061-5570

M113A1 FOV, M113A2 FOV WITH 200 AMP GENERATOR — 2520-01-362-8589

DRIVE ASSEMBLY, FINAL

M113A2 FOV, M113A3 FOV — 2520-01-061-5766

M548, M548A1 — 2520-01-067-8933

DIFFERENTIAL, STEERING CONTROL

M113A1 FOV, M113A2 FOV, M548, M548A1 — 2520-00-714-6135

BRAKE, SINGLE DISK

M113 FOV, M548, M548A1 — 2530-00-088-9866

CYLINDER ASSEMBLY, HYDRAULIC BRAKE

M113 FOV, M548, M548A1 — 2530-00-679-9169

SUPERSEDURE NOTICE — This manual supersedes TM 9-2520-238-34 dated September 1991, including all changes.

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HEADQUARTERS, DEPARTMENT OF THE ARMY

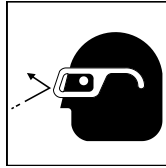
31 MAY 2001

WARNING SUMMARY

WARNING SUMMARY

This list summarizes critical WARNINGS in this manual. They are repeated here to let you know how important they are. Study these WARNINGS carefully; they can save your life and the lives of personnel you work with.

WARNING



Air pressure in excess of 30 psi (207 kPa) can injure personnel. Do not direct pressurized air at yourself or others. Always wear goggles.

WARNING



Adhesive is flammable and can injure you. Keep it away from heat, sparks, and open flame. Avoid repeated or prolonged breathing of vapors. Avoid contact with your skin.

WARNING



Fire resistant hydraulic (FRH) fluid may contain Tricresyl Phosphate which, if taken internally, can produce paralysis. Hydraulic fluid may be absorbed through the skin. Wear long sleeves, gloves, goggles, and face shield. If FRH gets in eyes, wash them immediately and get medical aid immediately. If FRH gets on skin, thoroughly wash with soap and water. Wash hands thoroughly prior to eating or smoking.

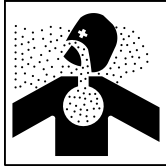
WARNING



Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move fog oil tank, armor, or other heavy objects.

WARNING SUMMARY (cont)

WARNING



Parts of the brake assembly may be coated with asbestos dust; breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

FIRST AID

For artificial respiration and first aid information, see FM 21-11.

INSERT LATEST UPDATED PAGES / WORK PACKAGES. DESTROY SUPERSEDED DATA.

LIST OF EFFECTIVE PAGES / WORK PACKAGES

NOTE: Updates to all portions of this TM are indicated by a vertical bar in the outer margin of the page.

Dates of issue for original and updated pages / work packages are:

Original 0 (31 May 2001)

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 28 AND TOTAL NUMBER OF WORK PACKAGES IS 35 CONSISTING OF THE FOLLOWING:

Page / WP No.	* Change No.	Page / WP No.	* Change No.	Page / WP No.	* Change No.
Title	0				
a - b	0				
A/B	0				
i - vii/viii blank	0				
WP 0001 00 - 0035 00	0				
1 - 2	0				
DA 2028/Back	0				
Authentication	0				
Blank	0				
Metric Chart	0				
Back Cover	0				

* Zero in this column indicates an original page or work package.

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 MAY 2001

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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 the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <http://aeprs.ria.army.mil>. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or email your letter, DA Form 2028 direct to: AMSTA-LC-CI/TECH PUBS, TACOM-RI, Rock Island Arsenal, Rock Island, IL 61299-7630. The email address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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HOW TO USE THIS MANUAL

HOW TO USE THIS MANUAL

This manual tells you how to perform direct and general support maintenance for transfer gearcases, final drives, cooling fan right angle drives, steering differential control, single disk pivot brake and hydraulic brake master cylinder for the M113 Family of Vehicles.

Before starting a task or procedure, read HOW TO USE THIS MANUAL and GENERAL MAINTENANCE PROCEDURES (WP 0014 00).

WHAT'S IN THE MANUAL — FRONT TO BACK

This TM supplement is divided into front and rear matter and Work Packages (WPs) for ease of use.

The WARNING SUMMARY section provides safety and first aid information. This section includes general warnings not found in the TM text and a list of the most important detailed warnings extracted from the WPs. All of these warnings cover hazards that could kill or injure personnel.

The TABLE OF CONTENTS lists the WPs.

CHAPTER 1 covers general introductory information. The Equipment Description WP gives a brief description of components covered in this manual.

CHAPTER 2 covers troubleshooting procedures authorized at the DS/GS maintenance level.

CHAPTER 3 includes PMCS procedures.

CHAPTER 4 contains maintenance WPs for the cooling fan right angle drives.

CHAPTER 5 contains maintenance WPs for the transfer gearcases.

CHAPTER 6 contains maintenance WPs for the final drive assemblies.

CHAPTER 7 contains maintenance WPs for the steering control differential.

CHAPTER 8 contains maintenance WPs for the single disk pivot steer brake and the hydraulic master brake cylinder.

CHAPTER 9 contains supporting information for the TM which includes the following WPs:

The REFERENCES WP lists references to be used by personnel in operating and maintaining the carrier.

The COMMON TOOLS and SUPPLEMENTS and SPECIAL TOOLS/FIXTURES WP lists the tools used in the initial setup.

The FABRICATED TOOLS WP lists instructions for making tools authorized to be fabricated at DS or GS maintenance levels.

The EXPENDABLE/DURABLE SUPPLIES and MATERIALS lists the expendable supplies and materials used to maintain or repair the carrier.

The INDEX is an alphabetical listing of all the tasks in the WPs of this TM. Each entry is cross-referenced to the WP number and page number.

The back cover includes a METRIC CONVERSION CHART that can be used to convert U.S. customary measurements to their metric equivalents. Measurements in this manual are given in U.S. customary unit with metric units in parentheses.

HOW TO USE THE WORK PACKAGES

How to find the WP you need

Pick a key word from the carrier part or system to be used during the WP. Look in the INDEX for this key word or the name of the action you will perform. Turn to the page indicated.

The INDEX lists each WP under one or more headings.

How to read the WP

Be sure to read all **warnings**, **cautions** and **notes**. These are in all types of WPs. They help you avoid harm to yourself, other personnel and equipment. They also tell you things you should know about the WP.

HOW TO USE THIS MANUAL (cont)

Before starting, get all tools, supplies, and personnel, listed on the setup page needed to do the WP. Be sure to read the WP before performing the maintenance. If any other WPs are referenced, you must go to the setup page for each of those WPs to find out what tools, parts, and materials will be needed.

Start with step 1 and do each step in given order.

Look at the illustrations. These show you what to look for when reading a maintenance WP.

Maintenance Instructions WPs

Doing maintenance WPs will keep the carrier in shape to operate. Maintenance WPs are used to present maintenance instructions. Each maintenance WP details steps which you need to perform. If the carrier and parts need maintenance that is not included in any WP in the manual, report this to your supervisor.

Read the INITIAL SETUP section carefully before you start a WP. Get the tools and supplies listed and the personnel needed to perform the WP. Be sure that the equipment is in the condition required.

DEFINITION OF WP TERMS

WARNINGS, CAUTIONS, AND NOTES

Be sure to read all warnings and cautions in the WP. Ignoring a warning could cause death or injury to yourself or other personnel. Ignoring a caution could cause damage to equipment. Notes contain facts to make the WP easier. Warnings, cautions, and notes always appear just above the WP step to which they apply.

WARNINGS Call attention to things that could kill or injure personnel. Warnings are also listed in the Warning Summary section (page a).

CAUTIONS Call attention to actions or materials that could damage equipment.

NOTES Contain important facts to make the procedure easier.

HELPER

Helpers are needed for WPs that require more than one person such as lifting heavy objects or acting as an observer.

If a helper is needed to perform a procedure, the INITIAL SETUP will list "Helper" under the PERSONNEL REQUIRED heading.

If helper assists with a step, the step will include: "Have helper assist".

If a helper performs the action alone, the step will start with "HELPER".

REFERENCES

References within a WP refer to a different manual or to another WP in the same manual. A step in one WP may be a complete WP someplace else. Below is an example of a reference step from the WP: REPAIR BRAKE SHOE ASSEMBLIES.

Example: Check wear limits and clearances of parts, (WP 0021 00).

The tools needed to do the task will be listed in that task.

MATERIALS/PARTS

For all WPs, the following comments apply:

Parts which are listed on the setup page will be referred to as "new" in the WP setup when installed.

Examples are: "locknuts", "lockwashers", "cotter pins", and some "gaskets".

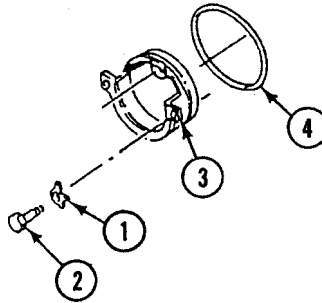
These and other new parts are listed under MATERIAL/PARTS in the initial set up.

GENERAL MAINTENANCE

Cleaning, inspecting, checking for leaks, and similar procedures which apply to most WPs are found in the GENERAL MAINTENANCE PROCEDURES (WP 0014 00). Use these steps to clean and inspect any part being removed, repaired, or installed. Special cleaning will be covered in the WP step. Below is a step that would require general cleaning.

HOW TO USE THIS MANUAL (cont)

11. Straighten tabs on two key washers (1). Remove two cap screws (2), key washers (3) and cover (4) from housing cover. Discard key washers.



After doing this step, you would clean the mating surface with cleaning compound and a wiping rag according to the general cleaning procedures. In other tasks, hoses or rubber hatch seals will need to be checked for leaks. Refer to (WP 0014 00) for general procedures.

HOW TO USE THE REPAIR PARTS AND SPECIAL TOOLS LISTS (RPSTL) WITH THIS MANUAL

The RPSTL TM 9-2520-238-34P gives the National Stock Number (NSN) required to order parts use in the maintenance WPs. To use the RPSTL to identify and order a part, do the following:

In this manual, turn to the first page of the WP to be performed.

Find Materials/Parts under INITIAL SETUP, and read the part(s) that need replacement. If required, find the illustrated part in the WP steps.

Go to the RPSTL and find the same illustrated part. That part will have an item number assigned to it. Look this item number up in the listing for that figure. The NSN can be found in the National Stock Number and Part Number Index in the back of the RPSTL.

If you inspect an item and find that it is damaged, go to the RPSTL and find the SMR code for the item. If the SMR code does not authorize you to repair the item, reassemble it and send it to the authorized level of maintenance.

CHAPTER 1

INTRODUCTORY INFORMATION WITH THEORY OF OPERATION

WORK PACKAGE INDEX

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EQUIPMENT DESCRIPTION AND DATA.....	.0002 00
REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.....	.0003 00

GENERAL INFORMATION

0001 00

SCOPE

Type of Manual: Direct and General Support Maintenance

Model Number and Equipment Name:

Table 1. TABLE 1-1: COMPONENTS COVERED AND END ITEM APPLICATION

Component	Alpha Symbol	NSN	Part No. (CAGE)	End Item and TM Reference
Gearcase, Transfer	A	2520-00-572-8605	10932770 (19207)	M106A1, M113A1, M125A1, M132A1, M577A1 (TM 9-2300-257 series). Replaced 2520-00-771-8377.
Gearcase, Transfer	B	2520-01-061-5570	12253625 (19207)	M106A2, M113A1, M113A2, M125A1, M125A2, M577A1, M577A2, M901A1, M981, M1059, M1064, M1068 (TM 9-2350-261 series) (Carriers with 100 ampere generators).
Gearcase, Transfer	C	2520-01-362-8589	12349527 (19207)	M113A2, M577A2, M981, M1059, M1064 (TM 9-2350-261 series) (Carriers with 200 ampere generators).
Gearcase, Transfer	E	2520-01-087-0156	12268757 (19207)	Service spare for transfer gearcases A, B, C
Gearcase, Transfer	F	2520-01-047-8613	12253385 -1 (19207)	M548, M548A1 (TM 9-2350-247 series).
Differential, Steering Control	A	2520-00-714-6135	10875026 (19207)	M106A1, M113A1, M125A1, M577A1 (TM 9-2300-257 series), M548, M548A1 (TM 9-2350-247 series), M106A2, M113A2, M125A2, M577A2, M901A1, M1059, M1064, M1068, M981 (TM 9-2350-261 series).

Brake, Single Disk, Pivot	A	2530-00-088-9866	11660974 (19207)	M106A1, M113A1, M125A1, M577A1 (TM 9-2300-257 series), M548, M548A1 (TM 9-2350-247 series), M106A2, M113A2, M125A2, M577A2, M901A1, M1059, M1064, M1068, M981 (TM 9-2350-261 series). Replaced 2520009991998.
Master Cylinder, Hydraulic Brake	A	2530-00-679-9169	10861712 (19207)	M106A1, M113A1, M125A1, M577A1 (TM 9-2300-257 series), M548, M548A1 (TM 9-2350-247 series), M106A2, M113A2, M125A2, M577A2, M901A1, M1059, M1064, M1068, M981 (TM 9-2350-261 series). Replaced 2530009749266.
Drive Assembly, Final	A	2520-01-067-8933	12253630 (19207)	M548, M548A1 (TM 9-2350-247 series).
Drive Assembly, Final	B	2520-01-061-5766	12253512 (19207)	M106A2, M113A2, M125A2, M577A2, M901A1, M1059, M1064, M1068, M981 (TM 9-2350-261 series), M113A3, M981A3, M1064A3, M1068A3, M577A3, M1059A3, M901A3, M58 (TM 9-2350-277 series).

Right Angle Drive, Cooling Fan	A	2900-00-712-1280	10863320 (19207)	M106A1, M113A1, M125A1, M577A1 (TM 9-2300-257 series), M106A2, M113A2, M125A2, M577A2, M901A1, M1059, M1064, M1068, M981 (TM 9-2350-261 series). Replaced 2992227818193.
Right Angle Drive, Cooling Fan	B		10863320-1	M113A2, M901A1, M981, M1068, M577A2, M1059, M1064, M106A2, M125A2, M741A2 (TM 9-2350-261 series). M548A3 (TM 9-2350-247 series).
Right Angle Drive, Cooling Fan	C	3010-01-318-5670	12349762-1 (19207)	M113A3, M981A3, M1064A3, M1068A3, M577A3, M1059A3, M901A3, M58 (TM 9-2350-277 series).

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pamphlet 738-750, The Army Maintenance Management System (TAMMS).

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. The preferred method for submitting EIRs is through the Army Electronic Product Support (AEPS) website, under the Electronic Deficiency Reporting System (EDRS). The web address is <https://aeaps2.ria.army.mil>. This is a secured site requiring a password, which can be applied for on the front page of the website. The mailing address for submitting EIRs is: Department of the Army, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-LC-CIP-W, Rock Island, IL 61299-7630. We'll send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in the future.

While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem.

If a corrosion problem is identified, it can be reported using Standard Form 368 (Quality Deficiency Report). Use of key words such as "corrosion," "rust," "deterioration" or "cracking" will assure that the information is identified as a CPC problem.

The preferred method for submitting QDRs is through the Army Electronic Product Support (AEPS) website, under the Electronic Deficiency Reporting System (EDRS). The web address is <https://aeaps2.ria.army.mil>. This is a secured site requiring a password, which can be applied for on the front page of the website. The mailing address for submitting QDRs is: Department of the Army, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-TR-E-PQDR, MS 267 Warren, MI 48397-5000.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

See the following technical manuals for information on destruction of Army materiel:

TM 750-244-2 Procedures for Destruction of Electronics Materiel to Prevent Enemy Use.

TM 750-244-5-1 Procedures for Destruction of Conventional Ammunition and Improved Conventional Munitions to Prevent Enemy Use.

TM 750-244-6 Procedures for Destruction of Tank Automotive Equipment to Prevent Enemy Use.

TM 750-244-7 Procedures for Destruction of Equipment in Federal Supply Classifications 1000, 1005, 1010, 1520, 2530, 5590, 5595 to Prevent Enemy Use.

PREPARATION FOR STORAGE OR SHIPMENT

See TM 740-90-1 for information about administrative storage or shipment of the component in this manual.

NOMENCLATURE CROSS-REFERENCE

This listing includes nomenclature cross references used in this manual.

COMMON NAME

Lock screw	Self-locking bolt
Lockwasher	Lockwasher

SAFETY, CARE, AND HANDLING

Read warnings in Warning Summary in front of manual.

EQUIPMENT DESCRIPTION AND DATA

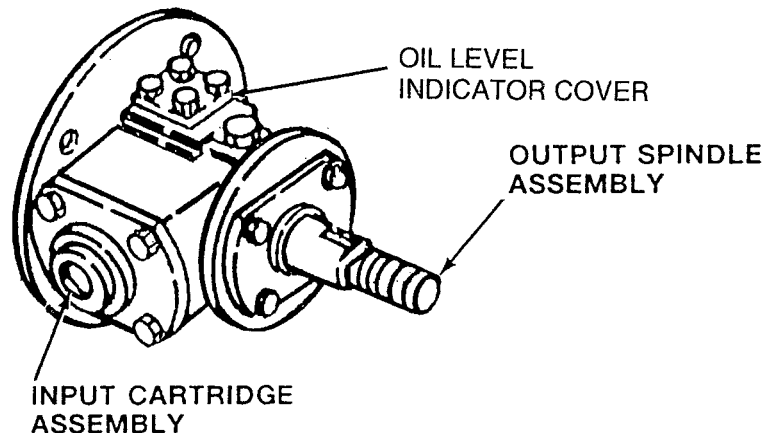
0002 00

EQUIPMENT FUNCTIONAL DESCRIPTION

COOLING FAN RIGHT ANGLE DRIVES

RIGHT ANGLE DRIVE A. Each cooling fan right angle drive A consists of an input cartridge assembly and an output spindle assembly encased in a magnesium or aluminum housing. When installed in a carrier, see Table 1-1, (WP 0001 00), the right angle drive receives torque through an input gearshaft and, by means of a 26-tooth spiral bevel gear in the cartridge assembly and a 27-tooth spiral bevel gear in the spindle assembly, drives a rotor (fan) mounted on the output shouldered shaft. The bevel gear and bevel gearshaft are a matched set and are mounted on matched sets of ball bearings. The gears and bearings are adjusted by inserting or removing laminated shims.

RIGHT ANGLE DRIVES A AND B. Each cooling fan right angle drive A consists of an input cartridge assembly and an output spindle assembly encased in a magnesium or aluminum housing. When installed in a carrier, see Table 1-1, (WP 0001 00), the right angle drive receives torque through an input gearshaft and, by means of a 26-tooth spiral bevel gear in the cartridge assembly and a 27-tooth spiral bevel gear in the spindle assembly, drives a rotor (fan) mounted on the output shouldered shaft. The bevel gear and bevel gearshaft are a matched set and are mounted on matched sets of ball bearings. The gears and bearings are adjusted by inserting or removing laminated shims. When viewed from the input gearshaft, the gearshaft rotates counterclockwise. The output shouldered shaft rotates clockwise and has left-hand threads at the lower end which act as an oil pump. Oil is forced down the outside of the shaft, through the threads and up the center of the shaft to the spindle assembly. A hollow pin in the shaft allows oil to spray against the gears. Some oil continues up the inside of the shaft to lubricate the upper bearings. Angle drive A has a plastic oil level indicator cover. Angle drive B has a visible liquid sight indicator glass.



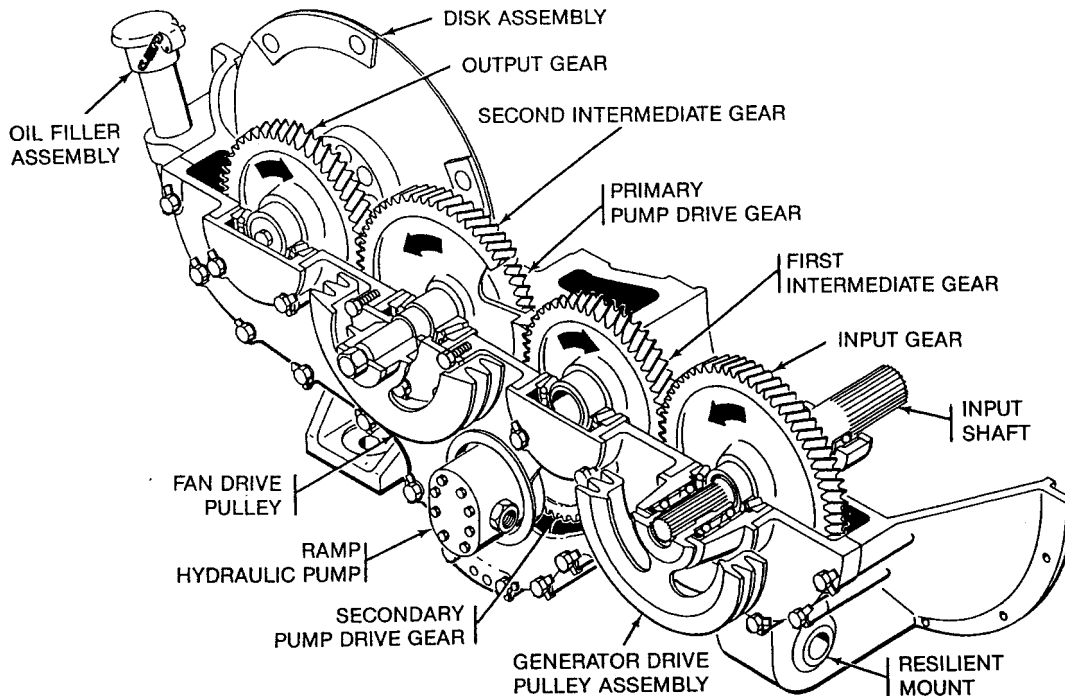
Cooling Fan Right Angle Drive

RIGHT ANGLE DRIVE C. Cooling fan right angle drive C consists of an input cartridge assembly and an output spindle assembly encased in an aluminum housing. When installed in a carrier, see Table 1-1, (WP 0001 00), the right angle drive receives torque through an input shouldered shaft and, by means of a 28-tooth spiral bevel gear in the cartridge assembly and a 21-tooth spiral bevel pinion gear in the spindle assembly, drives a cooling fan mounted on the shaft and bearing assembly. The bevel gear and bevel pinion gear are a matched set. This gear arrangement allows higher fan speed than angle drives A and B, with more cooling air flow. Like angle drives A and B, the shaft and bearing assembly act as an oil pump to lubricate the gears and bearings. When viewed from the input shaft, the shouldered shaft and bevel gear rotates clockwise, and the fan shaft and bearing and pinion gear rotates clockwise. The gears and bearings are adjusted by inserting or removing laminated shims. Angle drive C has a glass oil level sight indicator like right angle drive B.

TRANSFER GEARCASES

TRANSFER GEARCASE TORQUE PATH. The transfer gearcase delivers variable torque, generated at the input shaft by the engine and transferred through a series of four helically meshed gears, to the output gear and disk assembly. Any gear (input, first intermediate, second intermediate, or output gear) may drive an externally mounted power takeoff (pulley) assembly. Two additional gears (primary and secondary pump-drive gears) are coupled in series with the second intermediate gear to provide torque to externally mounted oil and hydraulic pumps.

GEAR ROTATIONS. Torque applied to the input shaft causes the shaft and input gear to rotate in a counterclockwise direction. The first intermediate gear rotates clockwise; the second intermediate gear and primary pump-drive gear rotate counterclockwise; and the output gear, output disk assembly, and secondary pump-drive gear rotate clockwise.

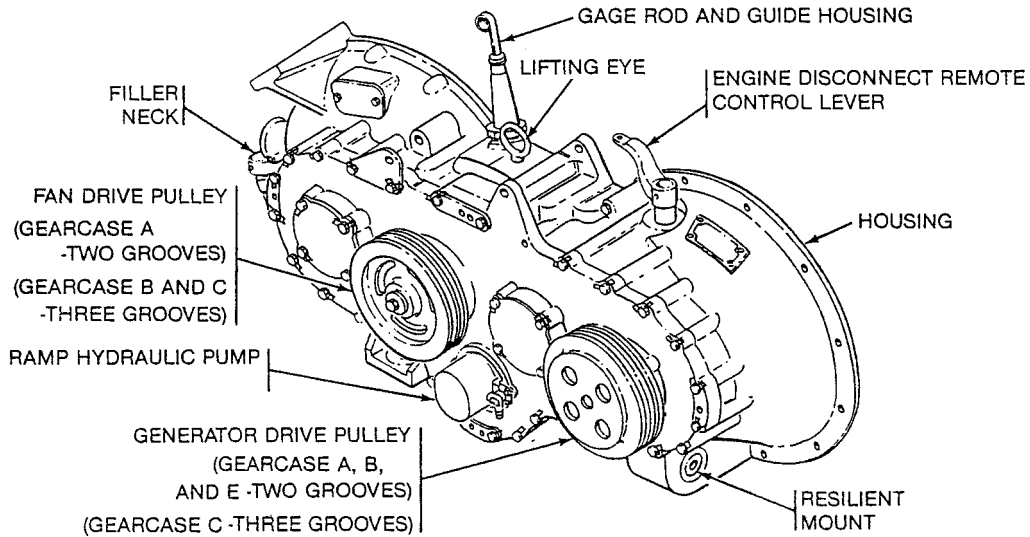


Typical Transfer Gearcase Torque Path

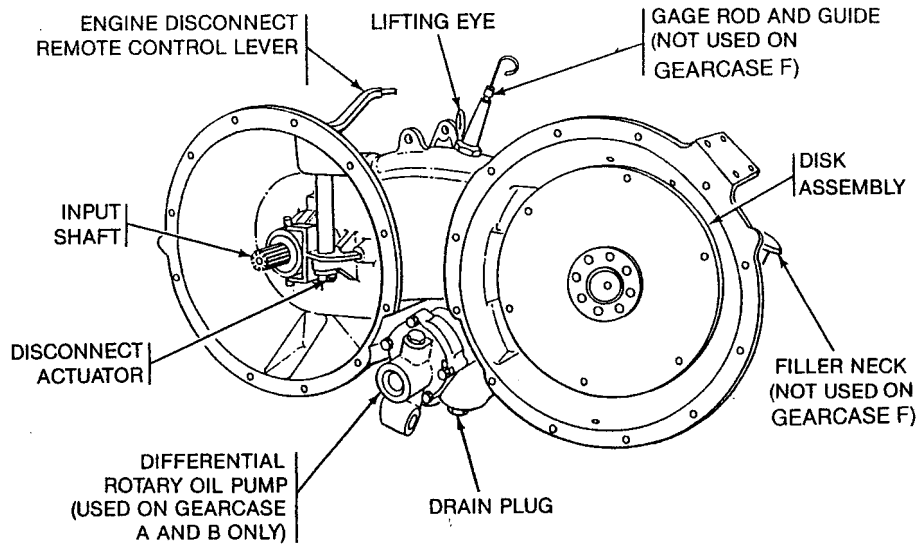
REMOTE CONTROL DISCONNECT LEVER. A manually operated remote control engine disconnect lever disengages the input shaft from the gear train to stop torque flow through the transfer gearcase. This enables the engine to operate with very little load for easier cold weather starting.

HOUSING AND COVER. The housing and cover of the transfer gearcases are made of aluminum and machined as a unit. They must be replaced as a matched pair.

CONFIGURATIONS. The transfer gearcases are similar to each other, differing where the input shaft engages the input gear and the manner in which the engine disconnect remote control lever operates. Other differences are the type and location of externally mounted power takeoff (pulley) assemblies, the installation of externally mounted pumps, and installation of a drive adapter. For specific differences between gearcases, see the following paragraphs.

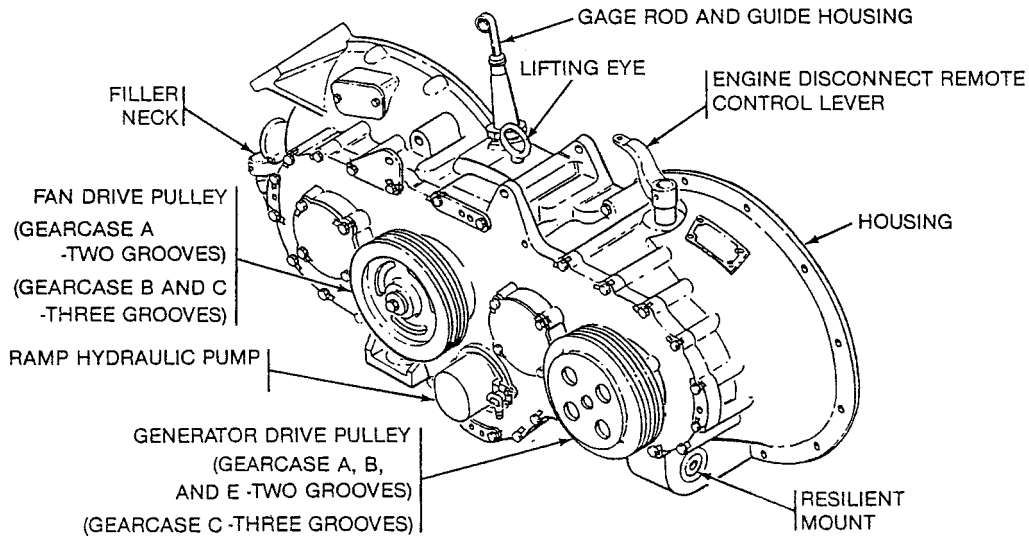


Transfer Gearcases A through C, and E – Rear View

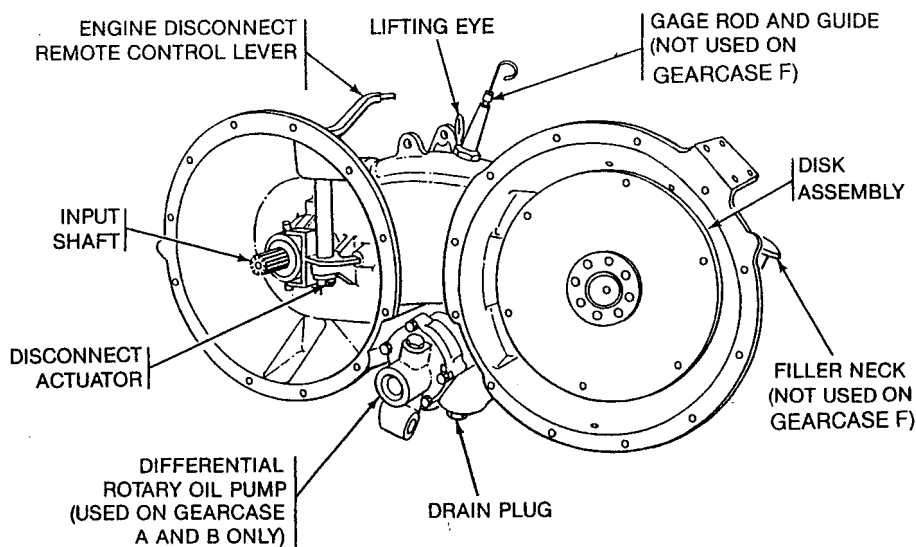


Transfer Gearcases A through F – Front View

TRANSFER GEARCASE A. Like gearcases B and C, transfer gearcase A is converted from service spare transfer gearcase E. Gearcase A is used on the M113A1 Family of Vehicles (FOVs). The gearcase has two two-grooved pulleys (one installed on the input shaft and the other on the hub of the second intermediate gear), a manual engine disconnect remote control lever, an oil filler assembly, an oil level gauge rod and guide, a differential oil pump, and a ramp hydraulic pump. The two pumps are driven internally by the secondary pump-drive gear. The gearcase is filled with oil through a filler assembly and is drained through a hole at the bottom of the housing. The output gear ratio is 1.268:1, and the maximum input speed is 2800 rpm. When the manually operated engine disconnect remote control lever is actuated, the splined input shaft mounted on the roller bearings and supported by the input gear, is disengaged from the input gear and the gear train but remains engaged with the power source (engine) to provide a couple between the engine and drive pulley.

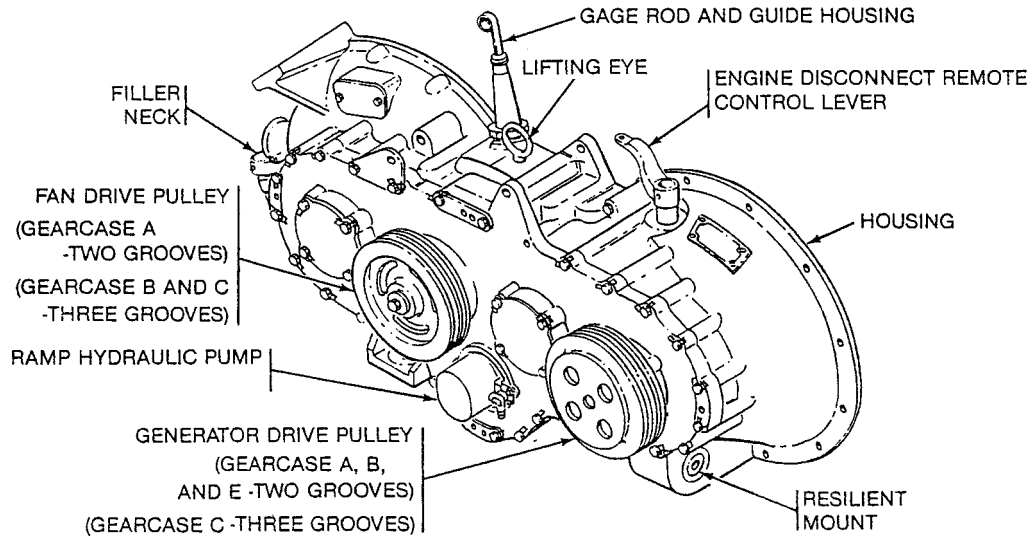


Transfer Gearcases A through C, and E – Rear View

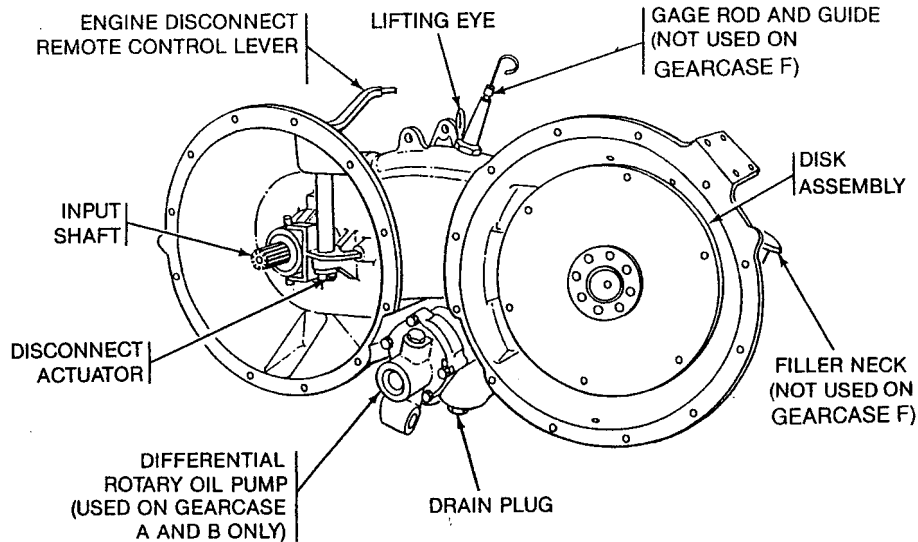


Transfer Gearcases A through F – Front View

TRANSFER GEARCASE B AND C. Transfer gearcases B and C are used on the M113A2 FOVs. They are identical to gearcase A except the pulleys on the hubs of the second intermediate gears has three grooves and both have a different type of manual actuating engine disconnect remote control lever. Gearcase B has a two-groove pulley installed on the input shaft for carriers with 100 ampere generators. Gearcase C has a three-groove pulley installed on the input shaft for carriers with 200 ampere generators.



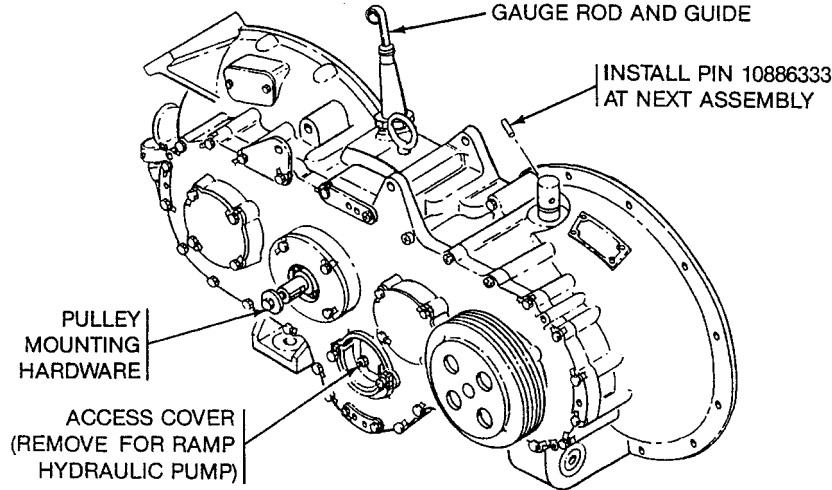
Transfer Gearcases A through C, and E – Rear View



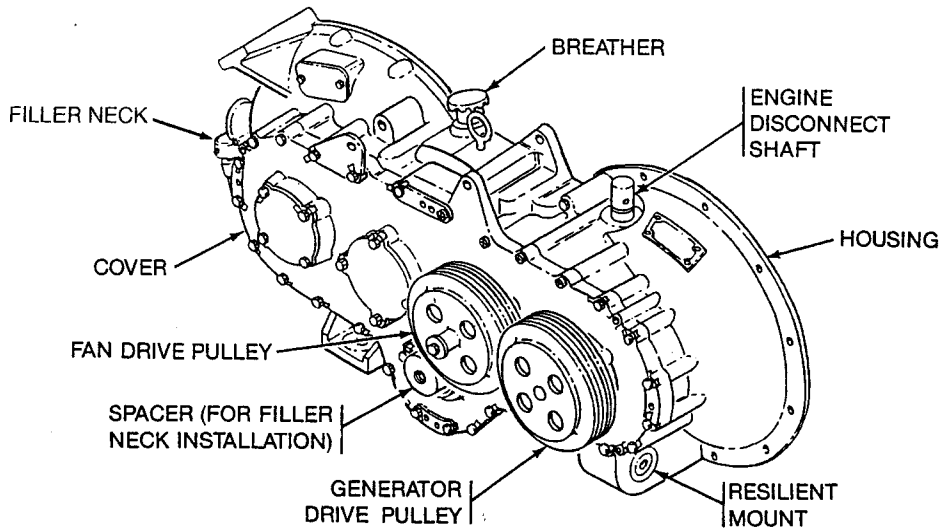
Transfer Gearcases A through F – Front View

TRANSFER GEARCASE E. Transfer gearcase E is used as the service spare transfer gearcase for gearcases A through C. This gearcase has one two-grooved pulley mounted on the input shaft. Mounting hardware is provided for a pulley on the second intermediate gear and for a manual engine disconnect remote control lever. A dummy shaft replaces the differential oil pump. In place of the ramp hydraulic pump there is an access cover plate.

TRANSFER GEARCASE F. Transfer gearcase F is used on the M548A1 carrier. There is no engine disconnect remote control lever. In place of a hydraulic pump there is a spacer and instead of an oil level gauge rod and guide, there is a breather. Unlike gearcases A through C and E, the two-groove pulley is mounted on the hub of the first intermediate gear, not the second.



Transfer Gearcase E Service Spare for Gearcases A through C – Rear View

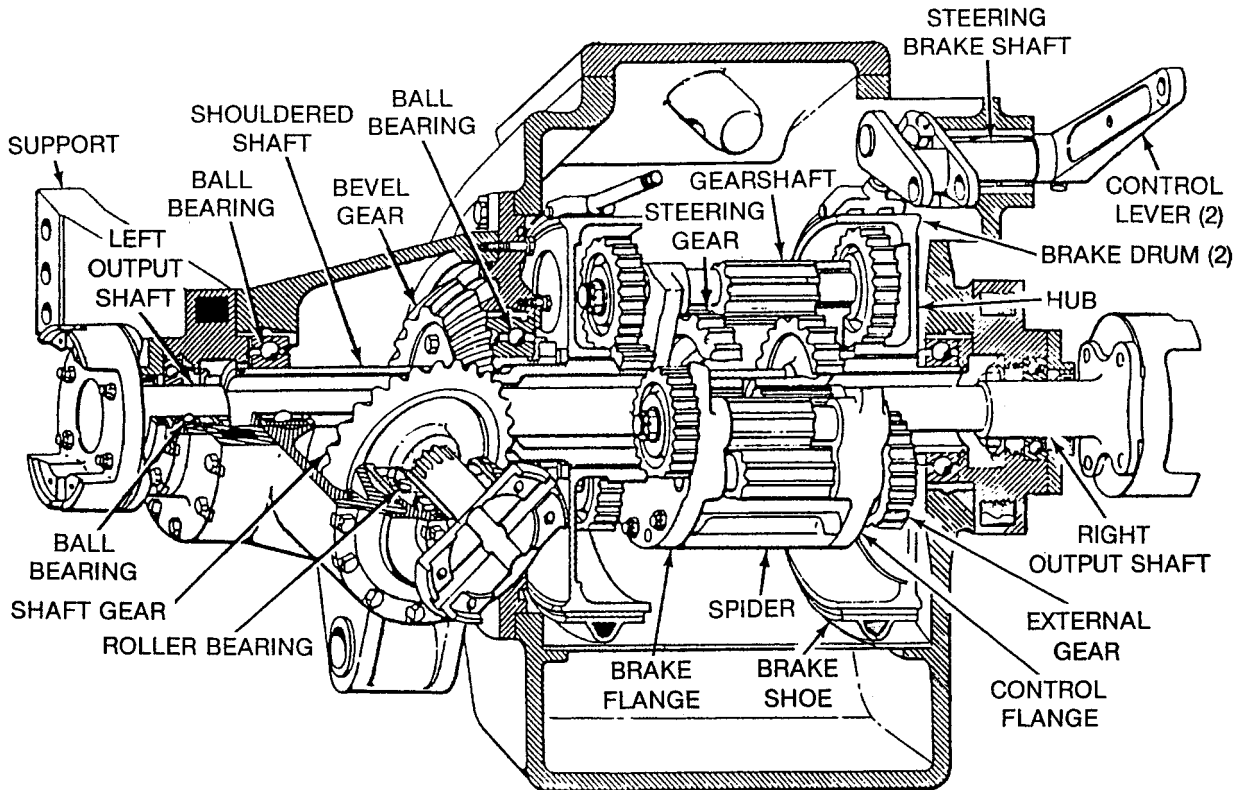


Transfer Gearcase F – Rear View

STEERING CONTROL DIFFERENTIAL

GENERAL. The steering control differential steers the carrier by means of internal brakes which control gear trains to provide rotational velocity differences between output shafts. A thorough understanding of the construction and function of each assembly as described below is essential for proper maintenance of the differential.

DIFFERENTIAL RIGHT ANGLE GEARBOX. A splined propeller shaft couples the right angle gearbox, through a universal joint, to the carrier transmission output shaft. The splined shaft drives a matched spiral bevel gear set consisting of an input shaft gear and an output bevel gear bolted to a shouldered shaft. The input shaft gear is mounted in roller bearings, and the output bevel gear is mounted in ball bearings. The gears and bearings are adjusted by inserting or removing laminated shims.



Steering Control Differential – Cutaway View

STEERING UNIT ASSEMBLY. The steering unit assembly consists of two planetary gear trains, a common carrier, and two brake drums. Brake drum and control flange assemblies are rigidly coupled by a differential spider to form the carrier. Each of the two gear trains consists of a brake drum hub with integral gear, three external spur gears, three spur gearshafts, and steering spur gear. The external gears are fixed to their respective gearshafts and mesh with the integral hub which is bolted to the hub brake drum, and the gearshafts mesh with the steering gear. The gearshafts of both gear trains are positioned in groups of three, with the opposite gearshafts of each group meshing. The brake drums provide differential control.

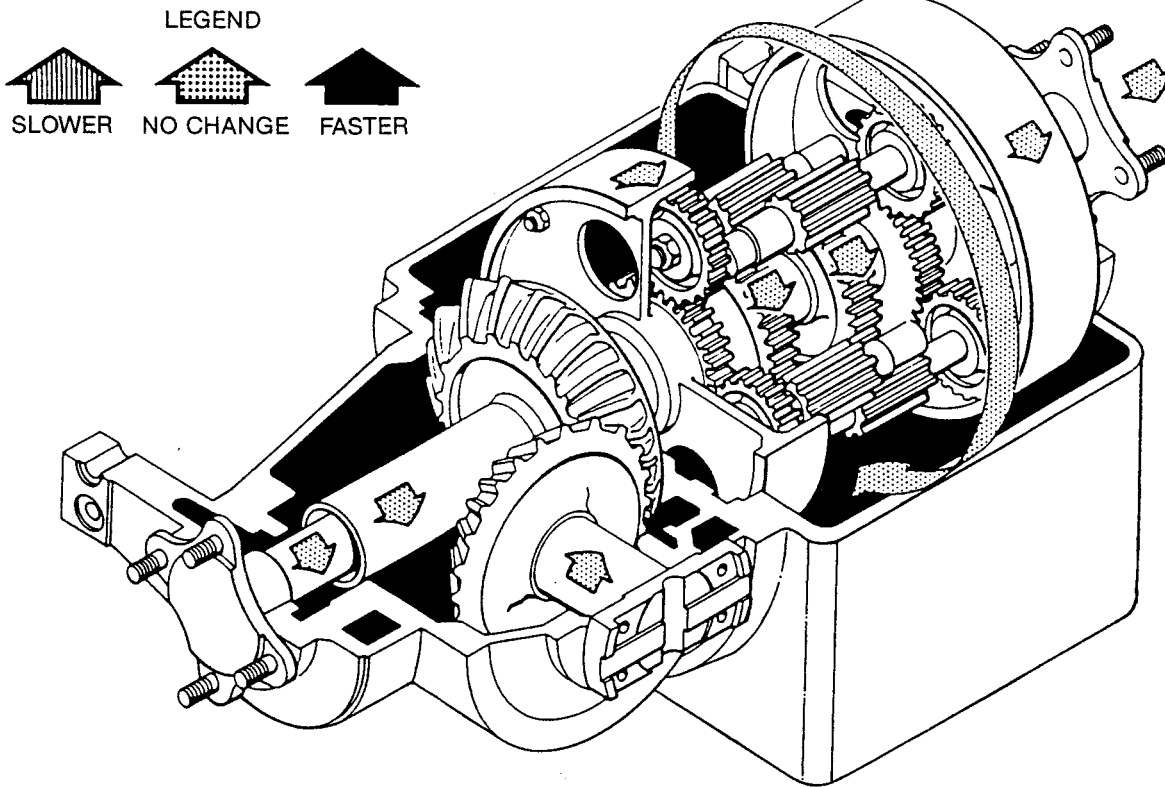
BRAKE SHOE ASSEMBLY. Each brake shoe assembly consists of three brake shoes with replaceable brake friction linings. Each set of brake shoes is held together by pins. They are of the contracting type arranged around the outside of the brake drums. When the right or left brake control lever is pulled, the torque action of the steering brake shaft contracts the diameter of the corresponding set of brake shoes and slows the rotation of that brake drum. When the brake control lever is released, a spring enlarges the diameter of the set of brake shoes allowing the brake drum to increase speed.

OUTPUT SHAFT ASSEMBLY. The splines of the left or right output shaft mate with a left or right steering gear of the steering unit assembly. Each shaft is ball bearing mounted, with bearings pressed on the shaft. The left output support is fixed to the right angle gearbox. The right output support is fixed to the differential housing.

OPERATION

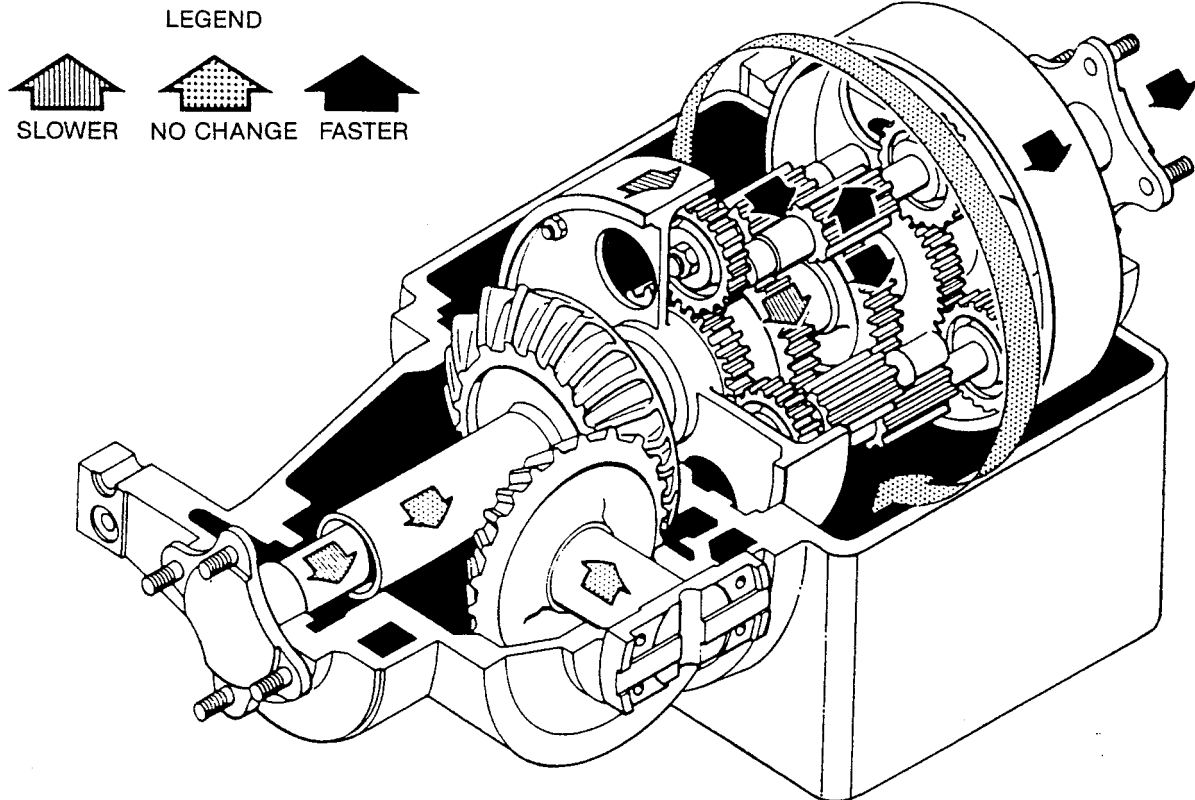
GENERAL. Understanding the movement of parts in relation the movement of the carrier is important for proper maintenance of the differential. Each steering function, in relation to the operation of parts when the carrier is moving ahead, is described below. When the carrier is in reverse, all parts rotate in the opposite direction.

CARRIER MOVING STRAIGHT AHEAD. The right angle gearbox receives torque into the differential, changes torque direction 90°, and transmits the torque to the left flange of the steering unit assembly. When the carrier is moving straight ahead, the steering unit assembly revolves as a unit about a central axis. The output shafts and brake drums revolve at the same velocity as the steering unit, with no change in gear rotation, and the external spur gears and gearshafts do not revolve on their own axis.



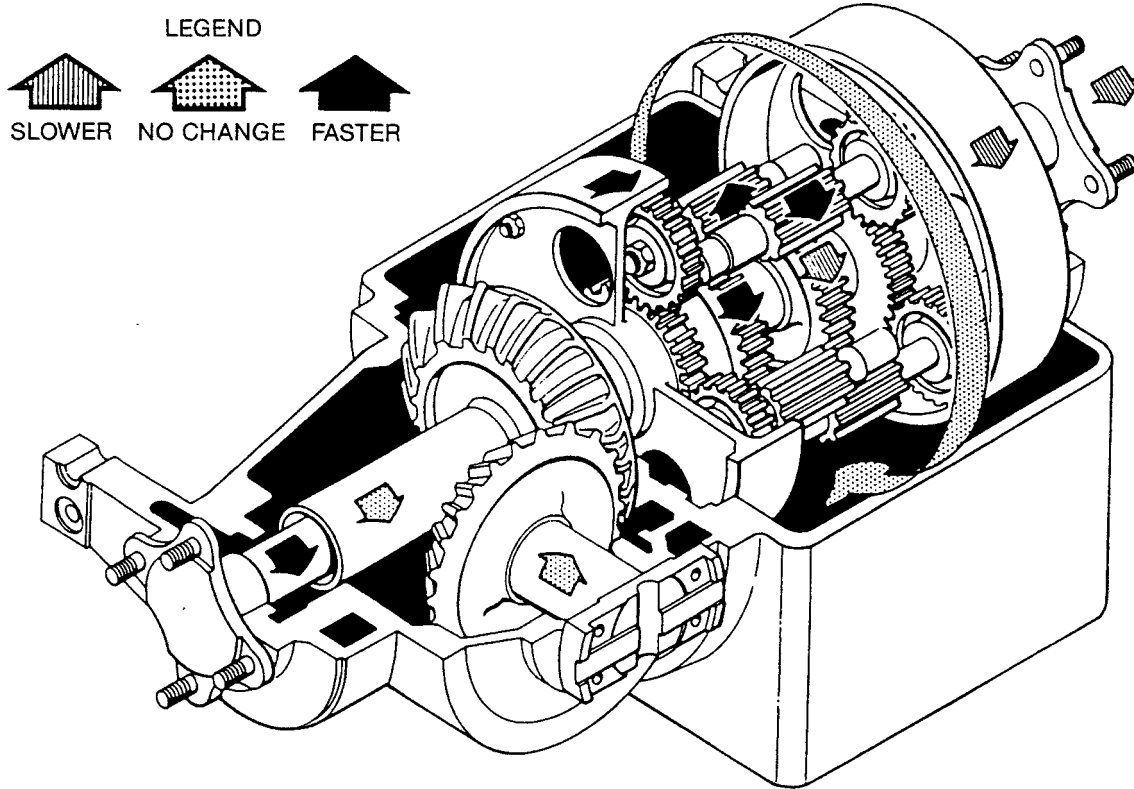
Steering Control Differential Straight Forward Torque Path

CARRIER MOVING TO LEFT WITH LEFT STEERING BRAKE APPLIED. When left brake is applied, the external spur gears and spur gearshafts continue to rotate at the same velocity. Since the brake impedes or even stops the rotation of the brake drum hub, the left external gears, in mesh with the hub gear, begin to rotate on their own axes. The gearshafts, fixed to the external gears, rotate in a direction which slows the rotation of the left steering spur gear, and the track speed on the left side of the carrier decreases. At the same time, the right gearshafts, in mesh with companion left gearshafts, rotate in the opposite direction, which speeds rotation of right steering spur gear, and increases track speed on right side of carrier.



Steering Control Differential Left Steer Torque Path

CARRIER MOVING TO RIGHT WITH RIGHT STEERING BRAKE APPLIED. When the right brake is applied, the same action takes place in the steering unit assembly as described in the left steering brake applied, except the sequence of motion is from right to left.



Steering Control Differential Right Steer Torque Path

SINGLE DISK PIVOT STEER BRAKE AND HYDRAULIC MASTER BRAKE CYLINDER

GENERAL. Two hydraulic master brake cylinders are connected by linkage to pivot steer levers in the driver’s compartment. Each master brake cylinder is connected by hydraulic hose and tubes to a pivot steer brake that controls rotation of the pivot steer brake disk mounted on the left and right side of the steering control differential. Actuating the pivot steer lever manually to the applied position on the inside of a turn causes the rotation of the brake disk, differential output shaft, and track to lock up on that side. This allows the carrier to make quick turns at low speed (15 mph maximum) and provides steering when operating in water.

PIVOT STEER BRAKE ASSEMBLY AND HYDRAULIC MASTER BRAKE CYLINDER. Single disk pivot steer brake and hydraulic brake master cylinder are major components of the pivot steer system installed in carriers listed in Table 1-1, (WP 0001 00). In a pivot steer system, the pivot steer brake assembly has two housings mounted together on a flange on each side of the differential. The pivot steer brake disk rotates in a gap between the two housings. The master cylinder contains a low pressure piston, high pressure piston, and relief valve. As actuated manually by pivot steer lever, the pistons compress the hydraulic fluid, causing a rise in the fluid line to the pivot steer brake. The relief valve prevents pressure from exceeding a preset level.

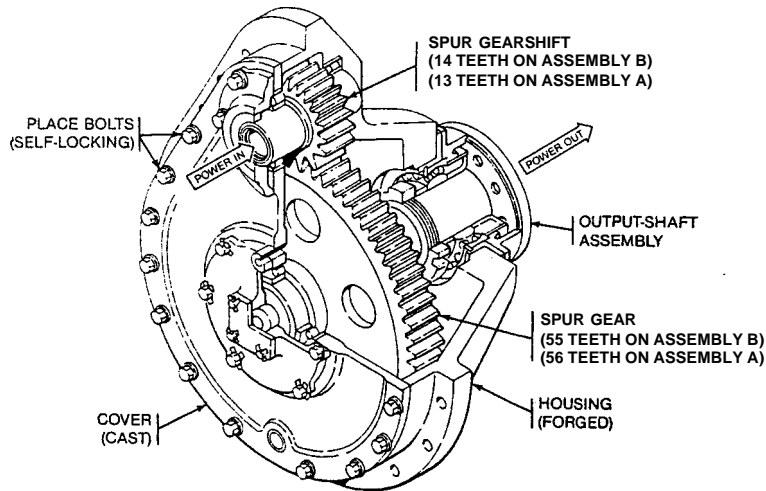
PIVOT BRAKE APPLIED. When hydraulic pressure of 20 to 40 psi is applied to the piston in each housing from its master brake cylinder, the release units in the housing simultaneously causes the brake linings to press against each side of the brake disk to stop the disk from turning.

PIVOT BRAKE RELEASED. Upon release of hydraulic pressure, wave washers in the housings pull the pistons and linings away from the brake disk and releasing the disk and output shaft on the differential.

REPAIR FINAL DRIVE ASSEMBLIES

GENERAL. Final drive assemblies transmit power from the steering control differential to the track drive sprockets. The final drives consist of reduction gears encased in a forged housing with a cast cover and use a flat gasket to seal the cover to the housing.

FINAL DRIVE ASSEMBLIES A AND B. Final drive A has a spur gearshaft with 13 teeth and a spur gear with 56 teeth, resulting in a gear ratio of 4.308:1. Final drive B has a spur gearshaft with 14 teeth and a spur gear with 55 teeth, resulting in a gear ratio of 3.929:1.



Final Drive Assembly A and B

LOCATION AND DESCRIPTIONS OF MAJOR COMPONENTS

For differences between components, see Table 1-1, (WP 0001 00).

For configuration data, see Table 1-1, (WP 0001 00).

REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

0003 00**COMMON TOOLS AND EQUIPMENT**

For authorized common tools and equipment, see the Modified Table of Organization and Equipment (MTOE) for your unit.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special tools you need are listed in Repair Parts and Special Tools List (RPSTL), TM 9-2520-238-34P. Test Measurement and Diagnostic Equipment (TMDE) and special tools are listed in your (WP 0033 00).

FABRICATED TOOLS

These tools enable direct support and general support personnel to fabricate the tools locally. The tools are of particular value to organizations engaged in repairing a number of identical components. Fabricated tools are not available for issue. Materials and dimensions required for tool fabrication are listed in (WP 0034 00).

REPAIR PARTS

Repair parts are listed and illustrated in the repair parts and special tools list TM 9-2520-238-34P, covering direct and general support maintenance for this equipment. Maintenance and supply personnel can order them.

CHECKING EQUIPMENT

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on form SF 368, Quality Deficiency Report.

CHAPTER 2

TROUBLESHOOTING PROCEDURES

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
INTRODUCTION TO HOW TO USE TROUBLESHOOTING.....	0004 00
MALFUNCTION/SYMPTOM INDEX WP.....	0005 00
COOLING FAN RIGHT ANGLE DRIVE LEAKS OIL.....	0006 00
COOLING FAN RIGHT ANGLE DRIVE BINDS OR MAKES GRINDING NOISE.....	0007 00
TRANSFER GEARCASE LEAKS OIL.....	0008 00
DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE TURNING.....	0009 00
DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING.....	0010 00
FINAL DRIVE BINDS OR MAKES GRINDING NOISE.....	0011 00
FINAL DRIVE LEAKS OIL.....	0012 00
FINAL DRIVE HAS WATER INSIDE.....	0013 00

INTRODUCTION TO HOW TO USE TROUBLESHOOTING

0004 00

PURPOSE

The purpose of direct and general support maintenance level troubleshooting is to diagnose carrier problems which are reported to direct and general support maintenance. Troubleshooting tasks in this manual are common to all M113 FOV carriers except where indicated. You should not begin direct and general support maintenance troubleshooting until all operator and unit troubleshooting procedures have been completed. You will perform four actions in direct and general support maintenance troubleshooting:

- (1) Before starting a troubleshooting task, verify that the reported problem is present in the carrier.
- (2) After verifying the symptom, find the part that is causing the problem.
- (3) Replace or adjust that part.
- (4) Check to make sure the problem no longer exists, and that there are no other problems.

DEFINITIONS AND DESCRIPTIONS OF TROUBLESHOOTING PROCEDURES

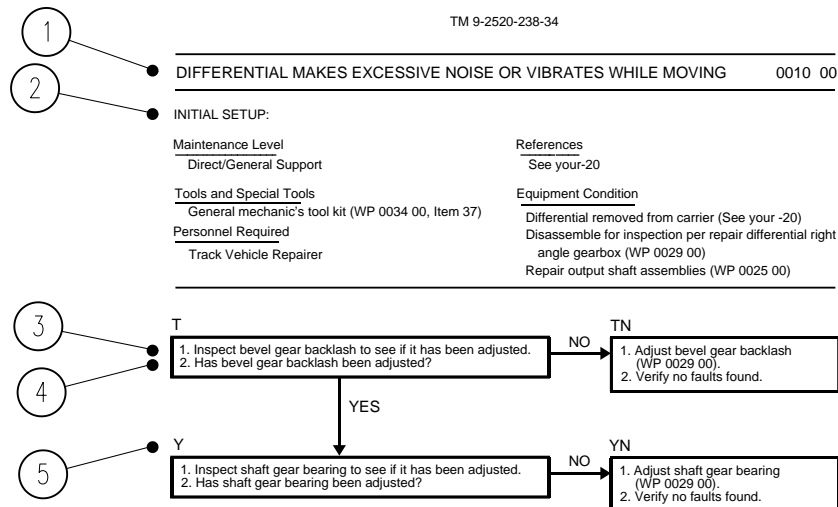
Troubleshooting tasks always have a beginning and an end. You will use task steps, test procedures, indexes, maintenance tasks, and other technical manuals to troubleshoot. Troubleshooting uses the following terms that are not used in other kinds of tasks:

- 1. FAULT:** The part that is not operating correctly and is causing the problem.
- 2. SYMPTOM:** The problem reported to direct and general support maintenance.
- 3. VERIFY NO FAULTS FOUND:** After you have completed the corrective action, you must verify that no faults exist. If the fault condition still exists, then the fault is not fixed or there is another fault. If this happens, start at the beginning of the troubleshooting procedure until you find and correct all faults. Always operate the system and/or carrier to make sure that you have corrected the reported problem. If troubleshooting does not identify a faulty part, the carrier is defective beyond the level of direct and general support maintenance.

TROUBLESHOOTING BASICS

Troubleshooting Procedure

A troubleshooting procedure serves as a starting point for your troubleshooting work. You will branch in and out of procedures as you work to find a fault. Also, you will correct the fault, and check that the fault has been corrected. The parts of a troubleshooting procedure are given below.



Legend to Sample Above

- | | |
|------------------------|--|
| 1 TITLE | This is the name of the procedure. |
| 2 INITIAL SETUP | This tells you the tools, materials/parts, personnel, references, and equipment conditions needed to do the procedure. |
| 3 TASK STEPS | These boxes give you step-by-step instructions. |
| 4 QUESTIONS | This is the last step in YES blocks. The answer to this question will direct you to the next block. |
| 5 BLOCK ID CODE | These codes identify YES/NO blocks for ease of referencing. |

Locating the Correct Troubleshooting Procedure

- (1) Component arrives at shop.
- (2) Read DA form 2404.
- (3) Verify that the problem on DA form 2404 exists.
- (4) Look up the carrier symptom in Troubleshooting Task Index, (WP 0005 00), in this chapter, and go to that task.

Doing the Troubleshooting Procedure

- (1) Make sure you have all items in INITIAL SETUP.
- (2) Perform required action(s) in Equipment Conditions.
- (3) Complete the first block of task steps.
- (4) Refer to system schematic or diagram for system components, detail, and clarification.
- (5) Answer the question at the bottom of the first block.
- (6) Follow YES or NO arrows to the next block.
- (7) Move from block to block. Answer questions and follow instructions. You may be directed to:
 - do further checks and tests on parts; or
 - go to another tasks.

NOTE

After completing the actions called for on another page, return to the point in the troubleshooting procedure where you left off.

- (8) Locate the fault in the carrier or part and perform the corrective action.
- (9) Check to make sure fault is corrected, and no new faults are found.
- (10) Button up by reinstalling items in Equipment Conditions after finishing the troubleshooting task.

TROUBLESHOOTING SAMPLE

The following sample takes you through a typical troubleshooting procedure.

Finding the Right Troubleshooting Procedure

A component arrives at the shop. The DA form 2404 shows that the differential makes excessive noise or vibrates while moving. Therefore, you look up differential makes excessive noise or vibrates while moving will be listed in Malfunction/Symptom Index, (WP 0005 00), in this chapter.

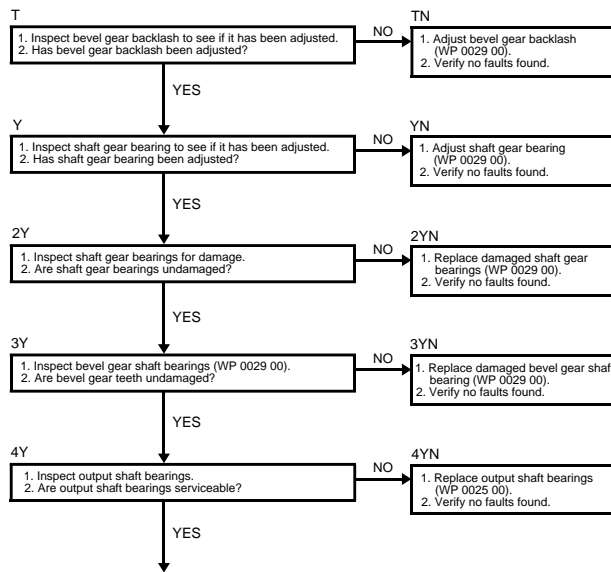
TM 9-2520-238-34

MALFUNCTION/SYMP TOM INDEX WP	0005 00
COOLING SYSTEM	
COOLING FAN RIGHT ANGLE DRIVE LEAKS OIL.....	WP 0006 00
COOLING FAN RIGHT ANGLE DRIVE BINDS OR MAKES GRINDING NOISE.....	WP 0007 00
TRANSFER GEARCASE	
TRANSFER GEARCASE LEAKS OIL.....	WP 0008 00
FINAL DRIVE ASSEMBLIES	
FINAL DRIVE BINDS OF MAKES GRINDING NOISE.....	WP 0011 00
FINAL DRIVE LEAKS OIL.....	WP 0012 00
FINAL DRIVE HAS WATER INSIDE.....	WP 0013 00
REAR AXLE	
DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE TURNING.....	WP 0009 00
DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING.....	WP 0010 00

This is the procedure you want.

TM 9-2520-238-34

DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING	0010 00
INITIAL SETUP:	
Maintenance Level Direct/General Support	References See your-20
Tools and Special Tools General mechanic's tool kit (WP 0034 00, Item 37)	Equipment Condition Differential removed from carrier (See your -20)
Personnel Required Track Vehicle Repairer	Disassemble for inspection per repair differential right angle gearbox (WP 0029 00) Repair output shaft assemblies (WP 0025 00)



0010 00-1

Check title to make sure you are troubleshooting the correct system for the problem. Next, read the INITIAL SETUP carefully. Make sure you have all the items listed in the INITIAL SETUP. Some access steps in Equipment Conditions may not need to be performed depending on the fault location. It's up to you to decide which are necessary for your particular problem.

TM 9-2520-238-34

DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING 0010 00

INITIAL SETUP:

<u>Maintenance Level</u> Direct/General Support	<u>References</u> See your-20
<u>Tools and Special Tools</u> General mechanic's tool kit (WP 0034 00, Item 37)	<u>Equipment Condition</u> Differential removed from carrier (See your -20)
<u>Personnel Required</u> Track Vehicle Repairer	Disassemble for inspection per repair differential right angle gearbox (WP 0029 00) Repair output shaft assemblies (WP 0025 00)

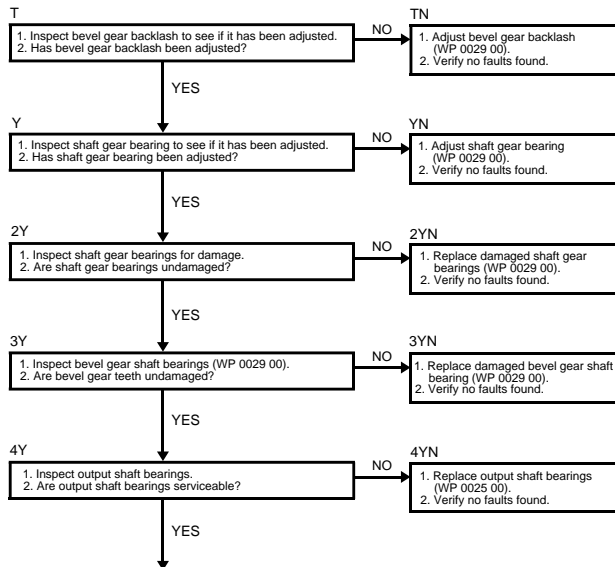
Now you're ready to begin troubleshooting. Look at the first block. Read step 1. If the answer to the question, "Has bevel gear backlash been adjusted?" is YES, follow the Yes arrow to the next box. Read step 1. If the answer to the question, "Has shaft gear bearing been adjusted?" is YES, follow the YES arrow to the next box. Follow the same procedure or each box. If you reach the last box on this page and the answer to the question "Are output shaft bearings serviceable?" is YES, follow YES arrow to the next box.

TM 9-2520-238-34

DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING 0010 00

INITIAL SETUP:

<u>Maintenance Level</u> Direct/General Support	<u>References</u> See your-20
<u>Tools and Special Tools</u> General mechanic's tool kit (WP 0034 00, Item 37)	<u>Equipment Condition</u> Differential removed from carrier (See your -20)
<u>Personnel Required</u> Track Vehicle Repairer	Disassemble for inspection per repair differential right angle gearbox (WP 0029 00) Repair output shaft assemblies (WP 0025 00)



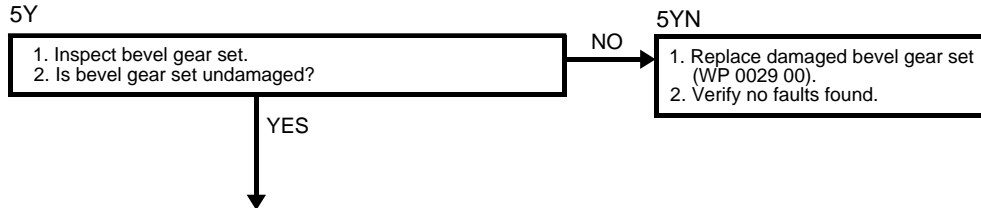
0010 00-1

This is how the box appears once you located it. Do steps 1 and 2. In this sample, if the answer to step 2 is NO, follow the NO arrow to the reference indicated.

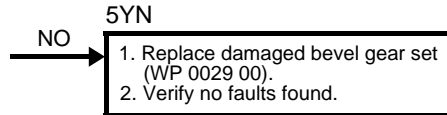
TM 9-2520-238-34

DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING-Continued

0010 00



The NO arrow takes you to this box. You have decided the drum brake is not serviceable. This box gives you the step to correct the fault. Do step 1. It tells you to go to another task in the manual. Go to the page shown and perform the task. Return to this box when you have completed the task.



Step 2 in this box is “Verify no faults found.” You must check to make sure you have correctly fixed the fault. After no faults found has been verified, return carrier to operation. This is the end of the troubleshooting sample.

MALFUNCTION/SYMPTOM INDEX WP

0005 00

COOLING SYSTEM

- COOLING FAN RIGHT ANGLE DRIVE LEAKS OIL.....WP 0006 00
- COOLING FAN RIGHT ANGLE DRIVE BINDS OR MAKES GRINDING
NOISE.....WP 0007 00

TRANSFER GEARCASE

- TRANSFER GEARCASE LEAKS OIL.....WP 0008 00

REAR AXLE

- DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE
TURNING.....WP 0009 00
- DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE
MOVING.....WP 0010 00

FINAL DRIVE ASSEMBLIES

- FINAL DRIVE BINDS OF MAKES GRINDING NOISE.....WP 0011 00
- FINAL DRIVE LEAKS OIL.....WP 0012 00
- FINAL DRIVE HAS WATER INSIDE.....WP 0013 00

COOLING FAN RIGHT ANGLE DRIVE LEAKS OIL

0006 00

INITIAL SETUP:

Maintenance Level

Direct Support

References

See your -34

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)

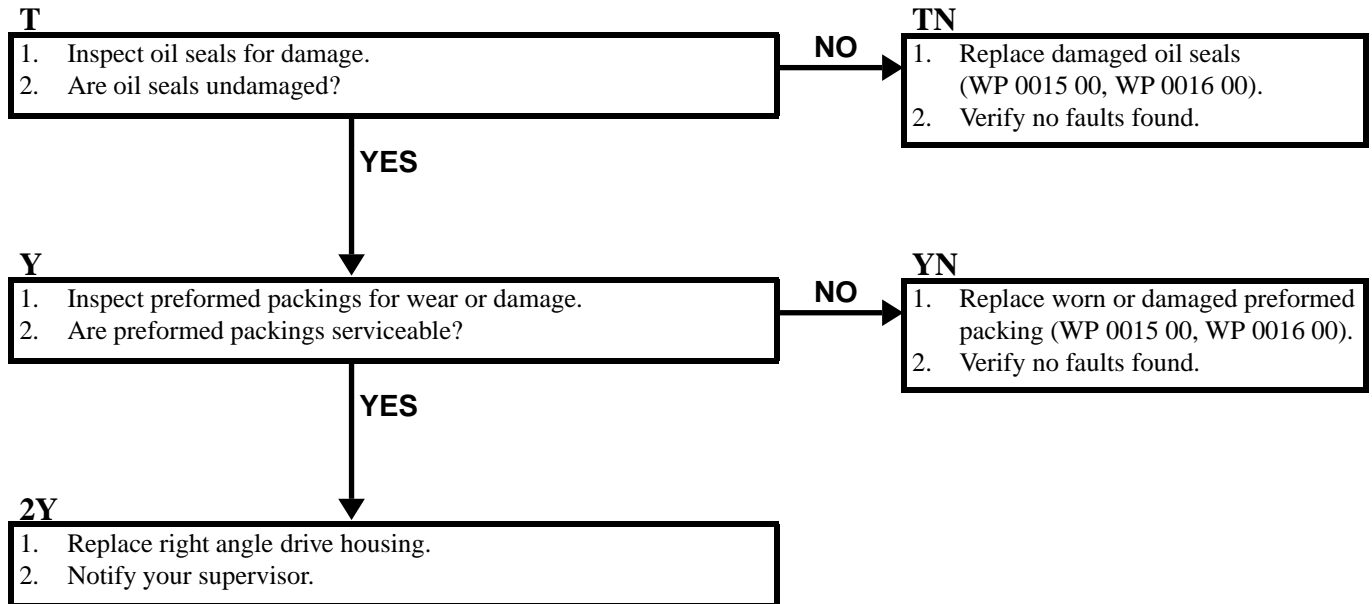
Equipment Condition

Right angle drive removed from fan assembly (See your -34)

Personnel Required

Track Vehicle Repairer

Disassemble for inspection per repair cooling fan right angle drives A, B (WP 0015 00) or C (WP 0016 00)



COOLING FAN RIGHT ANGLE DRIVE BINDS OR MAKES GRINDING NOISE

0007 00

INITIAL SETUP:

Maintenance Level

Direct Support

References

See your -34

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)

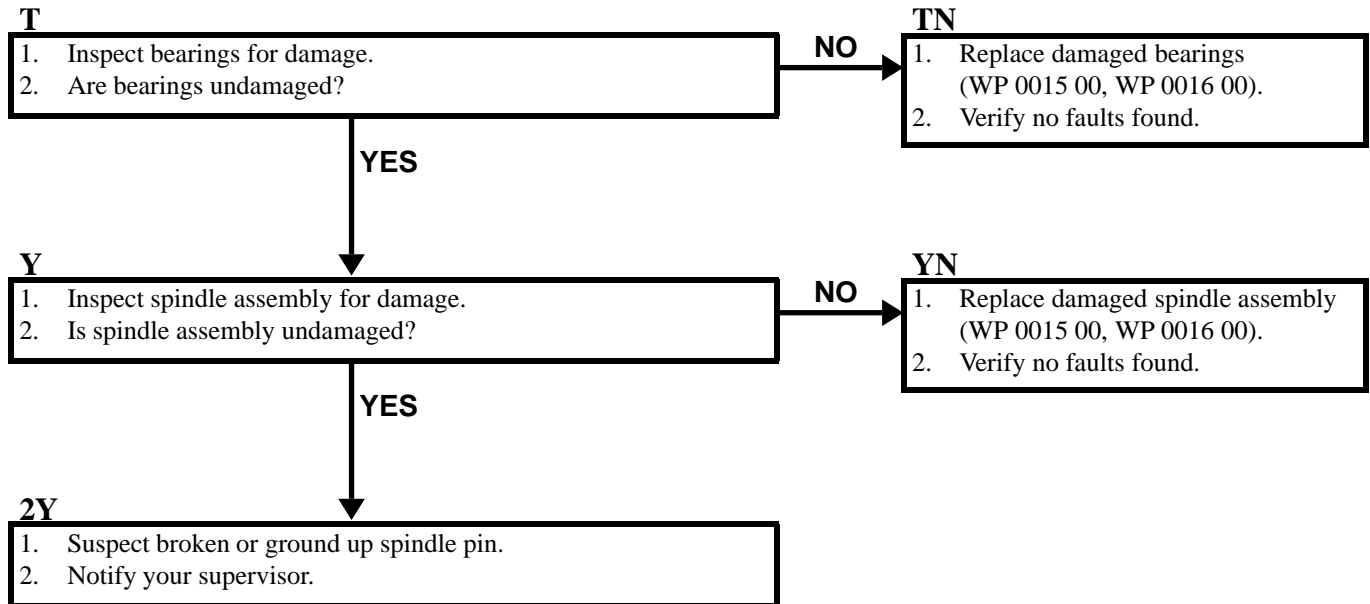
Equipment Condition

Right angle drive removed from fan assembly (See your -34)

Personnel Required

Track Vehicle Repairer

Disassemble for inspection per repair cooling fan right angle drives A, B (WP 0015 00) or C (WP 0016 00)



TRANSFER GEARCASE LEAKS OIL

0008 00

INITIAL SETUP:

Maintenance Level

Direct/General Support

References

See your -20

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)

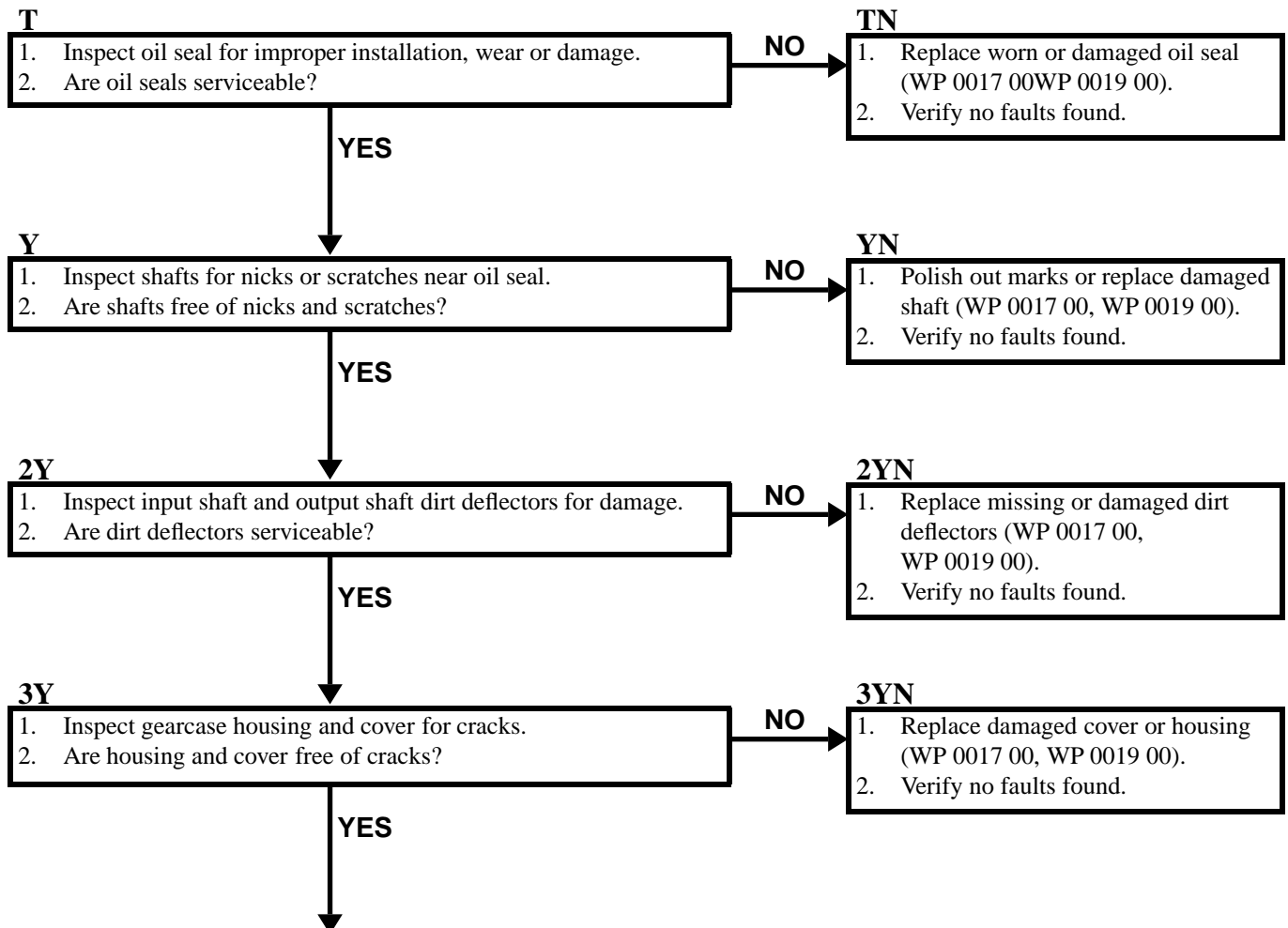
Equipment Condition

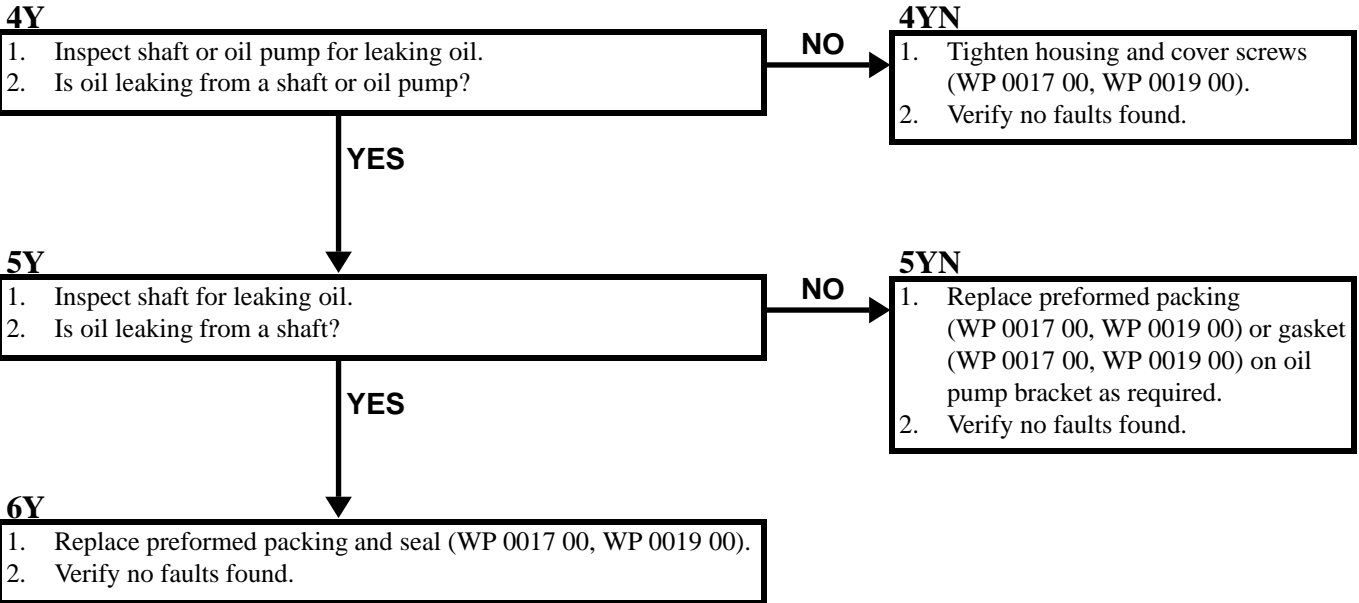
Transfer gearcase removed from carrier (See your -20 & -34)

Personnel Required

Track Vehicle Repairer

Disassemble for inspection per repair transfer gearcase A, B, C (WP 0017 00), E (WP 0018 00) or F (WP 0019 00)





DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE TURNING

0009 00

INITIAL SETUP:

Maintenance Level

Direct/General Support

References

See your -20

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)

Equipment Condition

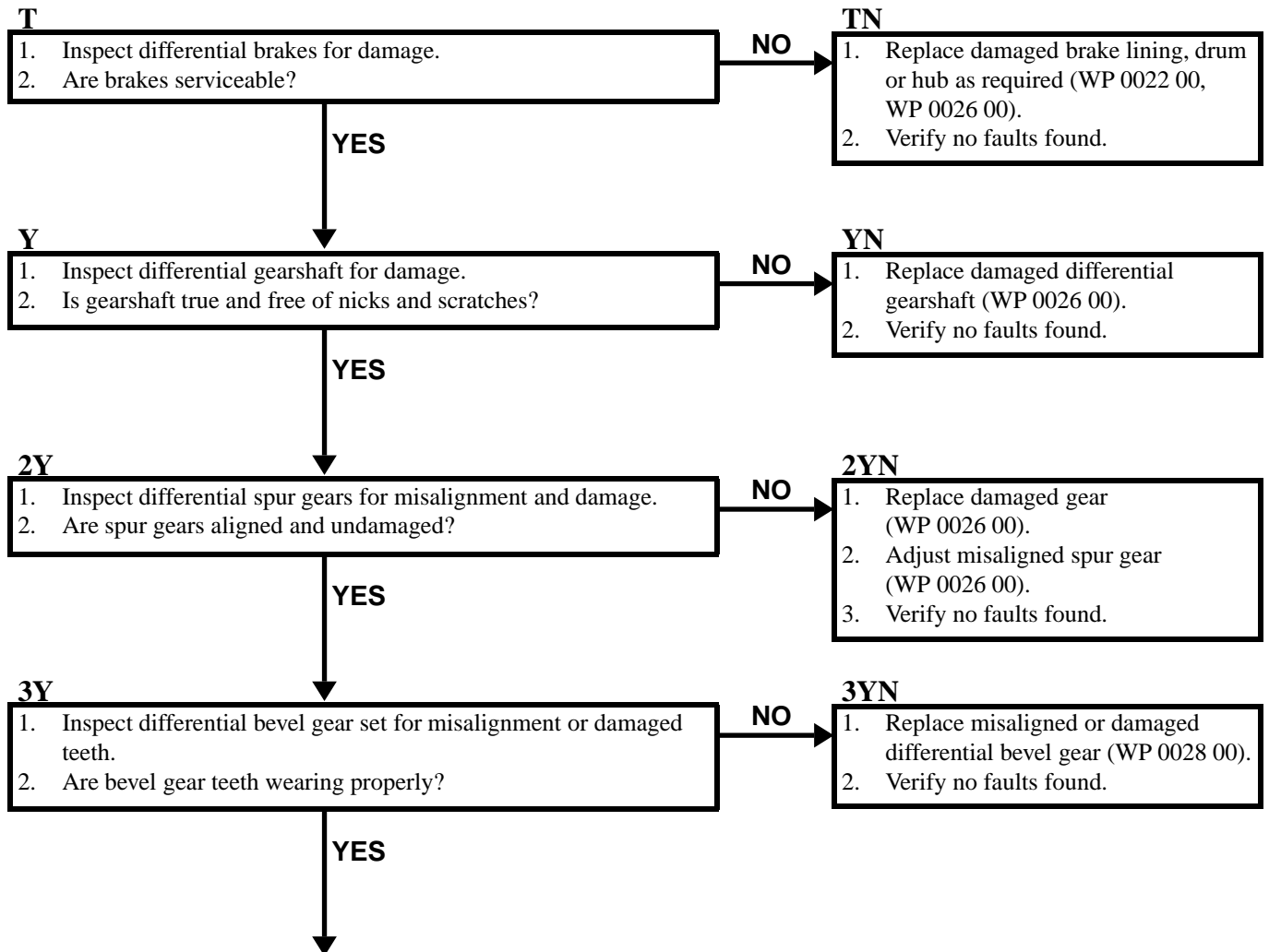
Differential removed from carrier (See your -20)

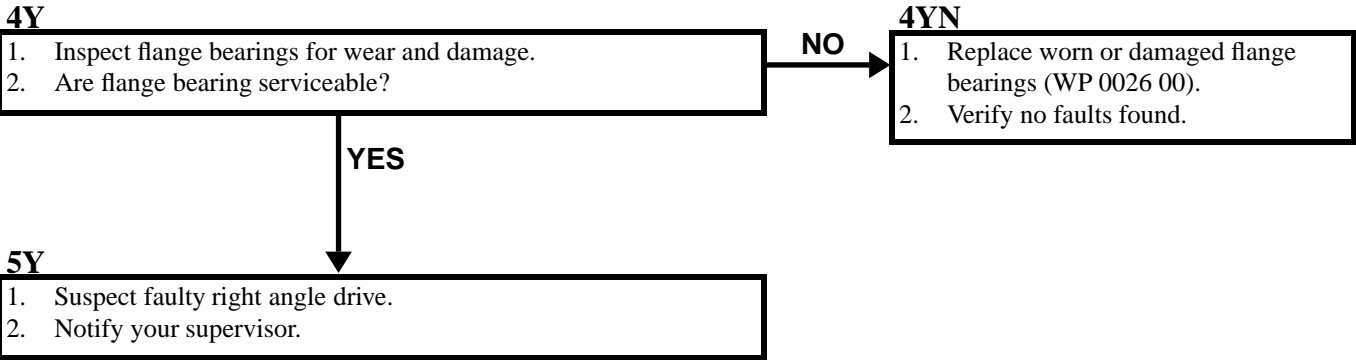
Brake shoe assembly removed (WP 0021 00)

Disassemble for inspection per repair brake shoe assemblies (WP 0022 00)

Repair differential steering control assembly (WP 0026 00)

Repair differential right angle gearbox (WP 0028 00)





DIFFERENTIAL MAKES EXCESSIVE NOISE OR VIBRATES WHILE MOVING

0010 00

INITIAL SETUP:

Maintenance Level

Direct/General Support

References

See your -20

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)

Equipment Condition

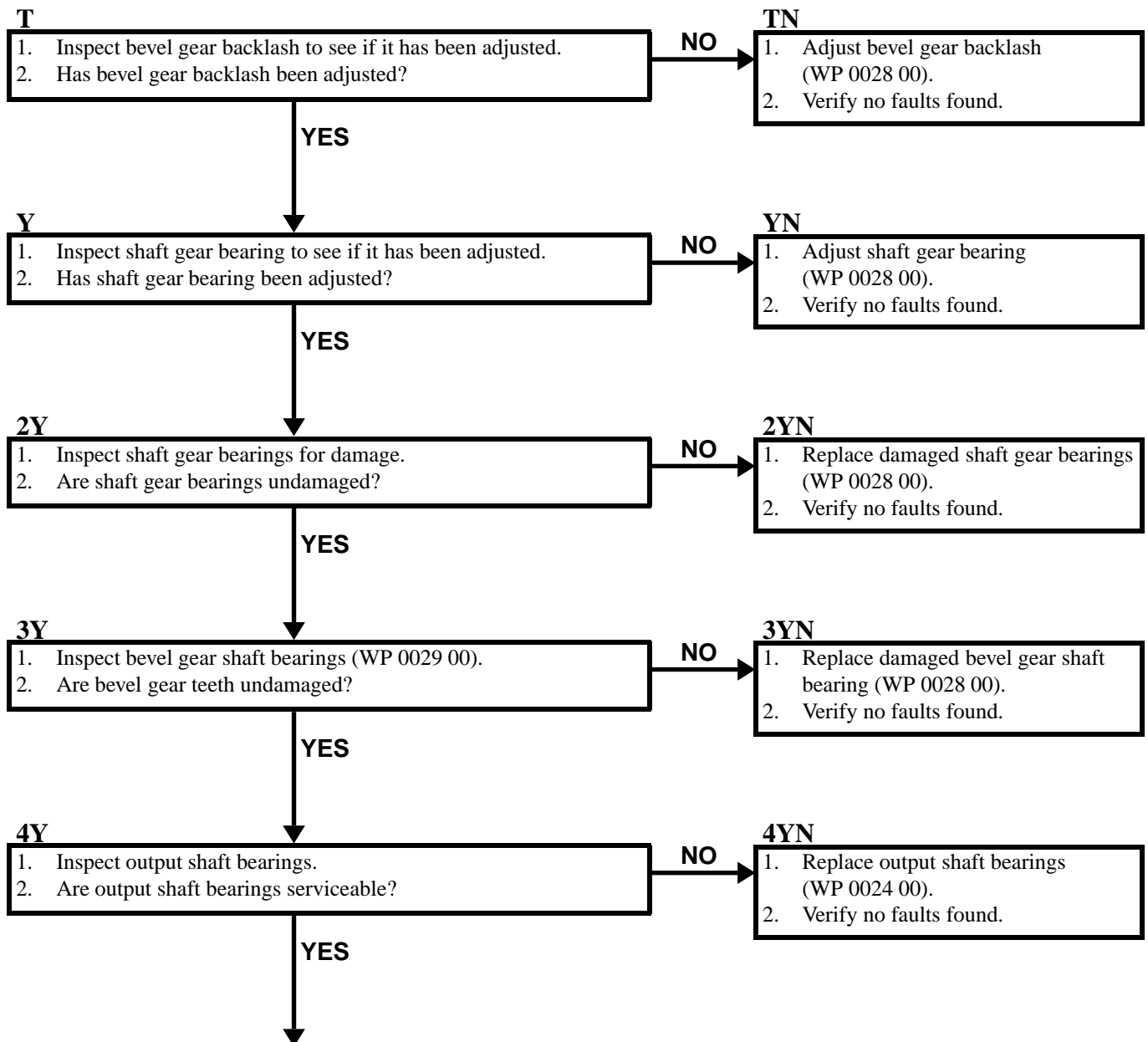
Differential removed from carrier (See your -20)

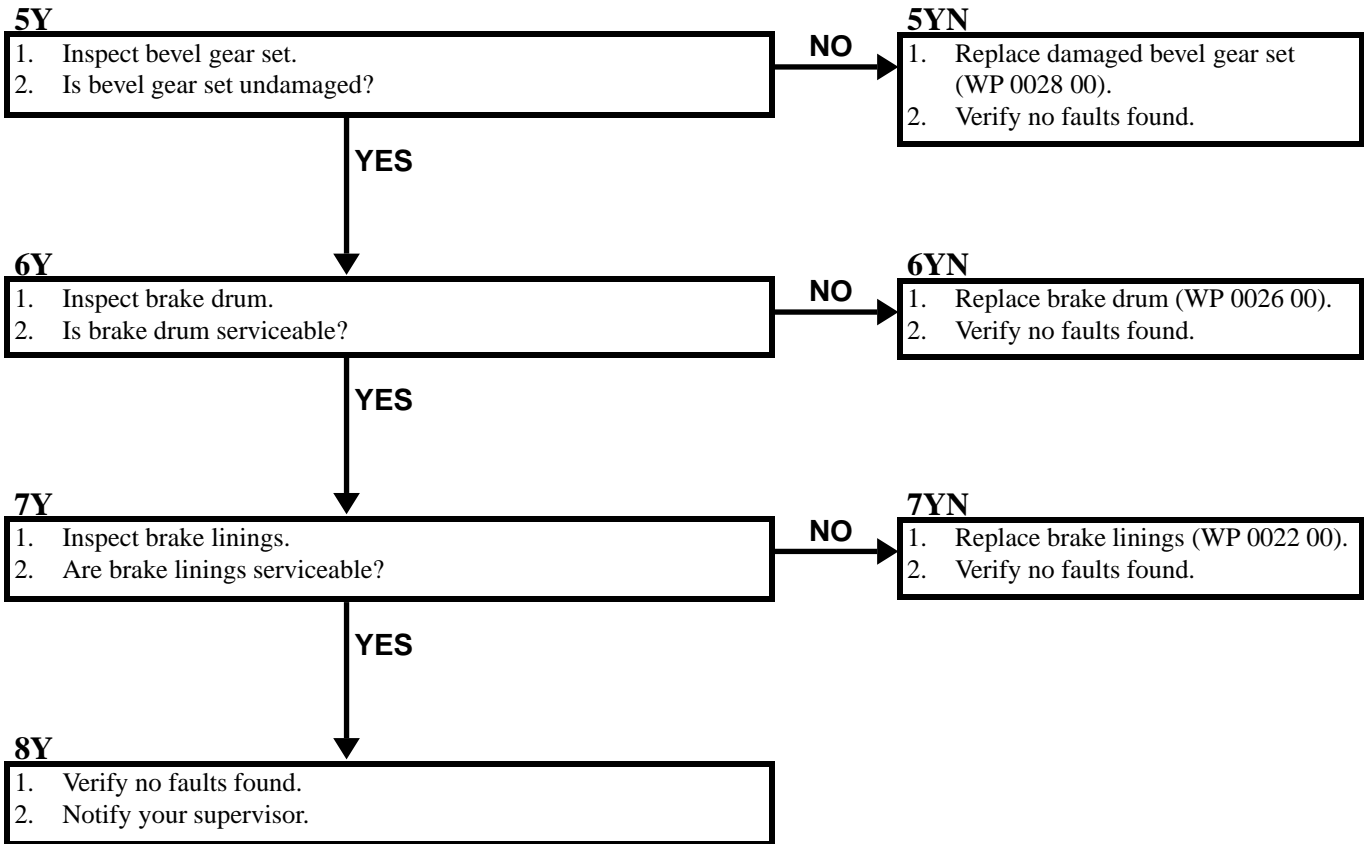
Personnel Required

Track Vehicle Repairer

Disassemble for inspection per repair differential right angle gearbox (WP 0028 00)

Repair output shaft assemblies (WP 0024 00)





FINAL DRIVE BINDS OR MAKES GRINDING NOISE

0011 00

INITIAL SETUP:

Maintenance Level

Direct/General Support

References

See your -20

Tools and Special Tools

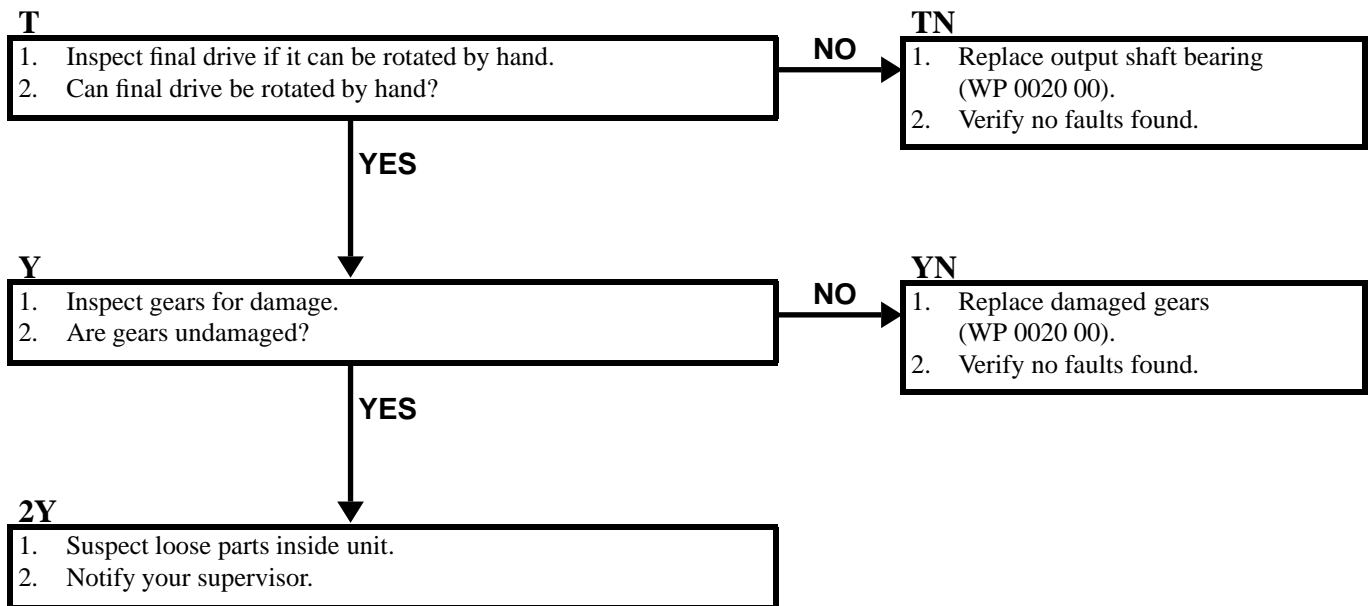
General mechanic's tool kit (WP 0033 00, Item 37)

Equipment Condition

Final drive removed from carrier (See your -20)
Disassemble for inspection per repair final drive assemblies A, B (WP 0020 00)

Personnel Required

Track Vehicle Repairer



FINAL DRIVE LEAKS OIL

0012 00

INITIAL SETUP:

Maintenance Level

Direct/General Support

References

See your -20

Tools and Special Tools

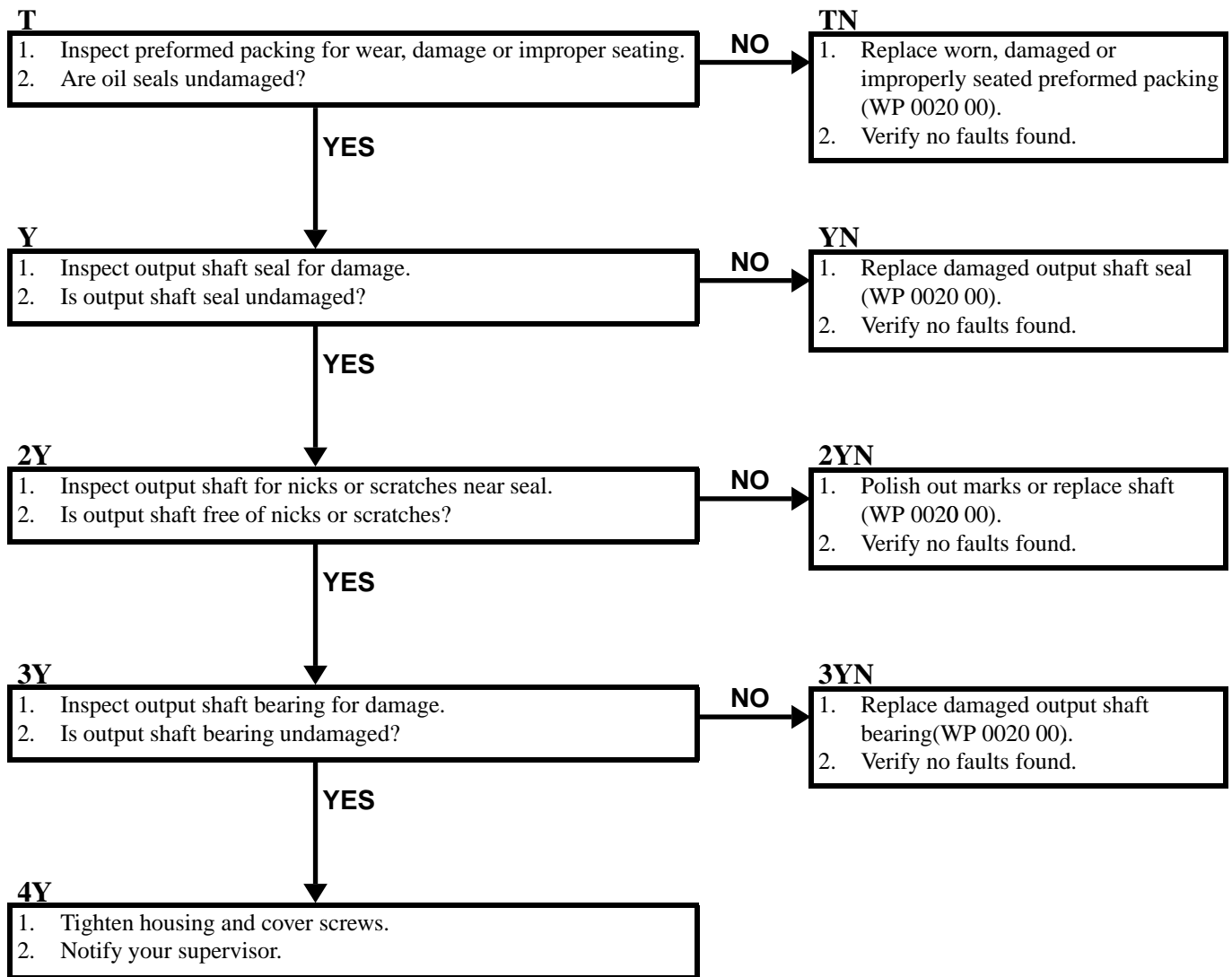
General mechanic's tool kit (WP 0033 00, Item 37)

Equipment Condition

Final drive removed from carrier (See your -20)
Disassemble for inspection per repair final drive assemblies A, B (WP 0020 00)

Personnel Required

Track Vehicle Repairer



FINAL DRIVE HAS WATER INSIDE

0013 00

INITIAL SETUP:

Maintenance Level

Direct/General Support

References

See your -20

Tools and Special Tools

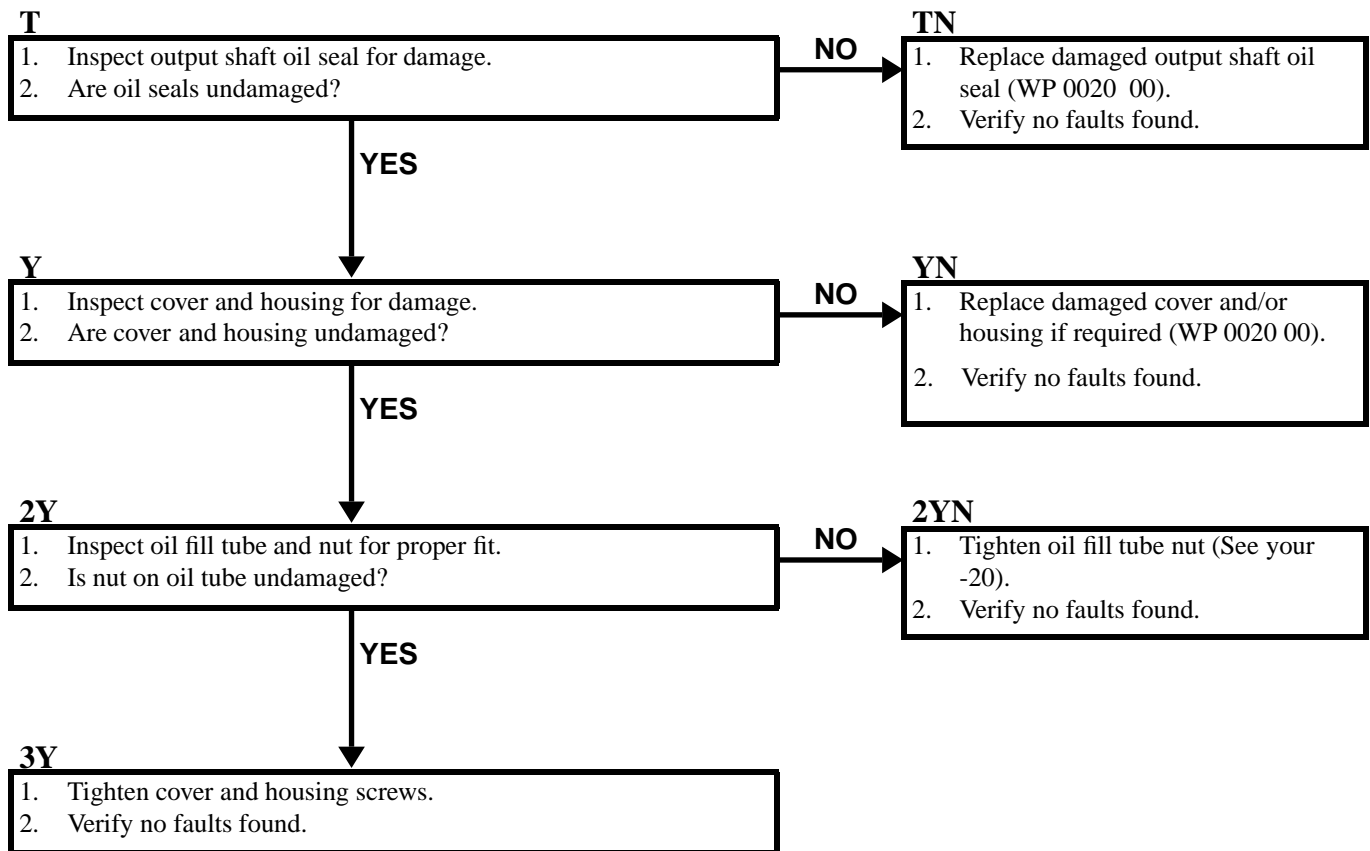
General mechanic's tool kit (WP 0033 00, Item 37)

Equipment Condition

Final drive removed from carrier (See your -20)
Disassemble for inspection per repair final drive assemblies A, B (WP 0020 00)

Personnel Required

Track Vehicle Repairer



CHAPTER 3

**DIRECT SUPPORT MAINTENANCE INSTRUCTIONS
FOR PMCS INCLUDING LUBRICATION PROCEDURES**

WORK PACKAGE INDEX

Title

Sequence No.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS), INCLUDING
LUBRICATION INSTRUCTIONS.....0014 00

**PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS),
INCLUDING LUBRICATION INSTRUCTIONS**

0014 00

THIS WORK PACKAGE COVERS:

INITIAL SETUP:Maintenance LevelDirect Support

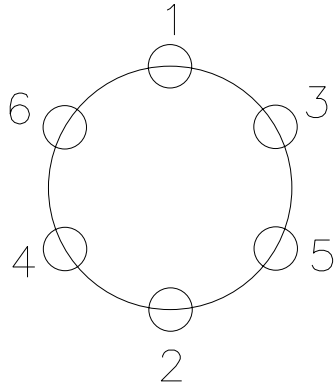
GENERAL MAINTENANCE INSTRUCTIONS**SCOPE**

This section contains safety warnings, guidelines, and general maintenance instructions. They should be followed when doing maintenance procedures authorized for direct and general support maintenance levels.

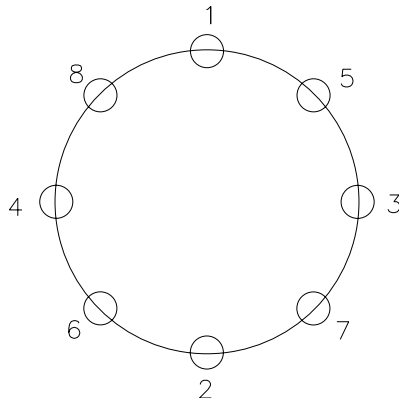
PREPARATION FOR MAINTENANCE

1. **PERSONNEL SAFETY.** Practice all shop safety procedures and read all warnings in this manual.
2. **PROPER EQUIPMENT.** Get tools and equipment before starting a maintenance task. See TM 9-2520-238-34P, and the maintenance tasks for tools, equipment, parts, and materials.
3. **WHAT TO DISCARD.** Parts to discard, such as lockwashers, locknuts, and gaskets are listed in the maintenance tasks. If the step does not say to discard a part, the part should be saved. It may be used later, or repaired.
4. **HANDLING TECHNIQUES.**
 - a. Avoid damage to parts during disassembly, cleaning, inspection, repair, and reassembly procedures. Nicks, scratches, and dents caused by careless handling could result in equipment failure.
 - b. Dirt can damage parts and cause malfunctions. Make sure all air and fluid openings, lines, and hoses are capped or plugged during maintenance procedures.
5. **IDENTIFICATION.**
 - a. During disassembly, tag parts to ensure proper assembly.
 - b. During disassembly, tag leads on electrical parts to ensure proper assembly. Tag each lead, as it is removed, with numbers from wiring diagrams and terminals.

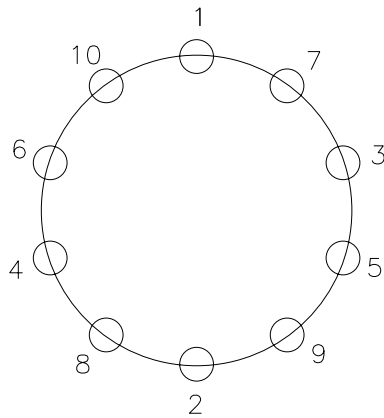
6. **TORQUING.** Where needed, torque values are listed in the maintenance task. When torquing, use one of the star pattern sequences below unless otherwise stated in the maintenance task.



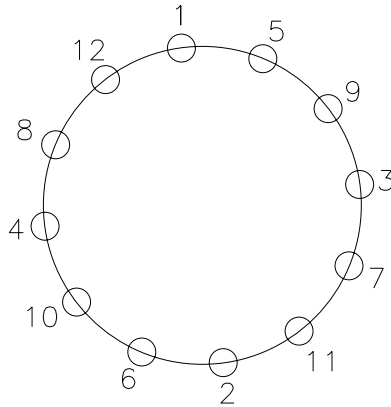
6-HOLE PATTERN



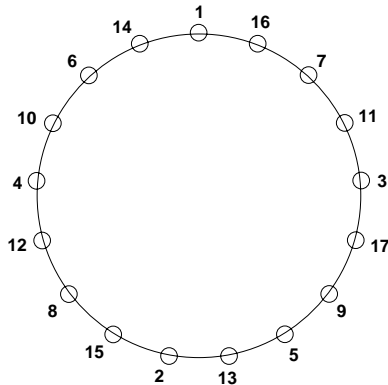
8-HOLE PATTERN



10-HOLE PATTERN



12-HOLE PATTERN



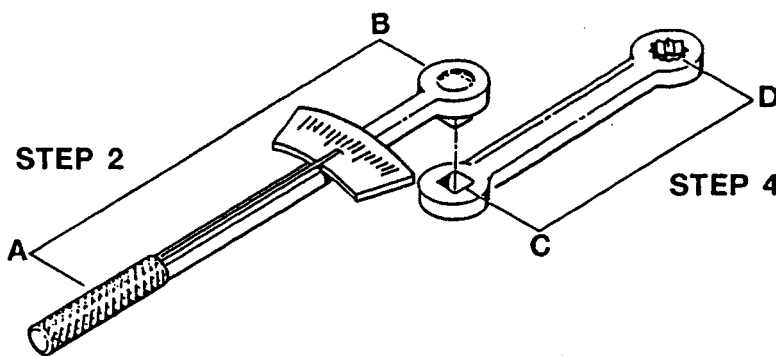
17-HOLE PATTERN

7. TORQUE WRENCH ADAPTERS AND CONVERSION FORMULA.

- a. Torque wrench adapters (extensions) are used to tighten screws and nuts to specific values that cannot be reached with a regular socket on the end of a torque wrench. This makes the dial or scale reading less than the actual torque applied to the screw or nut. When using an adapter, determine the dial or scale reading as follows:
 - 1) Check your manual for specific torque value to which the screw or nut should be tightened.
 - 2) Measure the length of your torque wrench, from the center of the handle (point A) to the center of the socket (point B). Record this measurement.
 - 3) Multiply the above measurement by the desired torque. Record this sum.
 - 4) Measure length of adapter from socket end (point C) to screw or nut end (point D). Record this measurement.
 - 5) Add length of adapter (Step 7a4) to the length of the torque wrench (Step 7a2). Record this sum.
 - 6) Divide the sum found in Step 7a3 by the sum found in Step 7a5.
 - 7) The sum found in Step 7a6 is your torque wrench setting. Set your dial.

NOTE

Setting the torque wrench dial at the reading found in Step 7a7 will deliver the required torque at the end of your adapter.



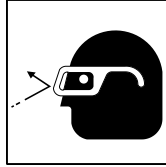
Example: (Metric equivalents omitted for clarity).

- 1) 40 lb-ft required.
- 2) 12 inches.
- 3) $12 \times 40 = 480$.
- 4) 4 inches.
- 5) $12 + 4 = 16$ inches.
- 6) $480/16 = 30$ lb-ft.
- 7) Torque wrench dial setting = 30.

CLEANING

8. **GENERAL.** Cleaning is very important. All parts must be cleaned well and kept clean during maintenance. Dirt or foreign matter can cause malfunctions and equipment failure. General cleaning procedures are detailed in the following steps. Special cleaning procedures are covered in the task relating to the specific part. Clean after repair and before assembly.
9. **CLEAN EVERY PART.** Clean every part well after disassembly and before assembly or installation. Clean parts such as housings, covers, and dipsticks before disassembly. Avoid getting dirt and foreign matter in a system.
10. **HANDLE WITH CARE.** Use care when handling parts during cleaning and maintenance. Nicks, scratches, dents, and burrs can prevent proper assembly or cause malfunctions after assembly.
11. **AVOID ABRASIVES.** Except where specially called for in a task, don't use abrasives, files, wire brushes, or sharp tools. On some surfaces, finish is important to the operation of close fitting parts.
12. **REMOVAL AGENTS.** Remove gum or old grease deposits by soaking parts in cleaning compound WP 0035 00, Item 4. Scrub with a brush. Use crocus cloth to remove minor surface defects.

WARNING



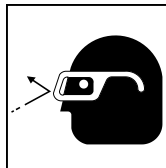
Air pressure in excess of 30 psi (207 kPa) can injure personnel. Do not direct pressurized air at yourself or others. Always wear goggles.

CAUTION

Lye or caustic substances will damage metal surfaces. Do not use lye or caustic mixtures to clean metal surfaces.

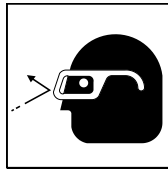
13. **STEAM CLEANING.** If steam cleaning is used, dry clean parts at once with compressed air. Apply a thin film of clean oil to surfaces that are not painted to prevent rusting. Never use lye or caustic mixtures that will corrode or etch metal surfaces.
14. **LUBRICATION OF NEW BEARINGS.** See TM 9-214 for cleaning and lubrication procedures. Bearings that have been in service should also be lubricated.
15. **CLEANING INSTRUCTIONS.** Care is needed in all cleaning procedures. Dirt can damage parts and cause malfunctions. When you perform any cleaning procedure, do the following:
 - a. Inspect and cap all air and fluid openings, lines, and hoses.
 - b. Clean all parts before inspection, after repair, and before assembly. Use cleaning compound WP 0035 00, Item 4 or approved cleaner. Dry parts with wiping rag WP 0035 00, Item 17.
 - c. Keep hands free of grease. Grease collects dirt.
 - d. After cleaning, cover or wrap parts to protect from dirt.

WARNING



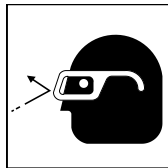
Air pressure in excess of 30 psi (207 kPa) can injure personnel. Do not direct pressurized air at yourself or others. Always wear goggles.

16. **CASTINGS.**
 - a. Clean inner and outer surfaces of casting with cleaning compound WP 0035 00, Item 4. Dry casting with compressed air.
 - b. Remove sludge and gum deposits with a brush.
 - c. Blow out all tapped holes and armor mounting inserts with compressed air.

WARNING

Air pressure in excess of 30 psi (207 kPa) can injure personnel. Do not direct pressurized air at yourself or others. Always wear goggles.

17. **BALL BEARINGS.** Bearings require special cleaning techniques. See TM 9-214 for cleaning and maintenance procedures for ball bearings.

WARNING

Air pressure in excess of 30 psi (207 kPa) can injure personnel. Do not direct pressurized air at yourself or others. Always wear goggles.

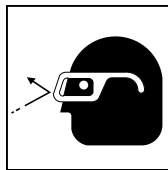
18. **OIL PASSAGES.**

- a. Make sure all oil passages are not clogged.
- b. Clean oil passages and break up any sludge or gum deposits.
- c. Flush oil passages with cleaning compound WP 0035 00, Item 4. Dry parts with compressed air.

CAUTION

Cleaning solvent causes leather, rubber, and synthetic materials to become brittle. Do not use cleaning solvent to clean seals, cables, and flexible hoses.

19. **OIL SEALS AND FLEXIBLE HOSES.** Clean seals, cables, and flexible hoses with detergent and water. Dry parts with wiping rag WP 0035 00, Item 17.

WARNING

Air pressure in excess of 30 psi (207 kPa) can injure personnel. Do not direct pressurized air at yourself or others. Always wear goggles.

20. **INSERTS.** Blow out insert holes with compressed air.
21. **GASKETS.** If gasket is being removed, scrape old gasket material and sealant off mating surface. Clean mating surface with cleaning compound WP 0035 00, Item 4. Dry with wiping rag WP 0035 00, Item 17.

**PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS), INCLUDING
LUBRICATION INSTRUCTIONS — Continued**

0014 00

INSPECTION

All removed parts must be inspected with care. Replace parts if damage or wear exceeds allowable limits.

22. **GENERAL.** Procedures for inspection will be the same for most parts. General inspection procedures are given in the following steps. Special inspection procedures are covered in the task as needed.
23. **CASTINGS.**
 - a. Use magnetic particle inspection equipment to check ferrous castings for cracks. Use a magnifying glass and strong light to check nonmetal castings for cracks. Check areas next to studs, threaded inserts, sharp corners, and fillets.
 - b. Inspect all castings and forgings for breaks, cracks, and wear or scoring that would impair function.
 - c. Inspect machined surfaces for nicks, burrs, and raised metal. Mark damaged areas for repair.
 - d. Use straightedge to check all mounting flanges on housings and supports for bends. Inspect mating flanges for stains which would indicate oil leakage.
 - e. Inspect all threaded parts for damaged or stripped threads.
24. **ROLLER AND BALL BEARINGS.** Inspect bearing races for wear and color changes due to heat. See TM 9-214 for inspection procedures for ball bearings.
25. **NEEDLE ROLLER BEARINGS.** Inspect bearings for free and smooth rotation, and broken or missing rollers. Also look for tightness of fit in bearing bores. Inspect bearing races for wear and color changes due to heat. See TM 9-214 for inspection procedures.
26. **STUDS.** Inspect all studs for stripped or damaged threads, bent or loose condition, and signs of stretching.
27. **GEARS.**
 - a. Use magnetic particle inspection equipment to check all gears for cracks.
 - b. Inspect gears for burrs, wear, cracked or broken teeth, and pitting at tooth contact areas.
28. **BUSHINGS AND BUSHING-TYPE BEARINGS.**
 - a. Check all bushings and bushing-type bearings for secure fit in casting. Check for color changes which could mean overheating. Inspect for size, scoring, out-of-roundness, burrs, sharp edges, and signs of seizing.
 - b. Check for dirt in oil holes and in bushing type bearings. Oil holes and grooves must be clean and not damaged.
29. **OIL/GREASE SEALS.**
 - a. Inspect lip seals for cracks, wear, cuts, and brittleness. Inspect springs and seal shells for damage.
 - b. Replace seals when there are signs of damage or oil leakage.
30. **PREFORMED PACKINGS AND GASKETS**
 - a. Gaskets and seals on electrical parts may be reused. Inspect gaskets and seals for wear, nicks, cuts, and torn or missing gasket material. Replace gasket if needed.
 - b. All other preformed packings and gaskets should be replaced when removed unless otherwise stated in the maintenance task.
31. **CORE HOLE PLUGS.** Inspect core holes for signs of leakage. Replace damaged core hole plugs.
32. **INSERTS.**
 - a. Inspect inserts for cracks and stripped or damaged threads.
 - b. Check inserts for loose fit.

**PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS), INCLUDING
LUBRICATION INSTRUCTIONS — Continued**

0014 00

33. **SPLINED PARTS.** Inspect splined parts for burrs, wear, and twisted, cracked or broken splines.
34. **THREADED PARTS.** Inspect all threaded parts for burrs, and stripped or damaged threads.
35. **RETAINING RINGS.** Inspect retaining rings for nicks, burrs, defects, loss of tension, or wear.
36. **SPRINGS.** Inspect springs for wear, defects, breaks, and loss of tension or compression. Inspect springs using a spring tester.
37. **SHAFTS AND SPINDLES.** Inspect shafts and spindles for excessive wear, binding, scores, cracks, burrs, and obstructed oil passages.

REPAIR

38. **GENERAL.** General repair procedures are given in the following steps. Special repairs are covered in the task. After repair, clean all parts well.
39. **CASTINGS.**
 - a. Replace all cracked or broken castings.
 - b. Repair minor damage to machined surfaces of castings with crocus cloth. Replace any part with defects that cannot be corrected or which will impair function.
 - c. Repair minor surface bends by working bent surface of casting across sheet of crocus cloth on surface plate. Replace bent castings which would impair assembly or function.
 - d. Repair damaged pipe or screw threads with correct tap or die.
40. **BALL BEARINGS.** See TM 9-214 for inspection and maintenance of ball bearings.
41. **NEEDLE ROLLER BEARINGS.** See TM 9-214 for inspection and maintenance of needle roller bearings.
42. **STUDS.**
 - a. Replace all bent or loose studs, or studs which show signs of stretching.
 - b. Repair minor thread damage with standard thread chaser.
 - c. To remove studs, back out studs slowly with stud extractor to avoid heating and possible seizure. If studs are broken too short to use extractor, drill and extract studs with suitable remover. A short stud may be removed by welding nut to stud and removing with wrench.
 - d. To replace studs, lightly apply antiseize compound to stud before you install it. Only standard studs are supplied for repair parts. If threaded hole is damaged beyond repair, drill and tap damaged hole. Install threaded insert in tapped hole.
43. **GEARS.**
 - a. Replace gears that have worn, pitted or gouged teeth.
 - b. Remove sharp burrs from gear teeth with crocus cloth dipped in cleaning compound WP 0035 00, Item 4.

CAUTION

Damaged housing bore can cause equipment failure. Do not damage housing bore when cutting bushings.

NOTE

Do not remove bushings and bushing-type bearings unless replacement is necessary and authorized. Removal usually damages these parts.

44. **BUSHINGS AND BUSHING-TYPE BEARINGS.**

**PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS), INCLUDING
LUBRICATION INSTRUCTIONS — Continued**

0014 00

- a. Replace bushings and bushing-type bearings if they are loose, scored, or have color change due to heat. When you replace bushings and bushing type bearings, check nearby parts for damage or wear.
 - b. Remove bushings and bushing-type bearings by pressing them out. Use a suitable arbor press or special tools. It may be necessary to remove bushings in blind holes with a saw, or by using a narrow cap chisel.
 - c. Install bushings or bushing type bearings by aligning them in casting or retaining cage. Press bushing or bushing-type bearings into place with suitable arbor press or with special tools.
45. **OIL/GREASE SEALS.** Seals must be replaced when seal lip shows signs of wear, brittleness, cracks or damage. Replace seal if tension spring or seal shell is damaged.
- a. Press damaged oil seal from casting. Be careful not to damage bore.
 - b. When oil seal bore is damaged so an oil tight seal is impossible, replace casting or adapter. Remove slight nicks, burrs, and scratches with crocus cloth dipped in cleaning compound WP 0035 00, Item 4.
 - c. Install new oil seal in casting bore or adapter using suitable oil seal replacement tool.
46. **PREFORMED PACKINGS AND GASKETS.** Preformed packings and gaskets should be replaced when removed unless otherwise stated in the maintenance task. They should not be reused.
47. **INSERTS.** Replace insert when threads are stripped or when insert is cracked or loose.
- a. Drill and remove damaged insert from casting.
 - b. Install new insert in casting using suitable replacement tool.
48. **SPLINED PARTS.**
- a. Remove burrs from splined parts with a soft honing stone.
 - b. Replace parts that are worn or have twisted, cracked, or broken splines.

NOTE

Chase threads with a used tap or die. A new tap may cut oversize, while a new die may cut undersize.

49. **THREADED PARTS.** Repair all parts that have stripped or damaged threads by chasing threads with a used tap or die. Replace parts that cannot be repaired.
50. **RETAINING RINGS.**
- a. Retaining rings should be replaced when removed unless otherwise stated in the maintenance task. They should not be reused.
 - b. Some retaining rings are beveled on one side. When installing this type of ring, the beveled side must face the part to be retained.
51. **SPRINGS.** Discard springs that have defects. Load and height inspection data, where needed, are given in maintenance procedures.
52. **SHAFTS AND SPINDLES.**
- a. Replace shafts and spindles that show signs of wear, binding, scores, cracks, burrs, or clogged oil passages.
 - b. Remove obstructions with compressed air or by probing with soft wire.
 - c. Remove burrs and minor surface defects with a crocus cloth.
53. **ELECTRICAL PARTS.**
- a. Replace corroded or burned parts and parts which show signs of mildew.

**PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS), INCLUDING
LUBRICATION INSTRUCTIONS — Continued**

0014 00

- b. Tighten loose connections.
- c. Replace cracked or broken wires, circuit cards, relays, and connectors.
- d. Replace cracked, torn, or burned insulation and heat shrink tubing.

FLUID LEAKS AND CHECKING FOR LEAKS**NOTE**

You are allowed to operate equipment with minor leaks (Class I or II). You must consider how much fluid the item or system being checked or inspected can hold. When in doubt notify your supervisor. When operating equipment with Class I or II leaks, continue to check fluid levels as required in your PMCS. Report Class III or fuel leaks to your supervisor, or notify unit maintenance for corrective action right away.

54. **GENERAL.** Fluid leaks in hoses and fluid lines affect the carrier parts operation. The types and classes of leaks are given below.
- a. **CLASS I.** Fluid seepage is not great enough to form drops, but is shown by wetness or color changes.
 - b. **CLASS II.** Fluid leakage is great enough to form drops. Drops do not drip from the item being checked or inspected.
 - c. **CLASS III.** Fluid leakage is great enough to form drops that fall from the item being checked or inspected.
55. **CHECKING FOR LEAKS AFTER A MAINTENANCE TASK.** After doing maintenance on a part which involves hoses of fluid lines, check for leaks. If leaks occur after you have done a replace or repair task, find the source of the leak. Correct the problem. Follow these procedures:
- a. Do visual inspections to find the source of the leak.
 - 1) Check for cracks on housing or cover.
 - 2) Check that screws and any connections are not loose, or overtight.
 - b. If you cannot see the source of the leak, check the following items:
 - 1) Check that preformed gasket is not bent, or pinched.
 - 2) Check machined surfaces for fit and cleanliness.
 - 3) Install new replacement parts.
 - c. If leak persists, notify supervisor.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

There are no preventive maintenance checks and services (PMCS) or lubrication procedures required for this manual.

CHAPTER 4

**DIRECT SUPPORT MAINTENANCE INSTRUCTIONS
FOR REPAIR COOLING FAN RIGHT ANGLE DRIVES**

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
REPAIR COOLING FAN RIGHT ANGLE DRIVES A AND B.....	0015 00
REPAIR COOLING FAN RIGHT ANGLE DRIVE C (M113A3 FOV ONLY).....	0016 00

REPAIR COOLING FAN RIGHT ANGLE DRIVES A AND B

0015 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0015 00-2).
- Cleaning (page 0015 00-7).
- Assembly (page 0015 00-7).
- Wear Limits (page 0015 00-19).

INITIAL SETUP:

Maintenance Level

Direct Support

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Micrometer caliper (WP 0033 00, Item 2)
- Caliper gage set (WP 0033 00, Item 7)
- Vernier height gage, (WP 0033 00, Item 8)
- Dial indicator (WP 0033 00, Item 12)
- Wire twister plier (WP 0033 00, Item 15)
- Hand arbor press (WP 0033 00, Item 16)
- Socket wrench set, 3/8 inch drive,
(WP 0033 00, Item 34)
- Torque wrench (WP 0033 00, Item 41)
- Backlash adjusting tool WP 0034 00, Item 1

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Engine lubricating oil (WP 0035 00, Item 5)
- Grease (WP 0035 00, Item 6)
- Non-electrical wire (WP 0035 00, Item 9)
- Petrolatum (WP 0035 00, Item 10)
- Sealing compound (WP 0035 00, Item 11)
- Wiping rags (WP 0035 00, Item 17)
- Key washer (8)
- Key washer
- Oil seal
- Oil seal
- Preformed packing (4)
- Preformed packing (2)
- Preformed packing (Drive B only)
- Shim (3)
- Shim

Personnel Required

Track Vehicle Repairer

References

- See your PMCS
- See your -34
- TM 9-214

Equipment Condition

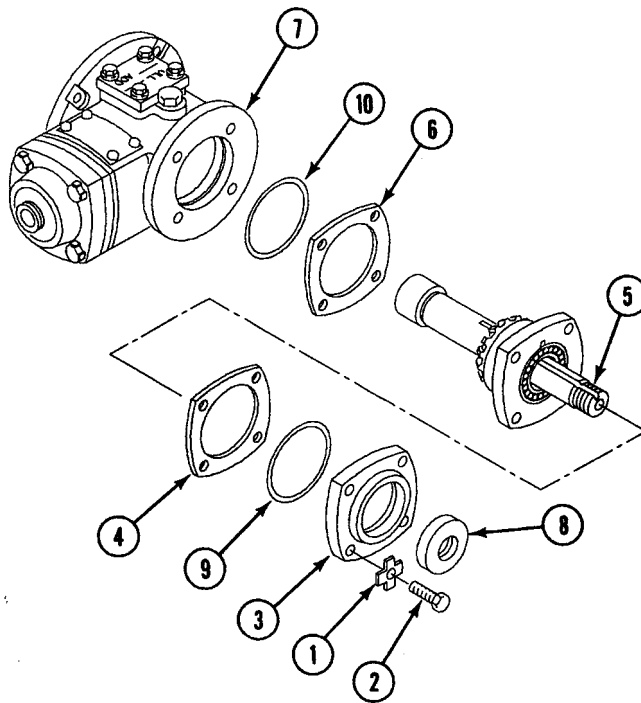
Cooling fan right angle drive removed from fan assembly (see your -34)

DISASSEMBLY

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

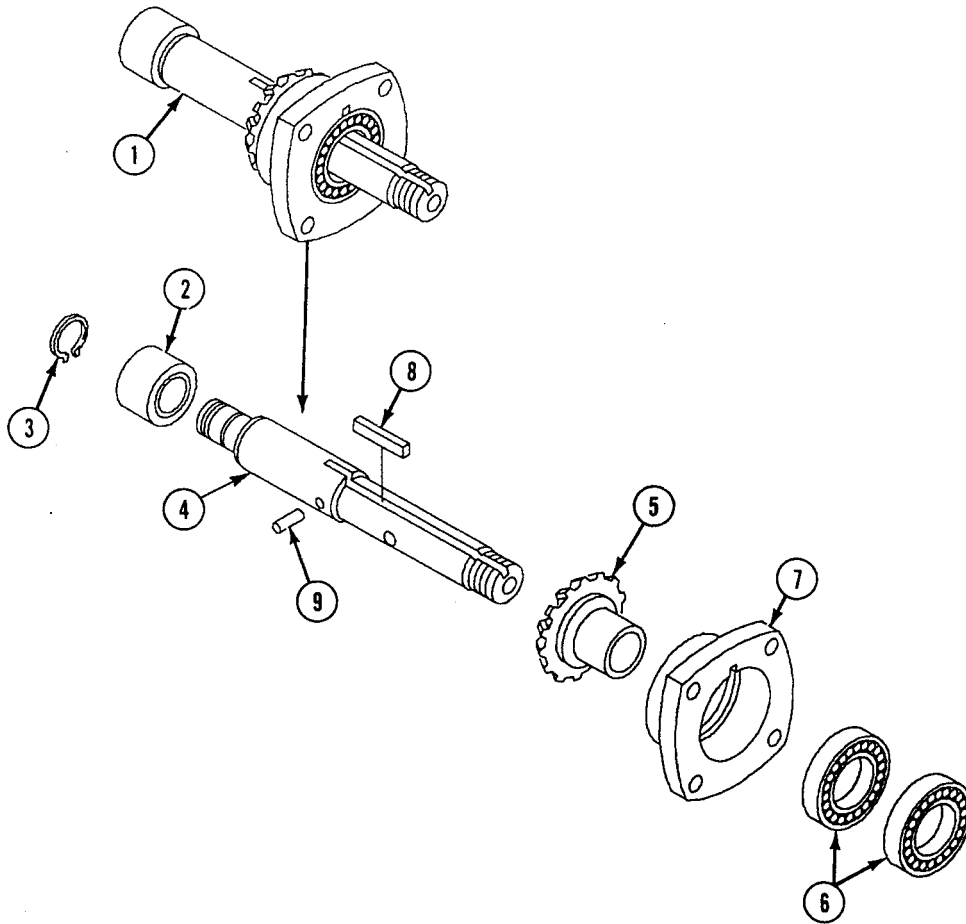
1. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers (1), bearing retainer housing (3), laminated shim (4), spindle assembly (5), and laminated shim (6) from housing (7). Discard key washers and shims.
2. Remove encased oil seal (8) and packing (9) from bearing retainer housing (3). Discard oil seal and packing.
3. Remove packing (10) from housing (7). Discard packing.



NOTE

Ball bearings are a matched set and both must be replaced if either is defective.

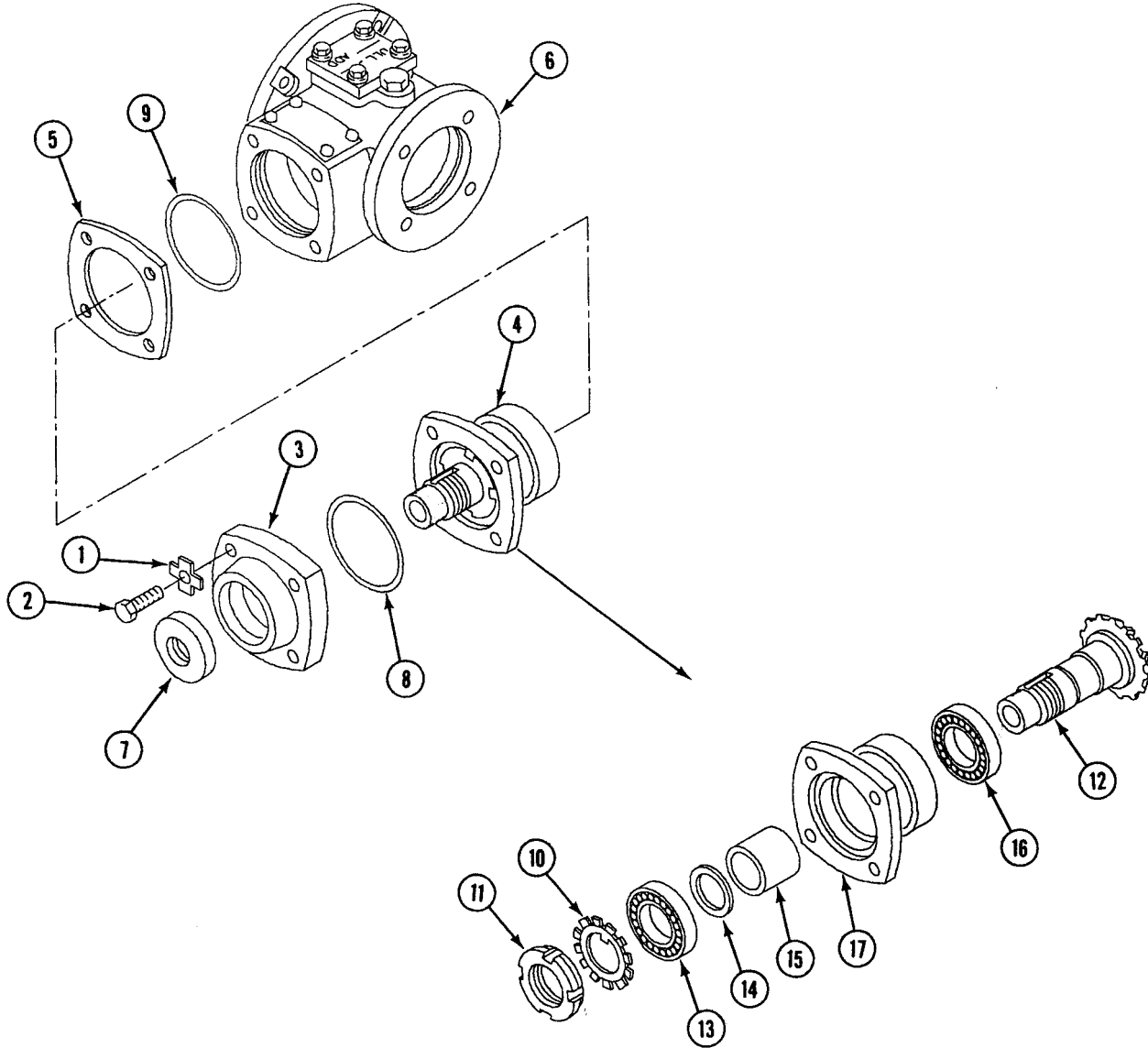
4. Disassemble spindle assembly (1) as follows:
 - a. If inspection indicates needle bearing (2) must be replaced, remove retaining ring (3) and needle bearing from shouldered shaft (4). Discard needle bearing.
 - b. Press shouldered shaft (4) and bevel gear (5) from ball bearings (6) in bearing housing (7). Use arbor press.
 - c. Remove two ball bearings (6) from bearing housing (7).
 - d. Separate bevel gear (5) from shouldered shaft (4). Use arbor press.
 - e. Remove machine key (8) from shouldered shaft (4).
 - f. If inspection indicates that orifice spring pin (9) is plugged, clean spring pin. If spring pin is damaged, remove pin from shouldered shaft (4). Discard pin.



REPAIR COOLING FAN RIGHT ANGLE DRIVES A AND B — Continued

0015 00

5. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers (1), bearing retainer housing (3), cartridge assembly (4), and laminated shim (5) from housing (6). Discard key washers and shim.
6. Remove encased oil seal (7) and packing (8) from bearing retainer housing (3). Discard oil seal and packing.
7. Remove packing (9) from housing (6). Discard packing.

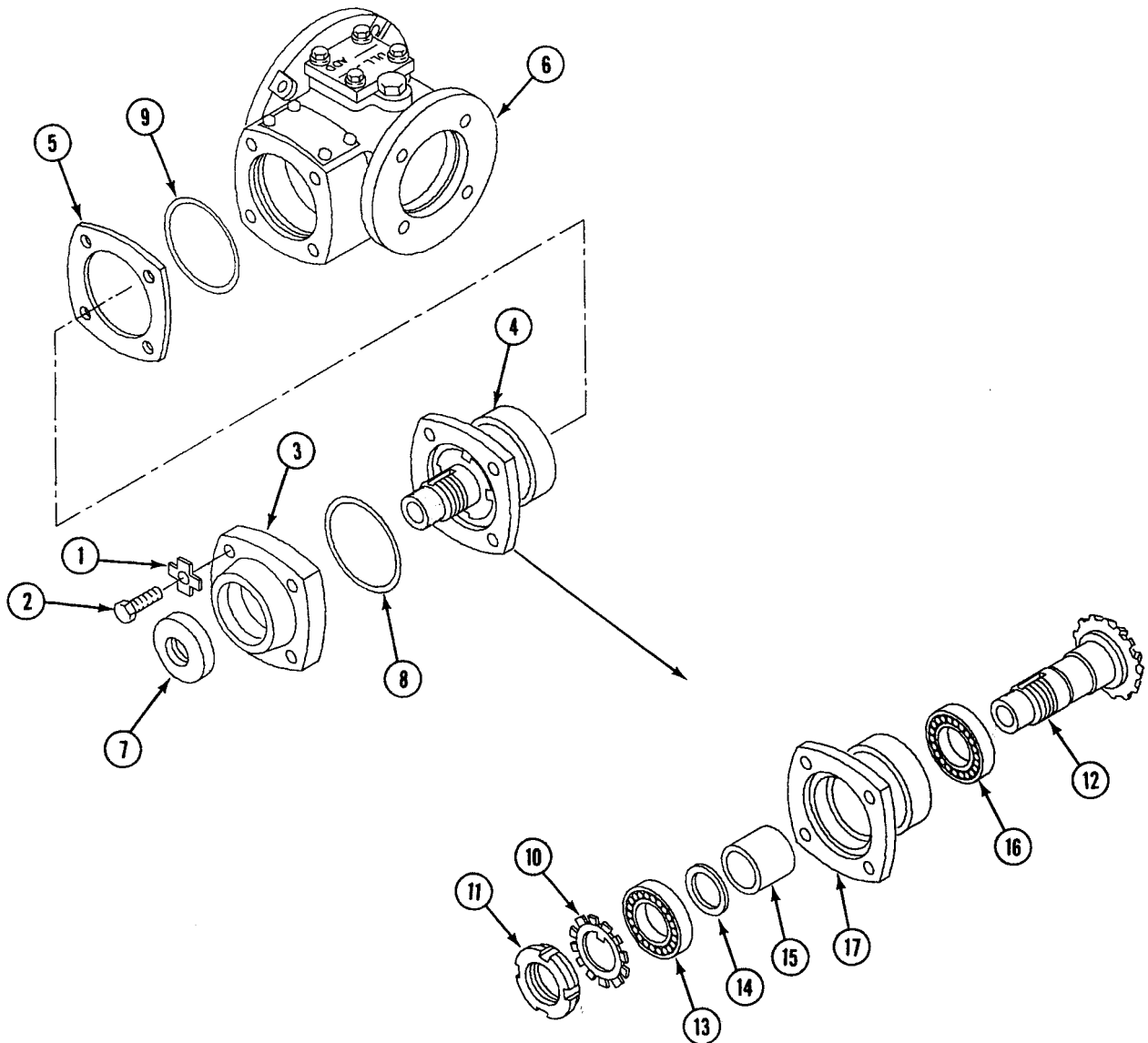


NOTE

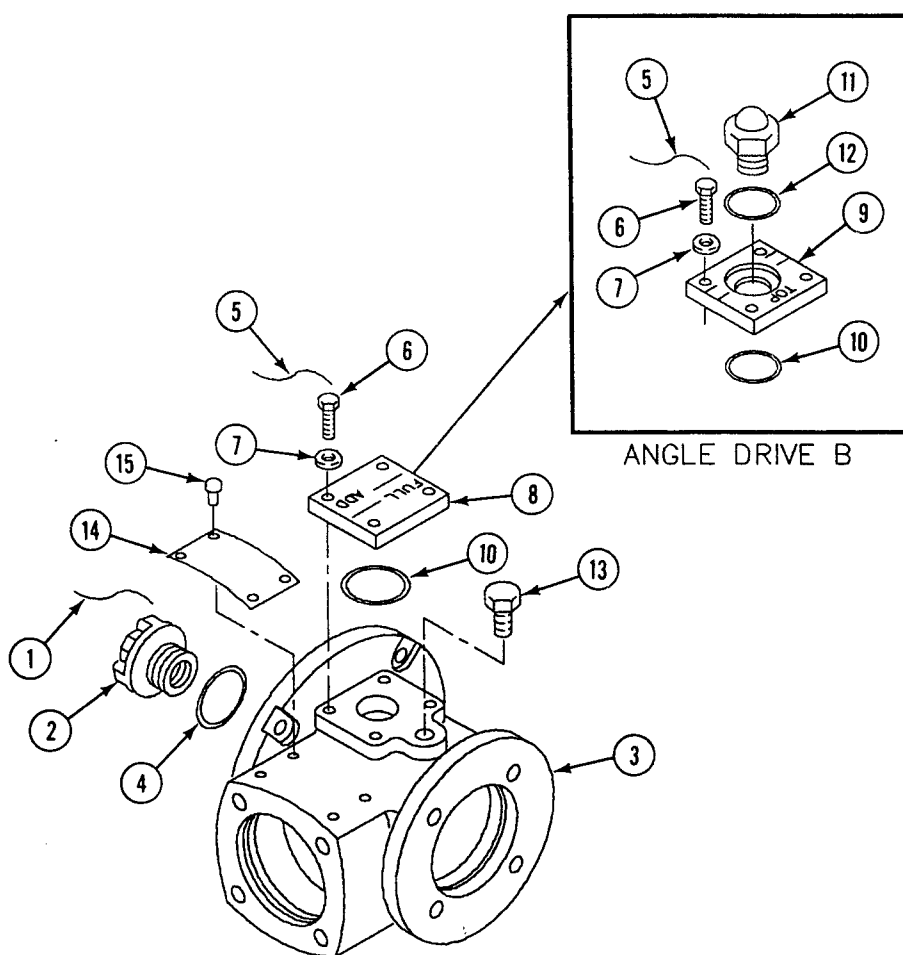
Ball bearings are a matched set and both must be replaced if either is defective.

8. Disassemble cartridge assembly (4) as follows:

- a. Straighten tang on key washer (10). Remove round nut (11) and key washer from bevel gearshaft (12). Discard key washer.
- b. Remove bevel gearshaft (12), ball bearing (13), laminated shim (14), sleeve spacer (15), and ball bearing (16) from bearing housing (17). Discard shim.



9. Remove lockwire (1) and cap plug (2) from housing (3). Discard lockwire.
10. Remove packing (4) from cap plug (2). Discard packing.
11. Remove lockwire (5), four cap screws (6), washers (7), and drive A indicator cover (8) or drive B mounting plate (9) from housing (3). Discard lockwire.
12. Remove packing (10) from drive A indicator cover (8) or drive B mounting plate (9). Discard packing.
13. On drive B only, remove sight indicator (11) and packing (12) from mounting plate (9). Discard packing.
14. Remove pipe plug (13) from housing (3).
15. If inspection indicates identification plate (14) must be replaced, remove four drive screws (15) and identification plate from housing (3). Discard drive screws. Record identification data for use on new plate before discarding old plate.



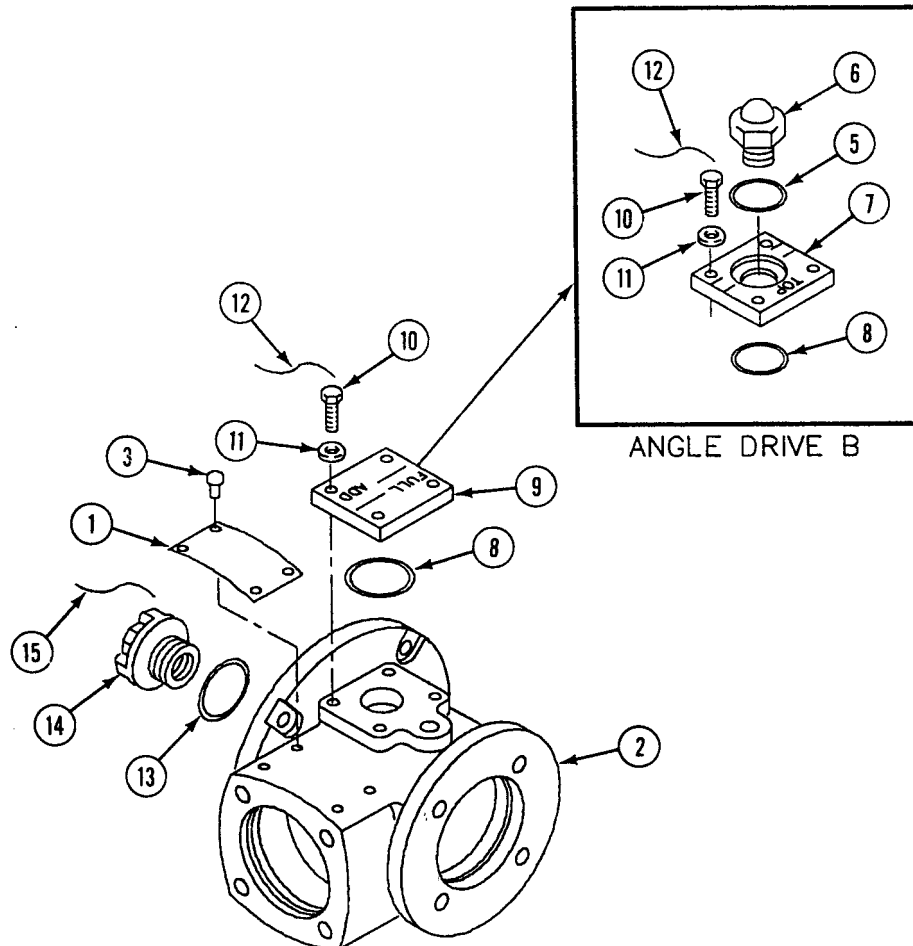
CLEANING

CLEAN, INSPECT, AND REPAIR

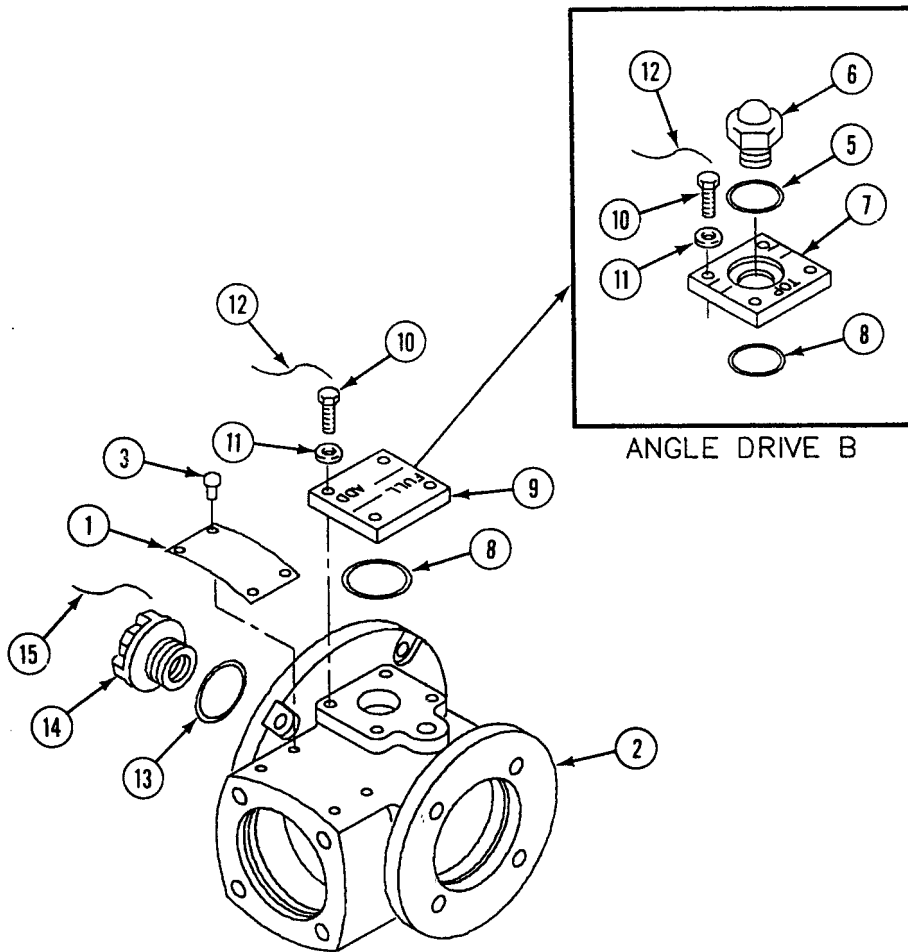
1. Before inspection, repair, or assembly, clean all parts as described in (WP 0014 00).
2. Inspect all parts. Refer to (WP 0014 00) for general inspection procedures. See TM 9-214 to check bearings. Check wear limits page 0015 00-19.
3. Repair or replace defective parts. Refer to (WP 0014 00) for general repair procedures.

ASSEMBLY

1. If identification plate (1) was removed, stamp identification data (recorded from old plate) on new plate and install plate on housing (2) with four new drive screws (3).
2. On drive B only, lubricate new packing (5) with grease or petrolatum and install packing and sight indicator (6) on mounting plate (7).
3. Lubricate new packing (8) with grease or petrolatum and install packing in drive A indicator cover (9) or drive B mounting plate (7).



4. Install drive A indicator cover (9) or drive B mounting plate (7) on housing (2) as follows:
 - a. Clean threads of four cap screws (10). Apply a light coat of antiseize compound to threads.
 - b. Install drive A indicator cover (9) or drive B mounting plate (7) on housing (2) with four washers (11) and cap screws (10).
 - c. Tighten cap screws (10) to 42-48 lb-in (4.8-5.4 N•m) torque. Use torque wrench and socket set.
 - d. Install new lockwire (12) between four cap screws (10) using twist method. Use wire twister pliers.
5. Lubricate new packing (13) with grease or petrolatum and install packing on cap plug (14).
6. Install cap plug (14) in housing (2). Secure with new lockwire (15). Use wire twister pliers.



NOTE

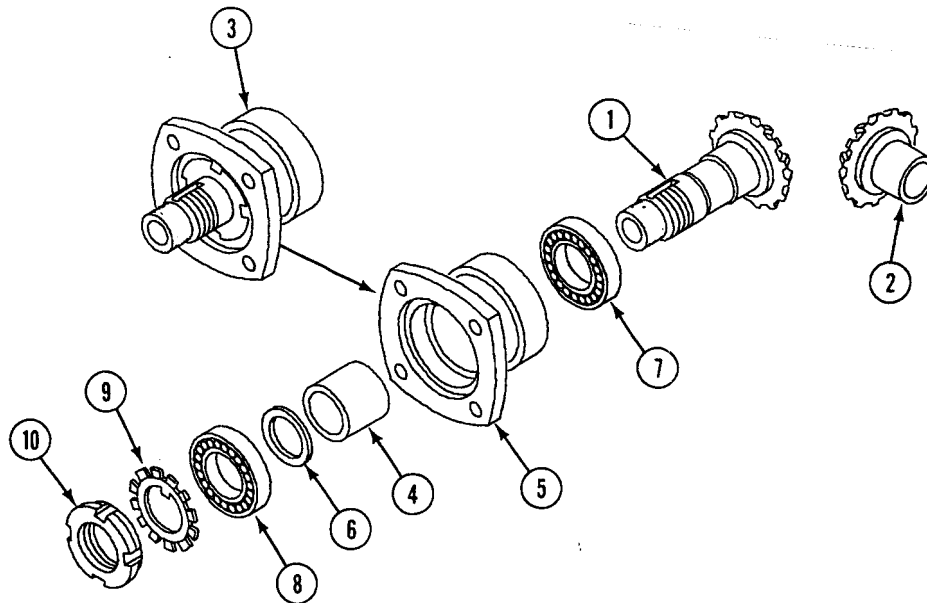
Bevel gearshaft and bevel gear are a matched set and must be installed as a set.

7. Check that serial number etched on face of bevel gearshaft (1) matches serial number etched on bevel gear (2).
8. Record M.D. (Mounting Distance) dimension etched on face of bevel gearshaft (1) for later use in shimming cartridge assembly (3).

NOTE

Matched duplex bearings stamped NEW DEPARTURE 0L07 or MCR107 must be installed with thick sections of outer races facing each other. Matched duplex radial bearings stamped NEW DEPARTURE 3L07 must be installed with stamped faces toward outside of assembly.

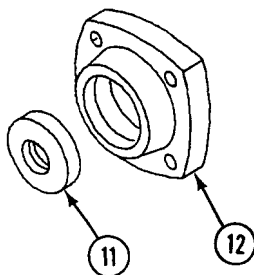
9. Assemble cartridge assembly (3) as follows:
 - a. Measure length of sleeve spacer (4) and distance between bearing bores inside bearing housing (5). Use caliper set.
 - b. Peel laminated shim (6) to thickness to provide equal spacing between inner and outer races of bearings (7) and (8) within ± 0.001 inch (shim thickness + spacer length = distance between bearing bores inside housing). Use caliper set.
 - c. Install ball bearing (7), bevel gearshaft (1), sleeve spacer (4), laminated shim (6), and ball bearing (8) in bearing housing (5).
 - d. Install new key washer (9) and round nut (10) on bevel gearshaft (1). Bend tang on key washer into slot on nut.



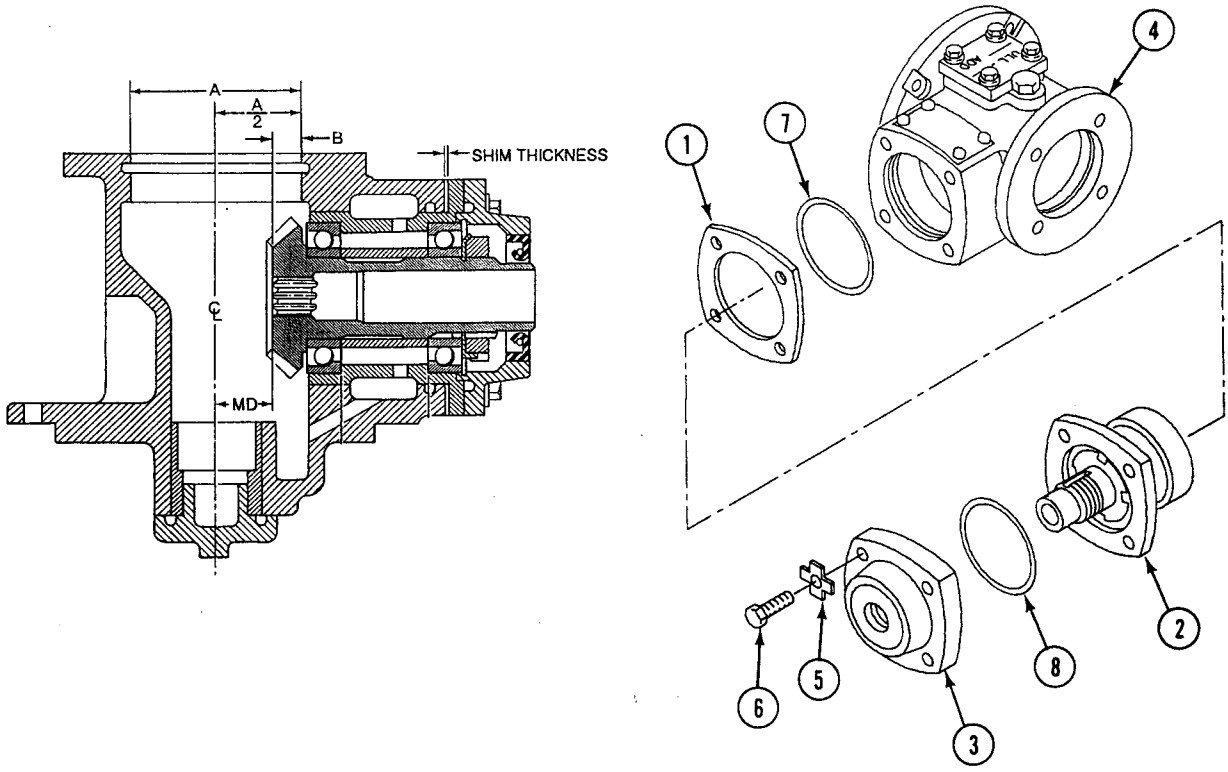
CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

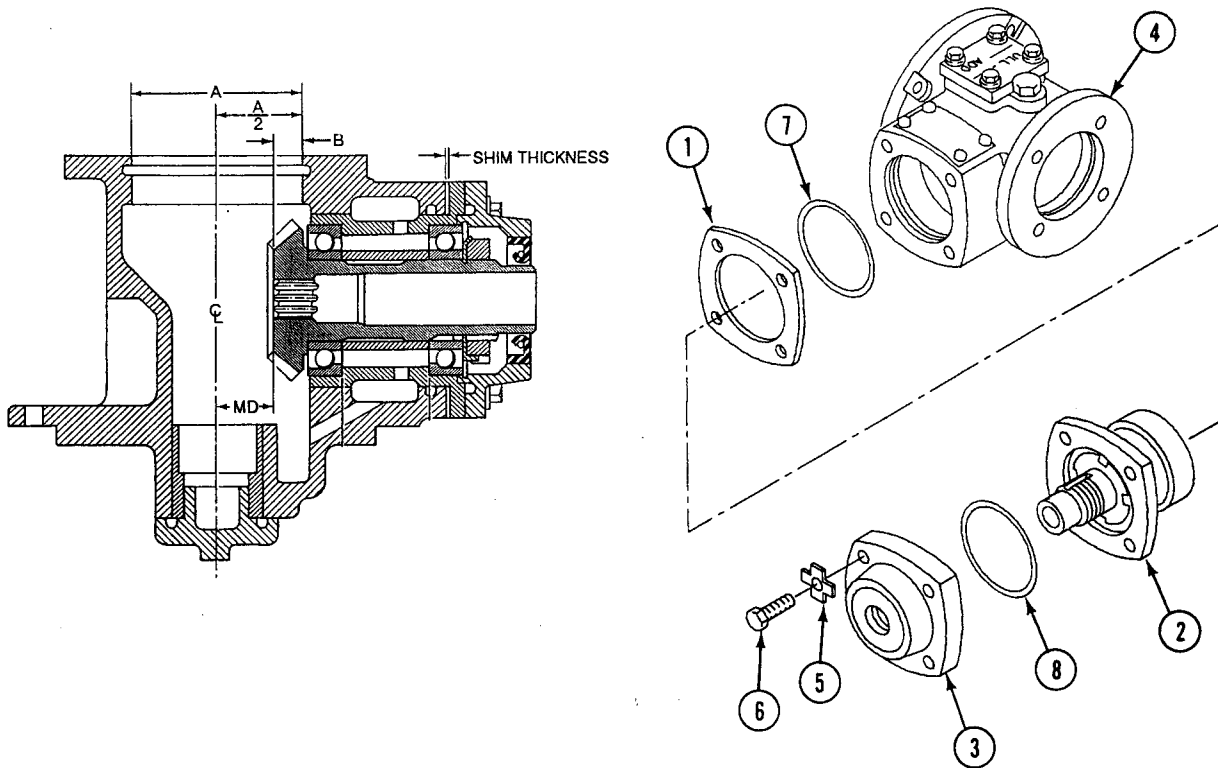
10. Install new encased oil seal (11) in bearing retainer housing (12) as follows:
- Clean mating surfaces of oil seal (11) and bearing retainer housing (12). Apply a thin film of sealing compound to outer edge of oil seal.
 - Press oil seal (11) into bearing retainer housing (12). Use arbor press.



11. Determine thickness of shim (1) as follows:
- Without installing shim (1), install cartridge assembly (2) and bearing retainer housing (3) on housing (4) with four new key washers (5) and cap screws (6). Tighten screws, but do not bend tabs on key washers at this time.
 - Measure inside diameter A in housing (4). Use caliper set.
 - Measure dimension B between inside edge of housing bore and unetched portion on face of bevel gearshaft. Use vernier height gage.
 - Calculate shim thickness using above measurements and M.D. dimension (etched on gearshaft) recorded in Step 8. Shim thickness = $M.D. - A/2 + B$.
 - Peel new laminated shim (1) to calculated thickness or next thinner laminate.
 - Remove four cap screws (6), key washers (5), bearing retainer housing (3), and cartridge assembly (2) from housing (4).



12. Lubricate new packing (7) with grease or petrolatum and install packing in groove in housing (4).
13. Lubricate new packing (8) with grease or petrolatum and install packing in bearing retainer housing (3).
14. Install cartridge assembly (2) in housing (4) as follows:
 - a. Clean threads of four cap screws (6). Apply a light coat of antiseize compound to threads.
 - b. Install laminated shim (1), cartridge assembly (2), and bearing retainer housing (3) on housing (4) and secure with four key washers (5) and cap screws (6).
 - c. Tighten four cap screws (6) to 144-180 lb-in (17-20 N•m) torque. Use torque wrench and socket set.
 - d. Bend tabs on four key washers (5).

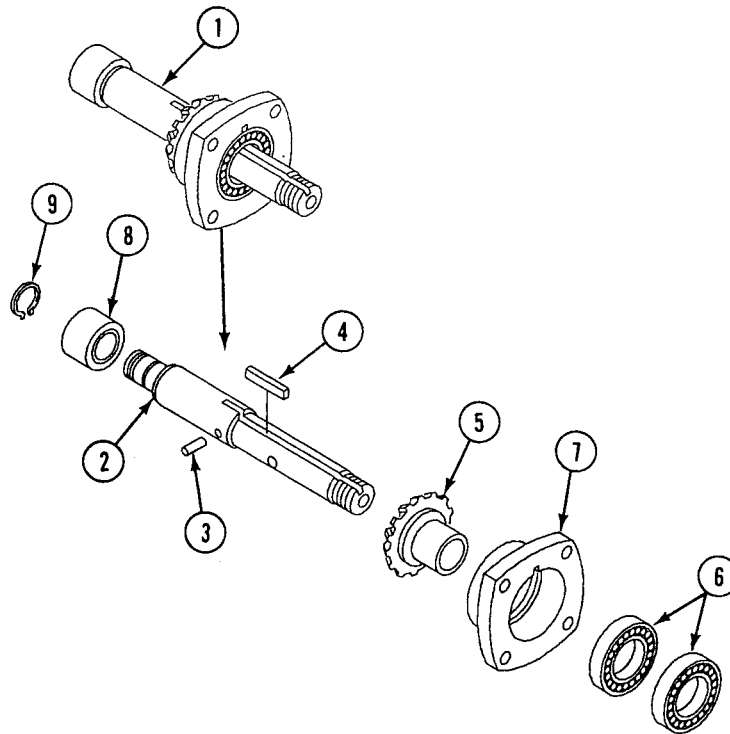


NOTE

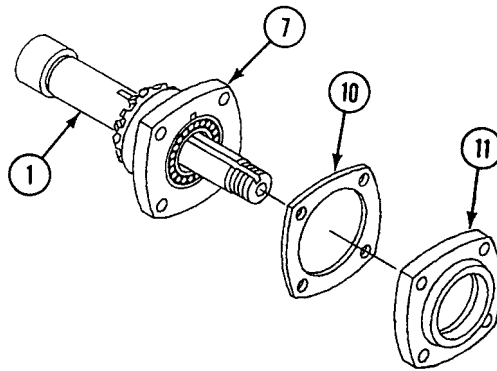
Ball bearings are a matched set and both must be replaced if either is defective.

Matched duplex bearings stamped NEW DEPARTURE 0L07 or MCR107 must be installed with thick sections of outer races facing each other. Matched duplex radial bearings stamped NEW DEPARTURE 3L07 must be installed with stamped faces toward outside of assembly.

15. Assemble spindle assembly (1) as follows:
 - a. Shouldered shaft (2) has left-hand threads at needle bearing end.
 - b. If orifice spring pin (3) was removed from shouldered shaft (2), install new pin in shaft with 1/16 to 1/8 inch protruding from shaft.
 - c. Install machine key (4) in shouldered shaft (2).
 - d. Press bevel gear (5) on shouldered shaft (2). Use arbor press.
 - e. Install two matched ball bearings (6) in bearing housing (7).
 - f. Press two bearings (6) inside bearing housing (7) onto bevel gear (5). Use arbor press.
 - g. If needle bearing (8) was removed from shouldered shaft (2), install new needle bearing onto shaft and secure with retaining ring (9).

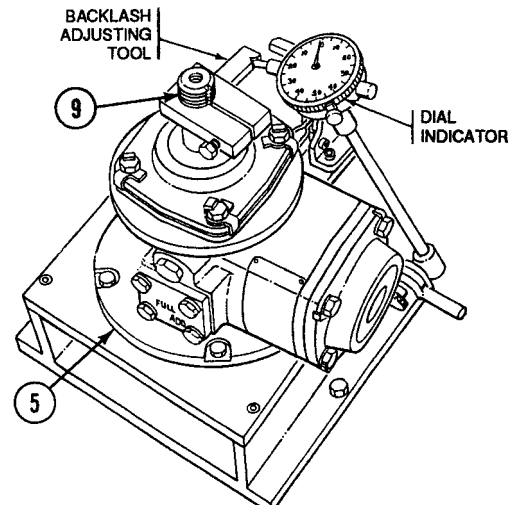
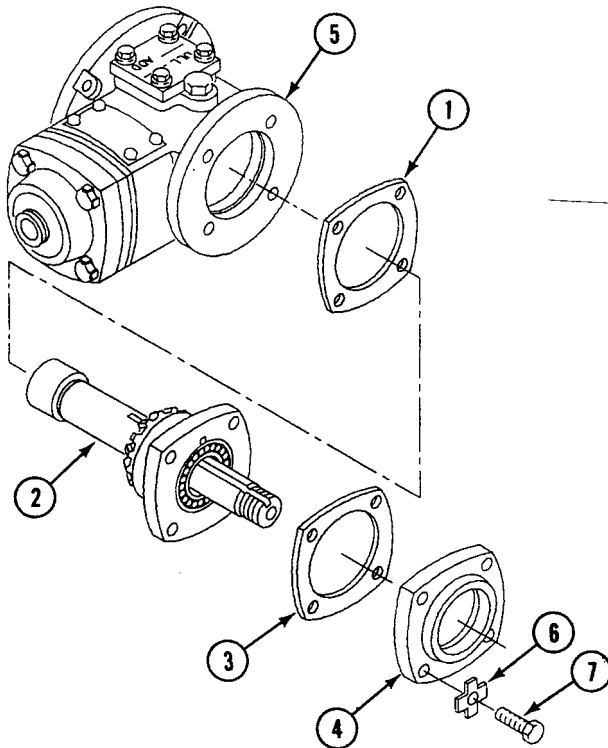


16. Determine thickness of shim (10) as follows:
- Without installing shim (10), hold bearing retainer housing (11) firmly against bearing outer race in spindle assembly (1).
 - With a thickness gauge, measure gap between bearing retainer housing (11) and spindle assembly bearing housing (7).
 - Peel new laminated shim (10) to nearest thickness smaller than gap measured in Step 16b.
 - Remove bearing retainer housing (11) from spindle assembly (1).



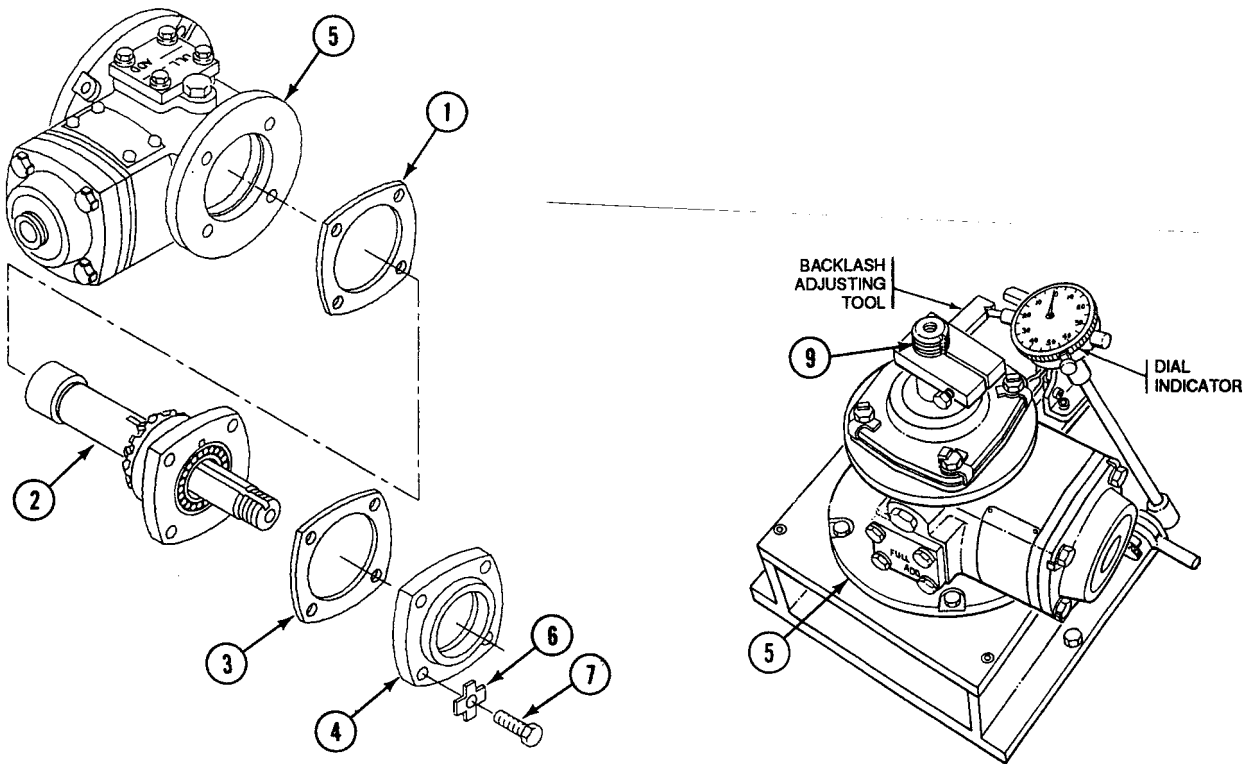
17. Determine initial thickness of shim (1) as follows:

- a. Without installing shim (1), install spindle assembly (2), laminated shim (3), and bearing retainer housing (4) on housing (5). Secure with four new key washers (6), and cap screws (7). Tighten screws only to the point where gear backlash has been removed. Do not bend tabs on key washers at this time.
- b. With a thickness gauge, measure gap between spindle assembly housing (8) and housing (5).
- c. Calculate shim thickness using above measurement as follows: Shim thickness = Gap + 0.006
- d. Peel new laminated shim (1) to calculated thickness or next thinner laminate. Keep removed laminates for later use in Step 18d below.
- e. Remove four cap screws (7), key washers (6), bearing retainer housing (4), laminated shim (3), and spindle assembly (2) from housing (5).



18. Check and adjust backlash as follows:

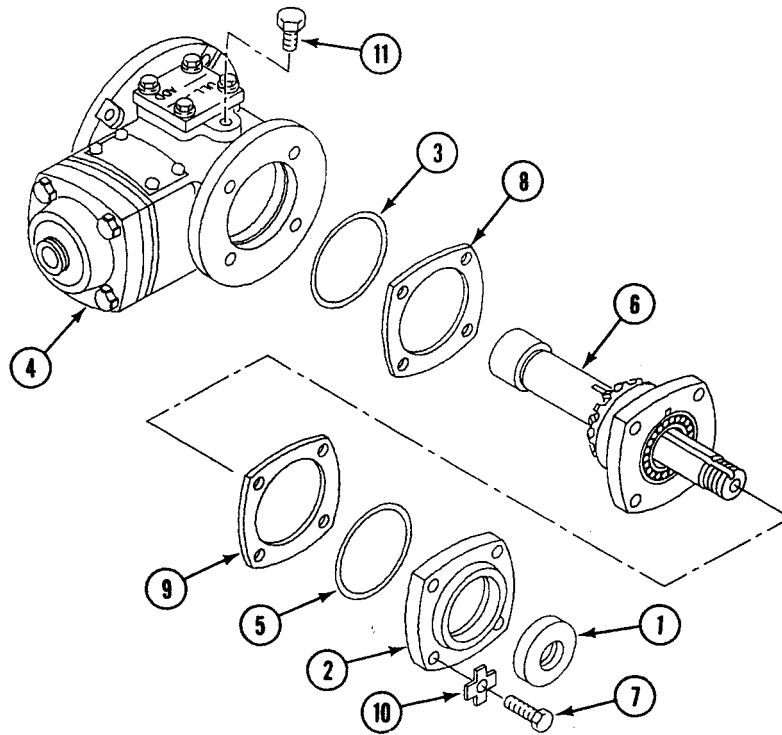
- a. Install laminated shim (1), spindle assembly (2), laminated shim (3), and bearing retainer housing (4) on housing (5) with four new key washers (6) and cap screws (7). Tighten screws, but do not bend tabs on key washers at this time.
- b. Position housing (5) with shouldered shaft (9) in up position. Install backlash adjusting tool on shouldered shaft (9) and secure tool by tightening socket head screw on tool. Attach dial indicator so that indicator feeler fits in notch on arm of tool.
- c. Check gear backlash by moving tool from side to side while observing dial indicator. Backlash reading should be between 0.002 inch and 0.004 inch.
- d. If backlash is less than 0.002 inch, add more laminates to shim (1). If backlash is greater than 0.004 inch, remove laminates from shim.
- e. If required, install new thickness shim and recheck backlash by repeating Steps 18a - 18c above.
- f. Remove dial indicator and backlash adjusting tool from shouldered shaft (9).
- g. Remove four cap screws (7), key washers (6), bearing retainer housing (4), laminated shim (3), and spindle assembly (2), and laminated shim (1) from housing (5).



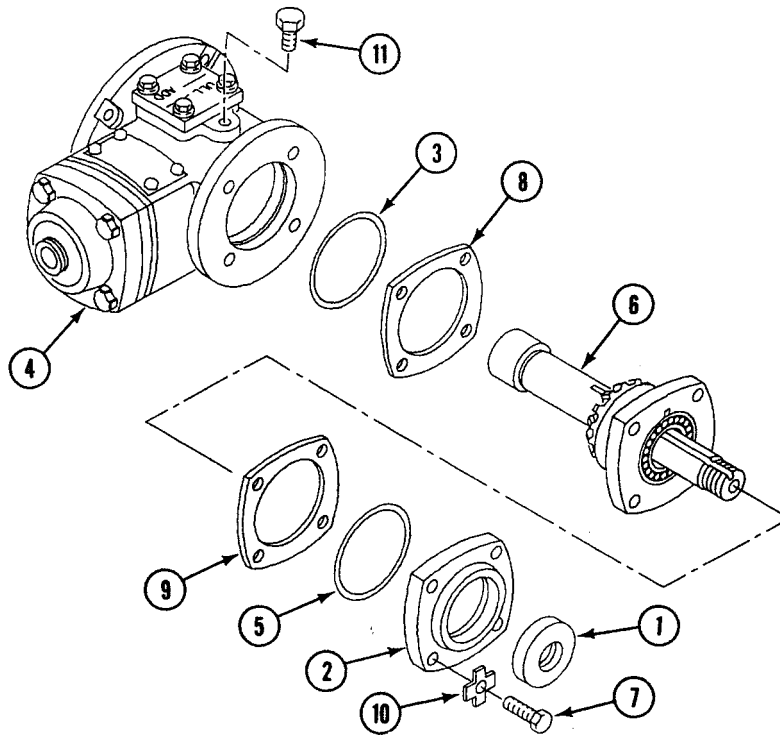
CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

19. Install new encased oil seal (1) in bearing retainer housing (2) as follows:
 - a. Clean mating surfaces of oil seal (1) and bearing retainer housing (2). Apply a thin film of sealing compound to outer edge of oil seal.
 - b. Press oil seal (1) into bearing retainer housing (2). Use arbor press.
20. Lubricate new packing (3) with grease or petrolatum and install packing in groove in housing (4).
21. Lubricate new packing (5) with grease or petrolatum and install packing in bearing retainer housing (2).

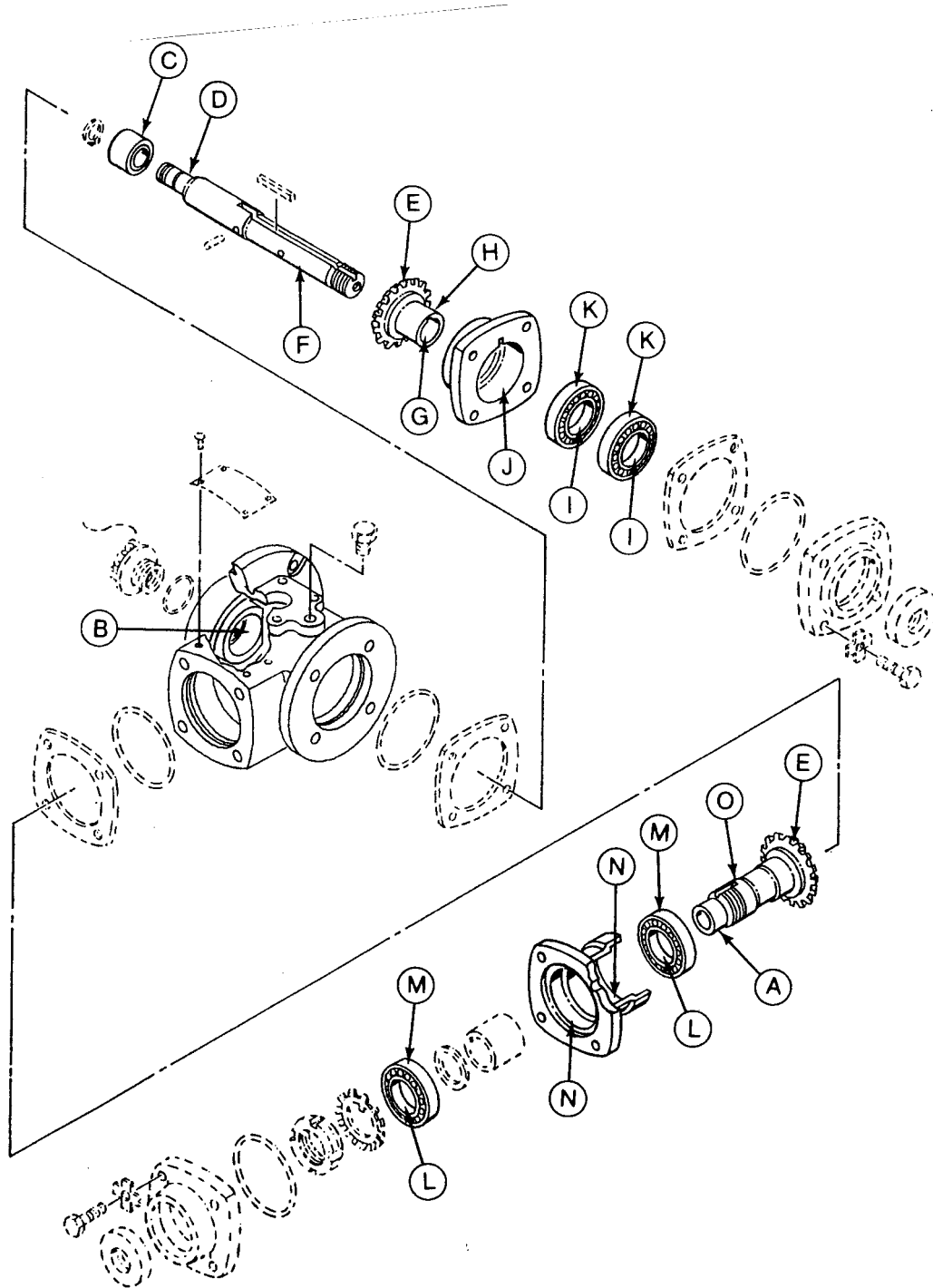


22. Install spindle assembly (6) in housing (4) as follows:
 - a. Clean threads of four cap screws (7). Apply a light coat of antiseize compound to threads.
 - b. Install laminated shim (8), spindle assembly (6), laminated shim (9), and bearing retainer housing (2) on housing (4). Secure with four key washers (10) and cap screws (7).
 - c. Tighten four cap screws (7) to 144-180 lb-in (17-20 N•m) torque. Use torque wrench and socket set.
 - d. Bend tabs on four key washers (10).
23. Preserve drive as follows:
 - a. Fill drive with 5 ounces of engine oil. Check for leaks. See your (WP 0014 00).
 - b. Drain oil. Leave residual oil as preservative during shipping or storage.
24. Install pipe plug (11) in housing (4) as follows:
 - a. Clean male pipe threads thoroughly. Apply sealing compound to pipe threads. Do not apply sealant beyond small end of threads. Do not fill leading thread.
 - b. Install plug (11) in housing (4).



WEAR LIMITS

1. Check parts that have reference letters in figure below.



2. Check the parts dimensions with chart on next page to determine replacement. Use micrometer, caliper set, and vernier height gauge.

Table 1. COOLING FAN RIGHT ANGLE DRIVES A AND B WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Outside diameter of gearshaft at seal surface	1.1220 to 1.1280	1.1200
B	Inside diameter of housing at bearing surface	1.2495 to 1.2505	1.2510
C	Outside diameter of bearing	1.2495 to 1.2504	(*)(**)
C-B	Fit of bearing in housing	0.0009T to 0.0010L	
D	Outside diameter of shaft at bearing surface	0.7496 to 0.7501	(*)(**)
E	Backlash between gears in plane of rotation	0.0020 to 0.0040	(*)(***)
F	Outside diameter of shaft	0.8752 to 0.8756	(*)(****)
G	Inside diameter of gear	0.8746 to 0.8756	(*)(****)
G-F	Fit of gear on shaft	0.0001T to 0.0010T	
H	Outside diameter of gear hub at bearing surface	1.3781 to 1.3785	(*)(**)
I	Inside diameter of bearings	1.3775 to 1.3780	(*)(**)
I-H	Fit of bearings on gear hub	0.0001T to 0.0010T	
J	Inside diameter of housing at bearing surface	2.4409 to 2.4415	(**) 2.4402
K	Outside diameter of bearings	2.4404 to 2.4409	(*)(**)
K-J	Fit of bearings in housing	0.0000 to 0.0011L	
L	Inside diameter of bearings	1.3775 to 1.3780	(*)(**)
M	Outside diameter of bearings	2.4404 to 2.4409	(*)(**)
N	Inside diameter of retainer at bearing surfaces	2.4409 to 2.4415	(**) 2.4420
N-M	Fit of bearings in retainer	0.0000 to 0.0011L	
O	Outside diameter of gearshaft at bearing surfaces	1.3770 to 1.3775	(*)(**)
O-L	Fit of bearings on gearshaft	0.0000 to 0.0010L	

* Must be within new parts dimensions.

** Measure only if there is visual indication of bearing turning.

*** Refer to page 0015 00-2.

**** Measure only if there are visual signs of wear or damage.

END OF TASK

REPAIR COOLING FAN RIGHT ANGLE DRIVE C (M113A3 FOV ONLY)

0016 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0016 00-20).
 - Cleaning (page 0016 00-5).
 - Assembly (page 0016 00-6).
 - Wear Limits (page 0016 00-17).
-

INITIAL SETUP:

Maintenance Level

Direct Support

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Bearing inserter (WP 0033 00, Item 1)
- Micrometer caliper (WP 0033 00, Item 2)
- Caliper gage set (WP 0033 00, Item 7)
- Vernier height gage (WP 0033 00, Item 8)
- Dial indicator (WP 0033 00, Item 11)
- Dial indicator set (WP 0033 00, Item 13)
- Hand arbor press (WP 0033 00, Item 16)
- Socket wrench set, 3/8 inch drive,
(WP 0033 00, Item 34)
- Spanner socket (WP 0033 00, Item 35)
- Torque wrench (WP 0033 00, Item 40)
- Torque wrench (WP 0033 00, Item 41)
- Backlash adjusting tool WP 0034 00, Item 1
- Test stand WP 0034 00, Item 2

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Engine lubricating oil (WP 0035 00, Item 5)
- Grease (WP 0035 00, Item 6)
- Petrolatum (WP 0035 00, Item 10)
- Sealing compound (WP 0035 00, Item 12)
- Sealing compound (WP 0035 00, Item 14)
- Sealing compound (WP 0035 00, Item 15)
- Wiping rags (WP 0035 00, Item 17)
- Key washer
- Oil seal
- Oil seal
- Preformed packing (4)
- Preformed packing
- Preformed packing
- Preformed packing
- Preformed packing
- Preformed packing
- Shim
- Shim
- Shim

Personnel Required

Track Vehicle Repairer

References

- PMCS
- TM 9-2350-277-34
- TM 9-214

Equipment Condition

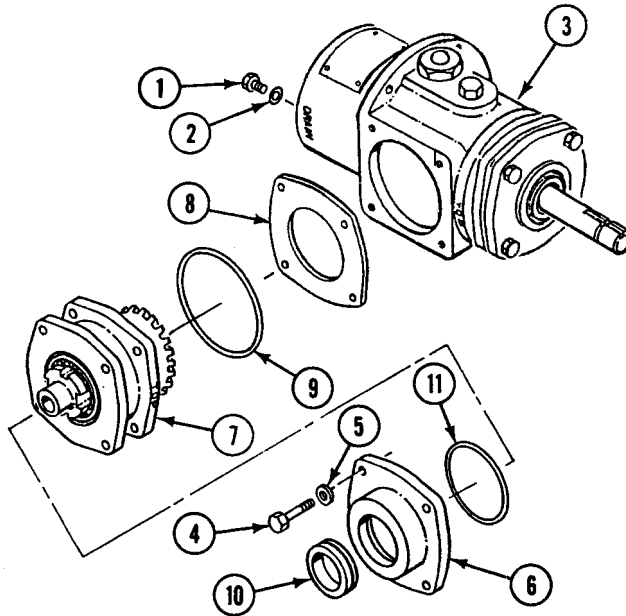
Cooling fan right angle drive removed from fan assembly (see your -34)

DISASSEMBLY

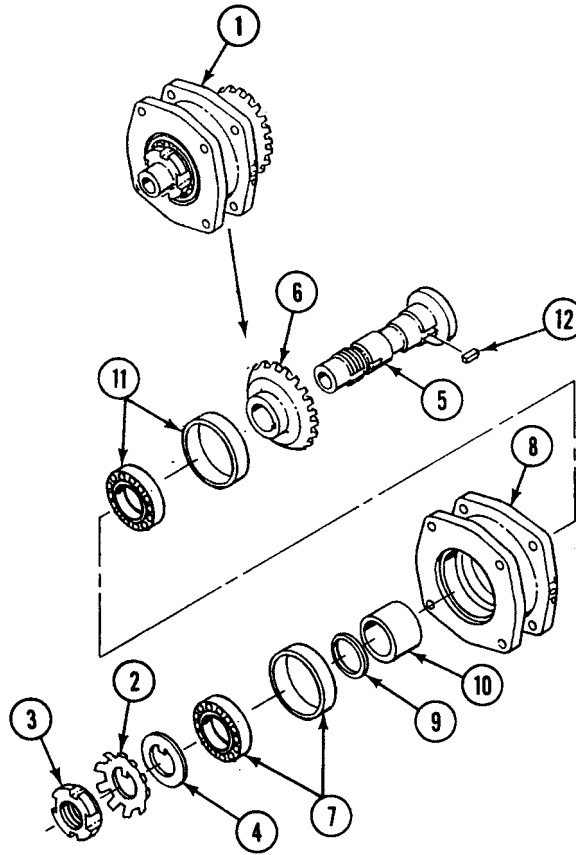
CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

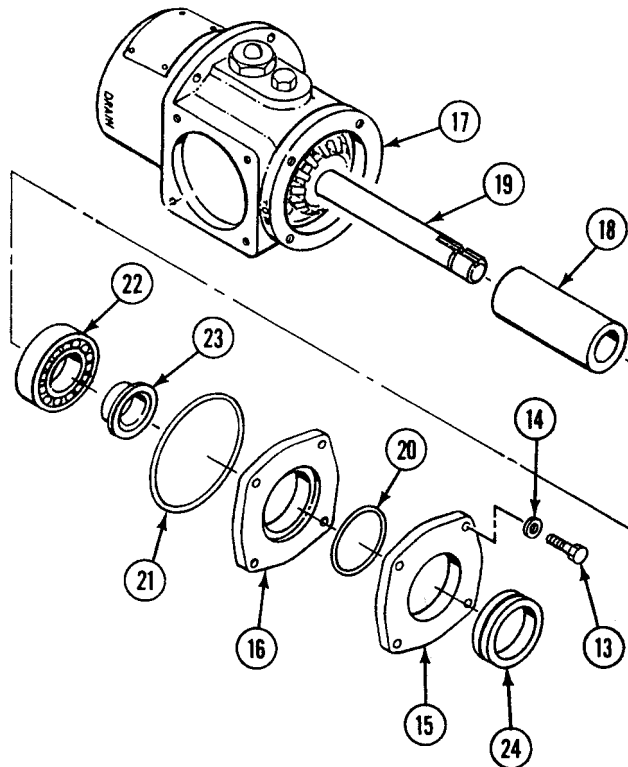
1. Remove screw (1) and copper washer (2) from housing (3) and drain oil into a suitable container.
2. Remove four bolts (4), washers (5), bearing and oil seal retainer (6), input cartridge assembly (7), and laminated shim (8) from housing (3). Discard shim.
3. Remove packing (9) from cartridge assembly (7). Discard packing.
4. Remove oil seal (10) and packing (11) from retainer (6). Discard oil seal and packing.



5. Disassemble cartridge assembly (1) as follows:
 - a. Straighten tang on key washer (2). Remove round nut (3), key washer (2), and key washer (4) from shouldered shaft (5). Use spanner socket. Discard key washer (2).
 - b. Press shouldered shaft (5) with attached bevel gear (6) out of inner race of bearing (7) in bearing retainer plate (8). Use arbor press.
 - c. Remove laminated shim (9) and sleeve spacer (10) from shouldered shaft (5). Discard shim.
 - d. Press inner race of bearing (11) and bevel gear (6) from shouldered shaft (5). Remove key (12). Use arbor press.
6. If inspection indicates tapered roller bearing (7) and tapered roller bearing (11) must be replaced, press outer races of bearings out of retainer plate (8). Use arbor press. Discard outer races and inner races.



7. Remove four bolts (13), washers (14), bearing and oil seal retainer (15), and bearing retaining plate (16) from housing (17).
8. Remove sleeve spacer (18) from spindle assembly (19).
9. Remove packing (20) and packing (21) from retaining plate (16). Discard packings.
10. Remove ball bearing (22) from bearing retaining plate (16). Use arbor press.
11. Press bearing sleeve (23) from ball bearing (22). Use arbor press.
12. Remove oil seal (24) from retainer (15). Discard oil seal.

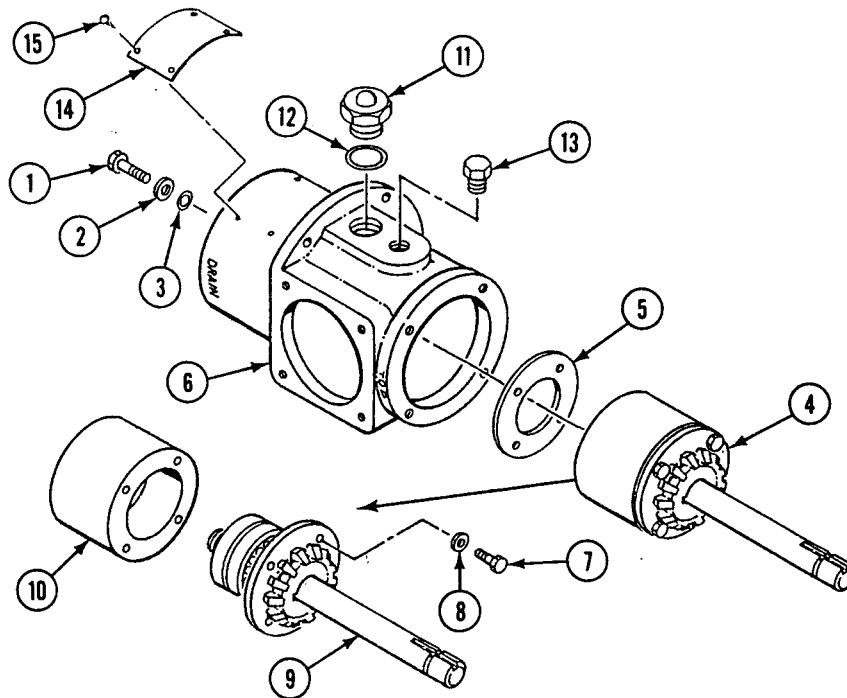


13. Remove four cap screws (1), washers (2), packings (3), spindle assembly (4), and laminated shim (5) from housing (6). Discard packings and shim.

NOTE

Do not attempt to remove tapered roller bearing from shaft. The bearing and shaft are a matched set. If bearing of shaft is damaged, obtain a new shaft and bearing from supply.

14. Disassemble spindle assembly (4) as follows:
 - a. Remove four cap screws (7) and washers (8).
 - b. Remove shaft and bearing (9) with attached parts from bearing retaining plate (10).
15. Remove liquid sight indicator (11) and packing (12) from housing (6). Discard packing.
16. Remove pipe plug (13) from housing (6).
17. If inspection indicates identification plate (14) must be replaced, remove four drive screws (15) and identification plate from housing (6). Discard drive screws. Record identification data for use on new plate before discarding old plate.



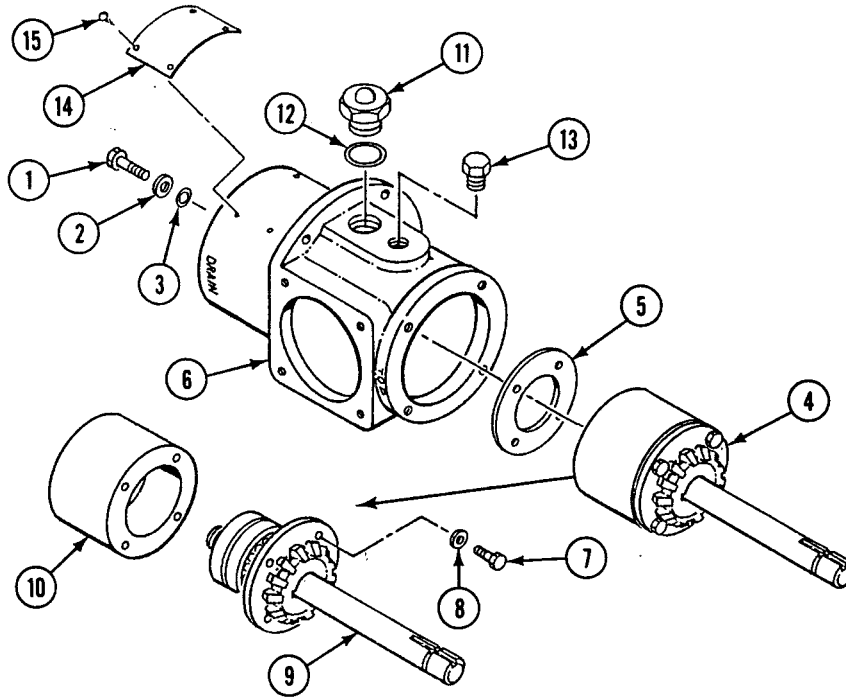
CLEANING

CLEAN, INSPECT, AND REPAIR

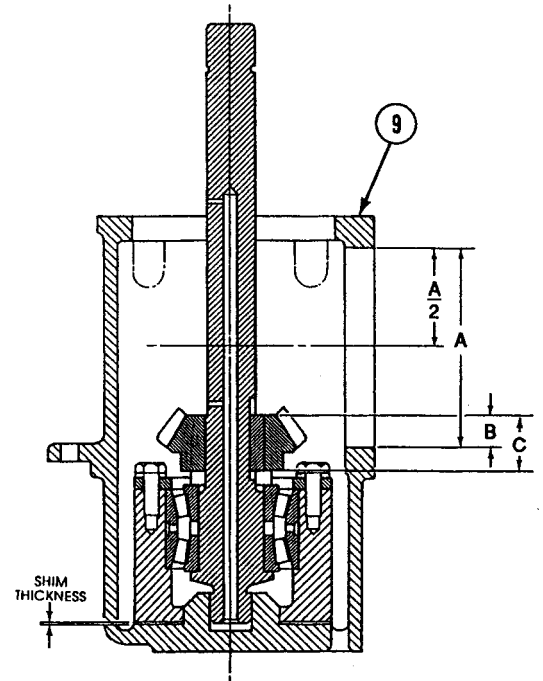
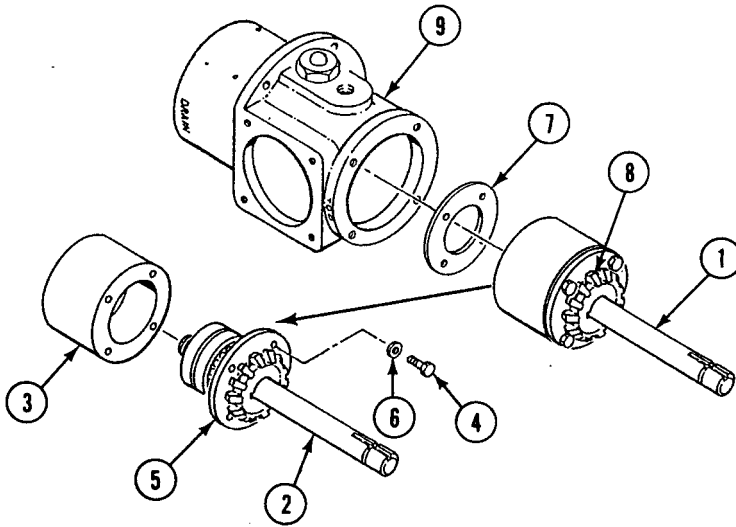
1. Before inspection, repair, or assembly, clean all parts as described in (WP 0014 00).
2. Inspect all parts. Refer to (WP 0014 00) for general inspection procedures. See TM 9-214 to check bearings. Check wear limits page 0016 00-17.
3. Repair or replace defective parts. Refer to (WP 0014 00) for general repair procedures.

ASSEMBLY

1. If identification plate (14) was removed, stamp identification data (recorded from old plate) on new plate and install plate on housing (6) with four new drive screws (15).
2. Install liquid sight indicator (11) as follows:
 - a. Lubricate new packing (12) with grease or petrolatum and install on liquid sight indicator (11).
 - b. Apply a light coat of antiseize compound to threads of sight indicator (11). Install sight indicator in housing (6).



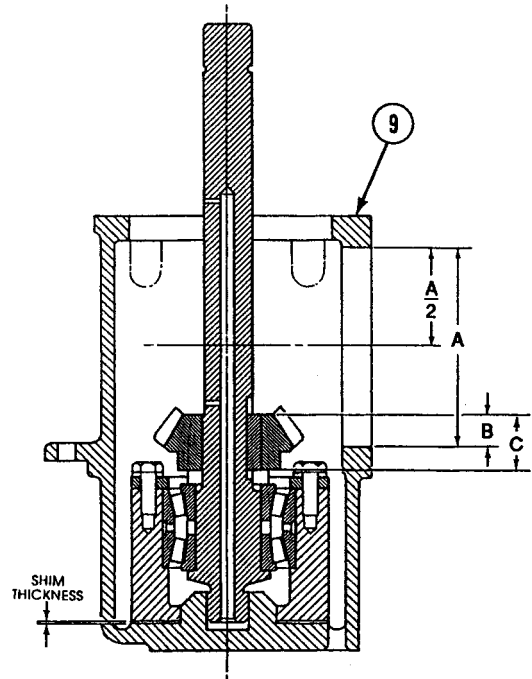
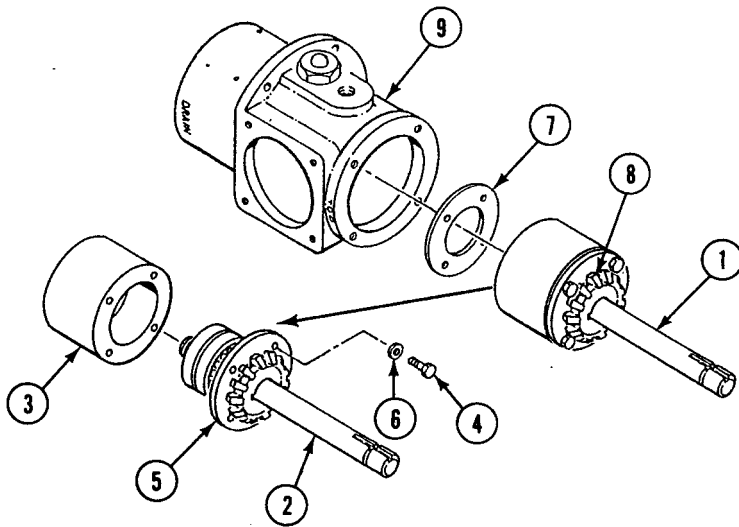
3. Assemble spindle assembly (1) as follows:
 - a. Install shaft and bearing (2) with attached parts in bearing retaining plate (3).
 - b. Apply a light coat of antiseize compound to threads of four cap screws (4).
 - c. Secure retaining plate (5) on shaft and bearing (2) to retaining plate (3) with four washers (6) and cap screws (4).
 - d. Tighten four cap screws (4) to 96-108 lb-in (11-12 N•m) torque. Use torque wrench (WP 0034 00, Item 40) and socket set.



NOTE

Take all measurements in thousandths of an inch.

4. Determine thickness of shim (7) as follows:
 - a. Place spindle assembly (1) on clean, flat surface. Measure from top of pinion gear (8) to surface and from bottom of pinion gear to surface. Subtract second reading from first. Record as dimension C. Use caliper set and dial indicator (WP 0033 00, Item 11).
 - b. Record Mounting Distance (M.D.) etched on pinion gear (8).
 - c. Measure inside diameter of bore in housing (9) and record as dimension A. Use caliper set.
 - d. Without installing shim (7), install spindle assembly (1) inside housing (9).
 - e. Place housing (9) on clean, flat surface. Measure from top of pinion gear (8) to surface and from edge of bore in housing to surface. Subtract second reading from first. Record as dimension B. Use caliper set and dial indicator (WP 0033 00, Item 11).
 - f. Calculate shim thickness using above measurements and M.D. dimension (etched on pinion gear). Shim thickness = $A/2 - B + C - \text{M.D.}$
 - g. Peel new laminated shim (7) to calculated thickness or next thinner laminate. Keep removed laminates for later use in Step 21 below.
 - h. Remove spindle assembly (1) from housing (9).

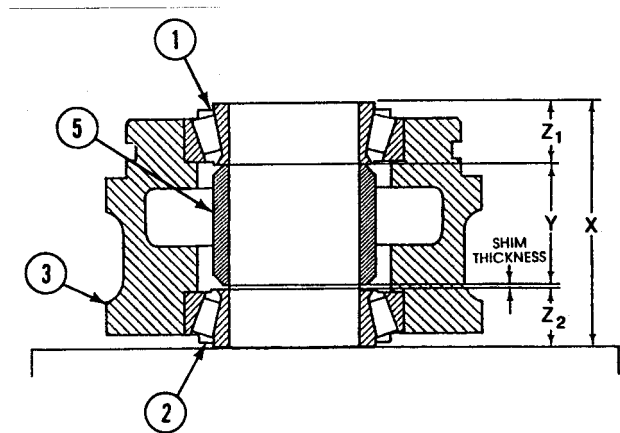
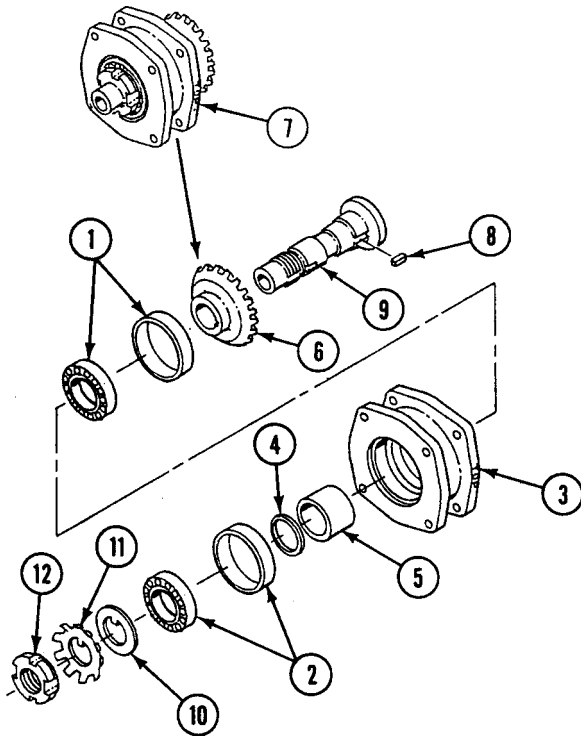


5. If tapered roller bearing (1) and roller bearing (2) must be replaced, press outer races of two new bearings into bearing retaining plate (3). Use arbor press.

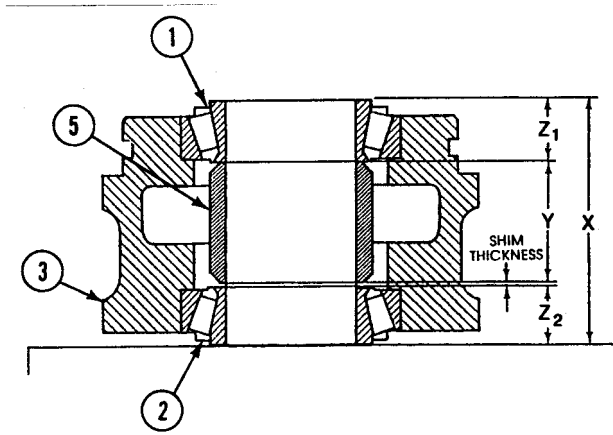
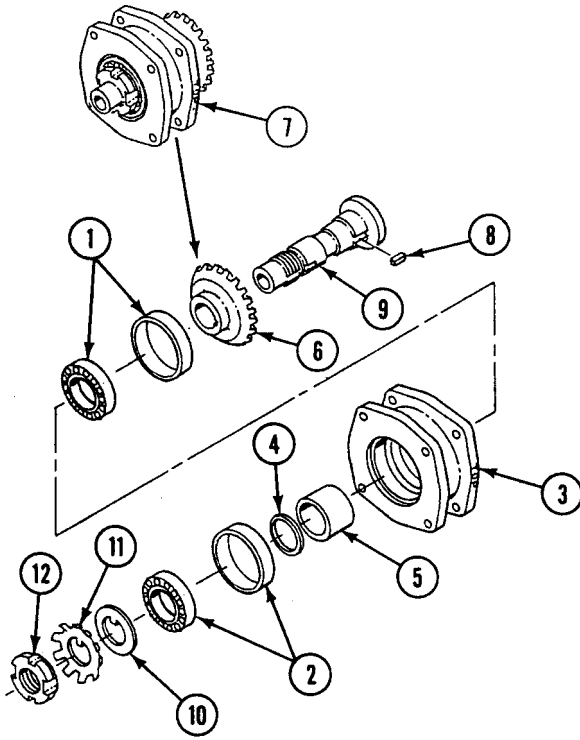
NOTE

Take all measurements in thousandths of an inch.

6. Determine thickness of shim (4) as follows:
 - a. Insert inner race of bearing (1) into outer race in retaining plate (3). Place retaining plate with inner race of bearing on clean, flat surface. Measure from top edge of inner race to surface. Record as dimension Z1. Use caliper set.
 - b. Insert inner race of bearing (2) into outer race in retaining plate (3). Turn retaining plate over with inner race of bearing (2) on clean, flat surface. Measure from top edge of bearing (2) inner race to surface. Record as dimension Z2. Use caliper set.
 - c. With inner races of bearing (1) and bearing (2) installed, measure and record total height of assembly as dimension X. Use caliper set.
 - d. Measure and record length of sleeve spacer (5) as dimension Y. Use caliper set.
 - e. Calculate shim thickness using above measurements as follows: Shim thickness = $X - Y - Z1 - Z2 - 0.001$
 - f. Peel new laminated shim (4) to calculated thickness or next thinner laminate.
 - g. Remove inner races of bearing (1) and bearing (2) from retaining plate (3).



7. Measure and record the thickness of bevel gear (6) as dimension C. Use caliper set.
8. Record Mounting Distance (M.D.) etched on bevel gear (6).
9. Assemble cartridge assembly (7) as follows:
 - a. Install key (8) on shouldered shaft (9), and press bevel gear (6) on shaft. Use arbor press.
 - b. Press inner race of bearing (1) on shaft (9). Use arbor press.
 - c. Install shaft (9) with bevel gear (6) and inner race of bearing (1) in retaining plate (3).
 - d. Install sleeve spacer (5) and peeled shim (4) on shaft (9) in retaining plate (3).
 - e. Press inner race of bearing (2) on shaft (9) in retaining plate (3). Use arbor press.
 - f. Install key washer (10), new key washer (11), and round nut (12) on shaft (9). Use spanner socket.
 - g. Bend tang on key washer (11) into slot on nut (12).

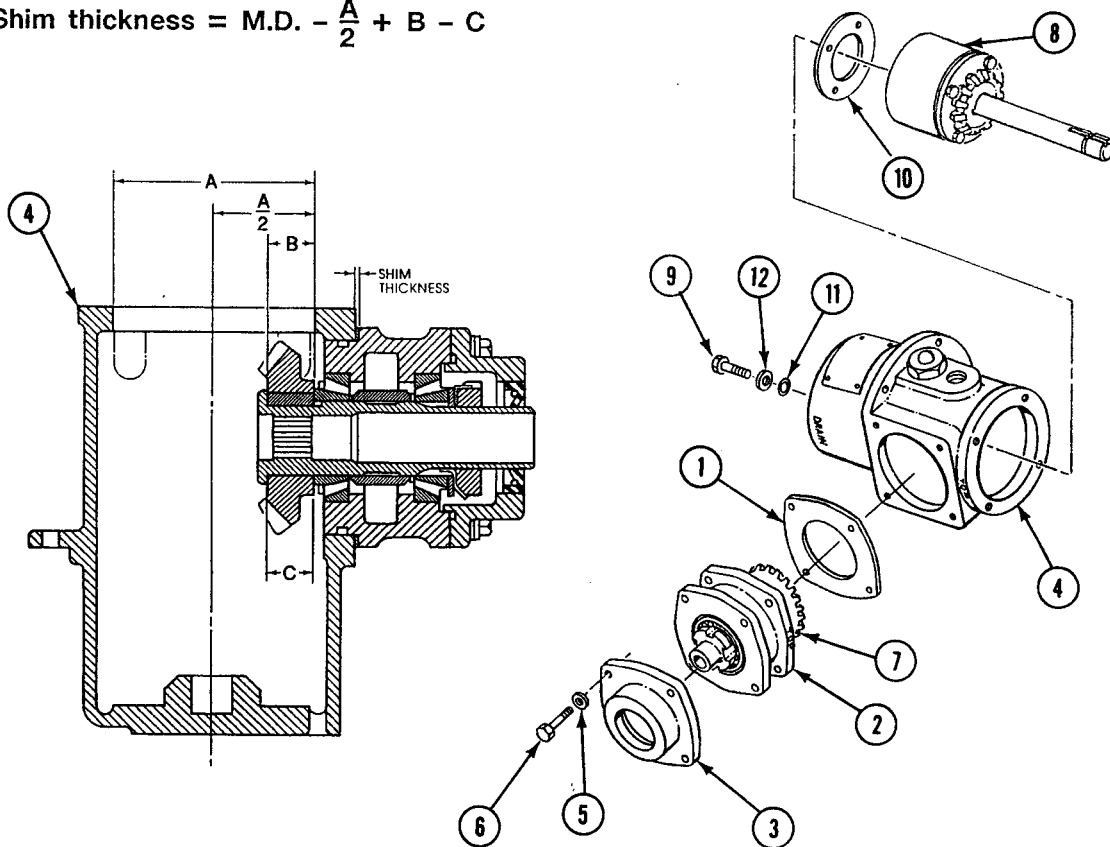


NOTE

Install cartridge assembly with the word TOP facing up.

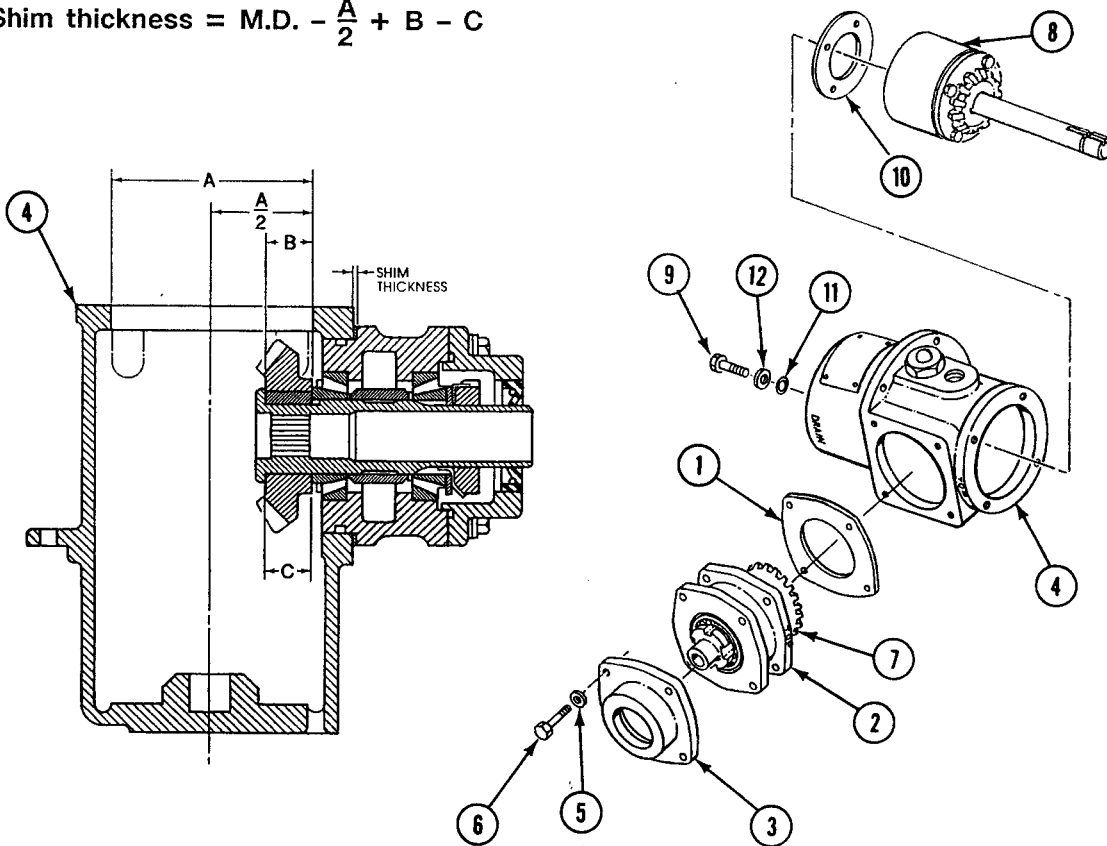
10. Determine thickness of shim (1) as follows:
 - a. Without installing laminated shim (1), install cartridge assembly (2) and retainer (3) on housing (4) with four washers (5) and bolts (6). Tighten bolts snug.
 - b. Measure and record inside diameter of bore in housing (4) as dimension A. Use caliper set.
 - c. Place housing (4) on clean, flat surface. Measure from face of bevel gear (7) to surface and from edge of bore in housing to surface. Subtract second reading from first. Record as dimension B. Use caliper set and dial indicator (WP 0033 00, Item 11).
 - d. Calculate shim thickness using above measurements, dimension C recorded in (Step 7), and M.D. dimension (etched on bevel gear) recorded in (Step 8). Shim thickness = M.D. $- \frac{A}{2} + B - C$
 - e. Peel new laminated shim (1) to calculated thickness or next thinner laminate. Keep removed laminates for later use in (Step 21) below.
 - f. Remove four bolts (6), washers (5), retainer (3), and cartridge assembly (2) from housing (4).

$$\text{Shim thickness} = \text{M.D.} - \frac{A}{2} + B - C$$



11. Install spindle assembly (8) in housing (4) as follows:
 - a. Apply a coat of antiseize compound to threads of four cap screws (9).
 - b. Install peeled shim (10) and spindle assembly (8) in housing (4).
 - c. Lubricate four new packings (11) with grease or petrolatum.
 - d. Secure shim (10) and spindle assembly (8) to housing (4) with four packings (11), washers (12), and cap screws (9).
 - e. Tighten four cap screws (9) to 384-408 lb-in torque (44-46 N•m). Use torque wrench (WP 0033 00, Item 41) and socket set.

$$\text{Shim thickness} = \text{M.D.} - \frac{A}{2} + B - C$$

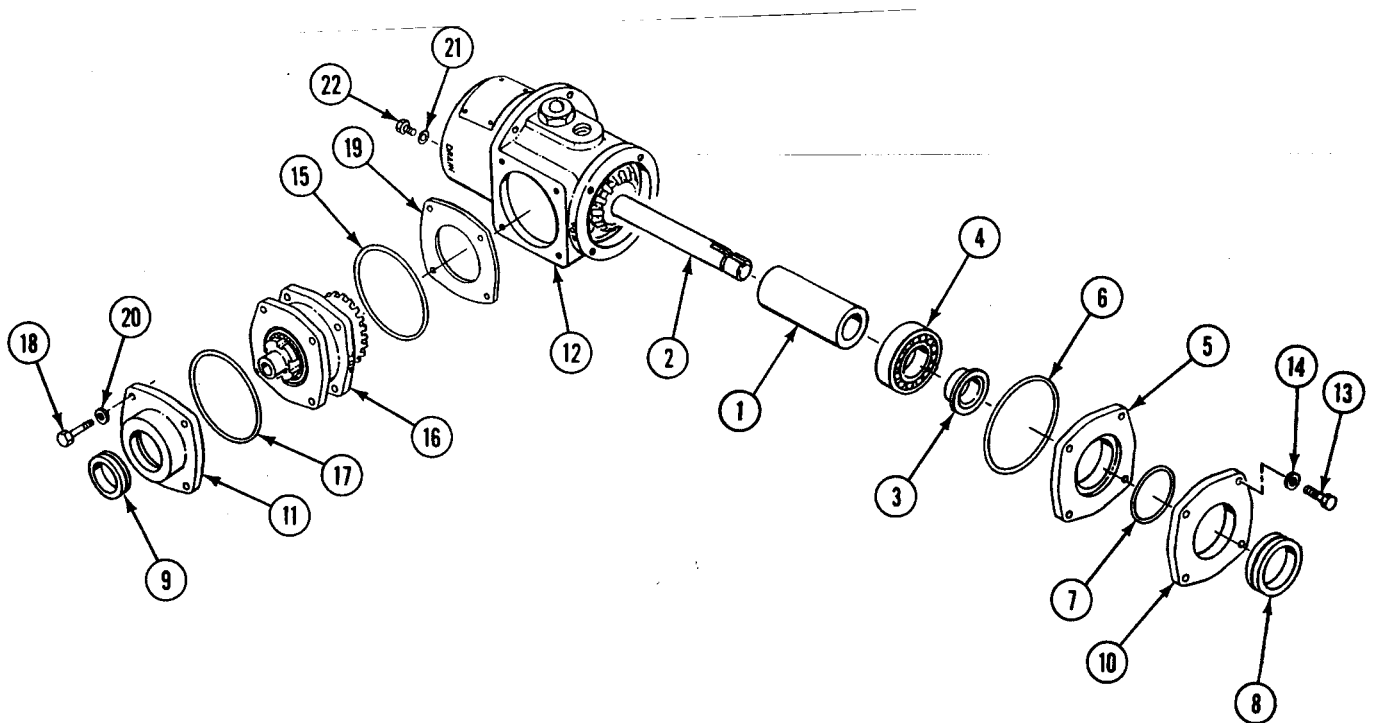


12. Install sleeve spacer (1) on shaft and bearing (2).
13. Press bearing sleeve (3) into ball bearing (4) and install ball bearing into bearing retaining plate (5). Use arbor press.

CAUTION

To prevent damage to oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

14. Lubricate new packing (6) and new packing (7) with grease or petrolatum. Install packings in bearing retaining plate (5).
15. Install new oil seal (8) and oil seal (9) into oil seal retainer (10) and oil seal retainer (11) as follows:
 - a. Clean mating surfaces of oil seal (8), oil seal (9), oil seal retainer (10), and oil seal retainer (11). Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 15) to outer edge of oil seals.
 - b. Press oil seal (8) and oil seal (9) into retainer (10) and retainer (11). Use arbor press.

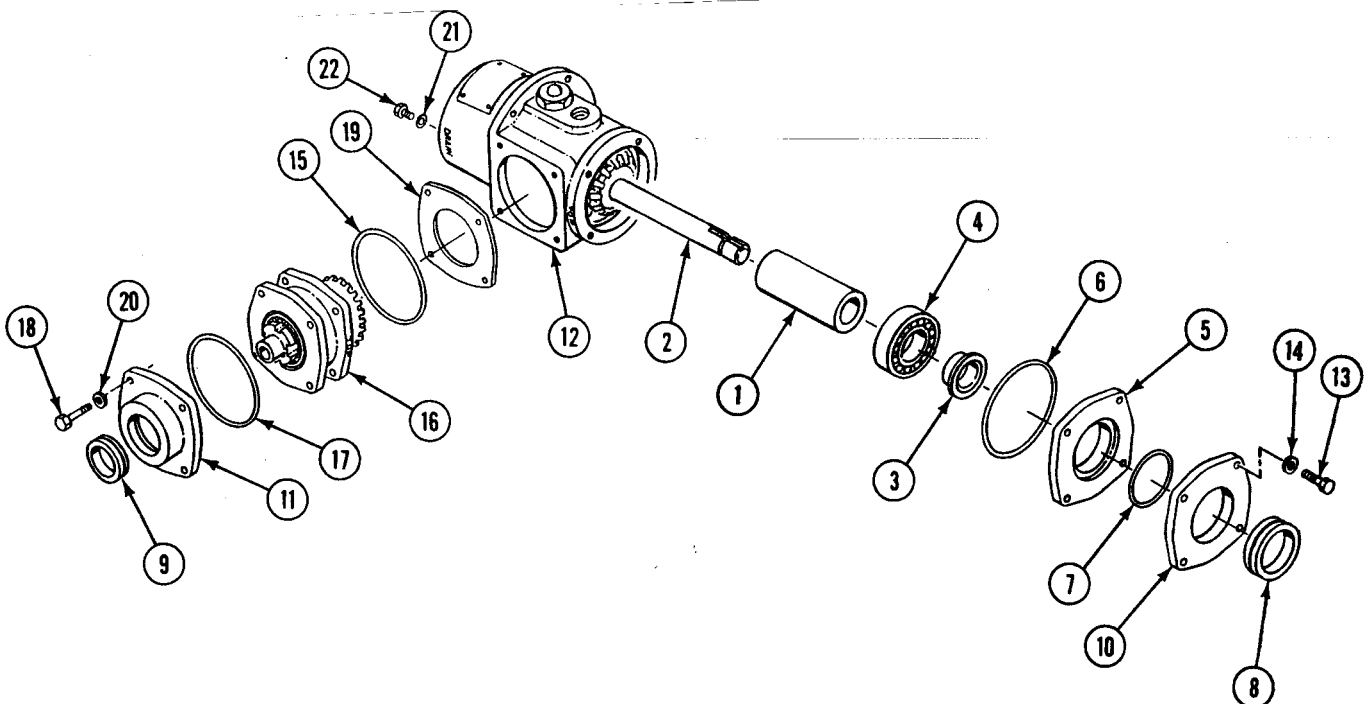


16. Install bearing retainer plate (5) on housing (12) as follows:
 - a. Apply a coat of antiseize compound to threads of four bolts (13).
 - b. Install bearing retaining plate (5) and oil seal retainer (10) on housing (12) and secure with four washers (14) and bolts (13).
 - c. Tighten four bolts (13) to 194-228 lb-in (22-25 N•m) torque. Use torque wrench (WP 0033 00, Item 41) and socket set.
17. Lubricate new packing (15) with grease or petrolatum. Install packing in groove on cartridge assembly (16).
18. Lubricate new packing (17) with grease or petrolatum. Install packing in groove on oil seal retainer (11).

NOTE

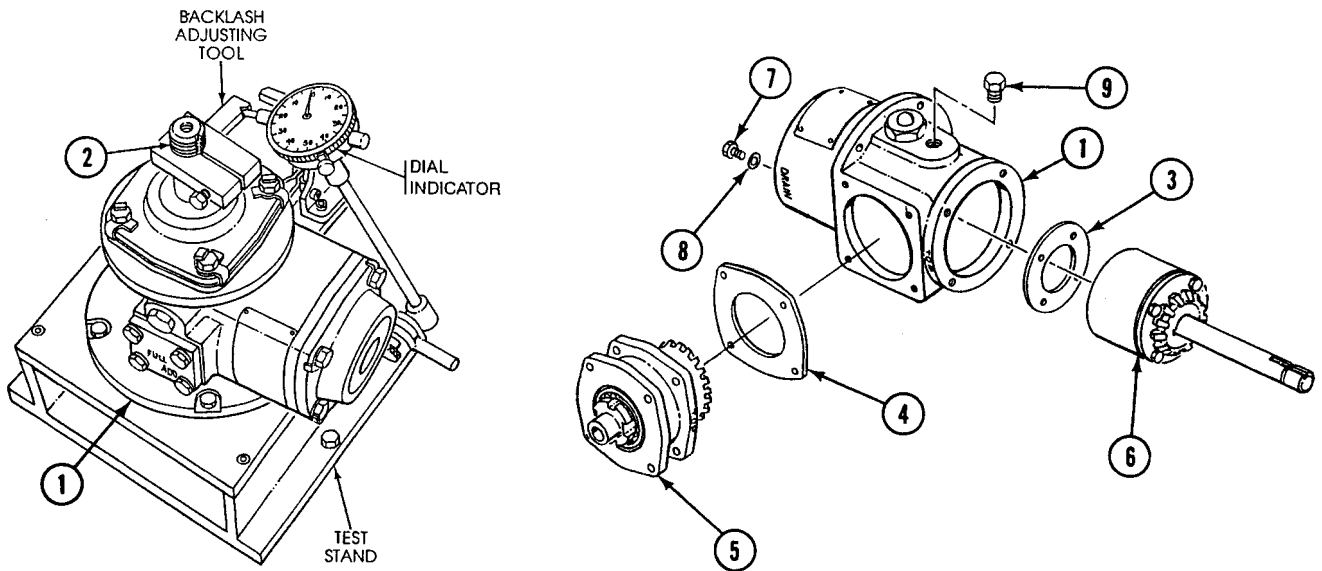
Install cartridge assembly with the word TOP facing up.

19. Install cartridge assembly (16) on housing (12) as follows:
 - a. Apply a coat of antiseize compound to threads of four bolts (18).
 - b. Install peeled shim (19), cartridge assembly (16), and oil seal retainer (11) on housing (12) and secure with four washers (20) and bolts (18).
 - c. Tighten four bolts (18) to 194-228 lb-in (22-25 N•m) torque. Use torque wrench (WP 0033 00, Item 41) and socket set.
20. Install copper washer (21) and screw (22) in drain hole in housing (12).



21. Check and adjust backlash between gears as follows:

- a. Install housing (1) in test stand with spindle shaft (2) in up position. Install backlash adjusting tool on spindle shaft (2) and secure tool by tightening socket head screw on tool. Attach dial indicator (WP 0033 00, Item 13) so that indicator feeler fits in notch on arm of tool.
- b. Check gear backlash by moving tool from side to side while observing dial indicator. Backlash reading should be between 0.005 inch and 0.009 inch.
- c. If backlash is less than 0.005 inch, remove more laminates from spindle shim (3) or add laminates to cartridge shim (4).
- d. If backlash is greater than 0.009 inch, add laminates to spindle shim (3) or remove laminates from cartridge shim (4).
- e. If required, remove cartridge assembly (5) and spindle assembly (6), install new thickness shim (3) and new thickness shim (4), and repeat Step 11, Step 16, and Step 19. Then recheck backlash by repeating steps Step 21a and Step 21b above.
- f. Remove dial indicator and backlash adjusting tool from spindle shaft (2).

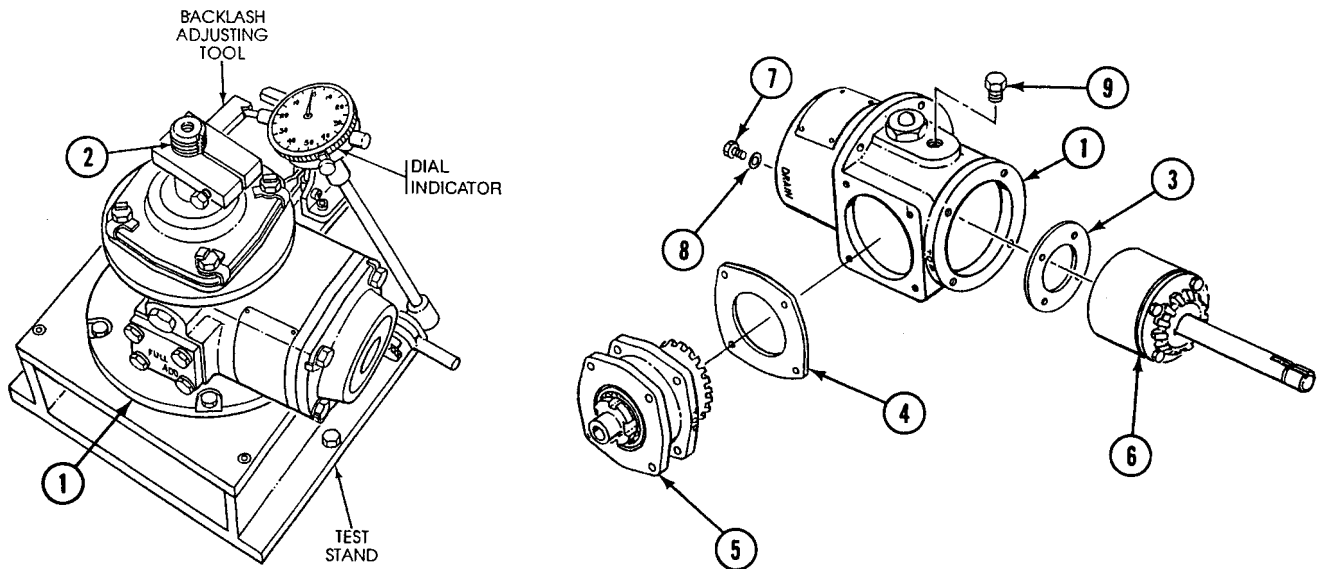


22. Preserve drive as follows:

- a. Fill drive with 5 ounces of engine oil. Check for leaks. See your (WP 0014 00).
- b. Remove screw (7) and copper washer (8) from housing (1) and drain oil into a suitable container. Leave residual oil as preservative during shipping or storage.
- c. Apply a coat of antiseize compound to threads of screw (7).
- d. Install copper washer (8) and screw (7) in drain hole in housing (1).
- e. Tighten screw (7) to 192-240 lb-in (22-27 N•m) torque. Use torque wrench (WP 0033 00, Item 41) and socket set.

23. Install pipe plug (9) in housing (1) as follows:

- a. Clean male pipe threads thoroughly. Apply sealing compound (WP 0035 00, Item 12) to pipe threads. Do not apply sealant beyond small end of threads. Do not fill leading thread.
- b. Install plug (9) in housing (1).



WEAR LIMITS

1. Check parts that have reference letters in figure below.
2. Check the parts dimensions with chart on next page to determine replacement. Use micrometer, caliper set, and vernier height gauge.

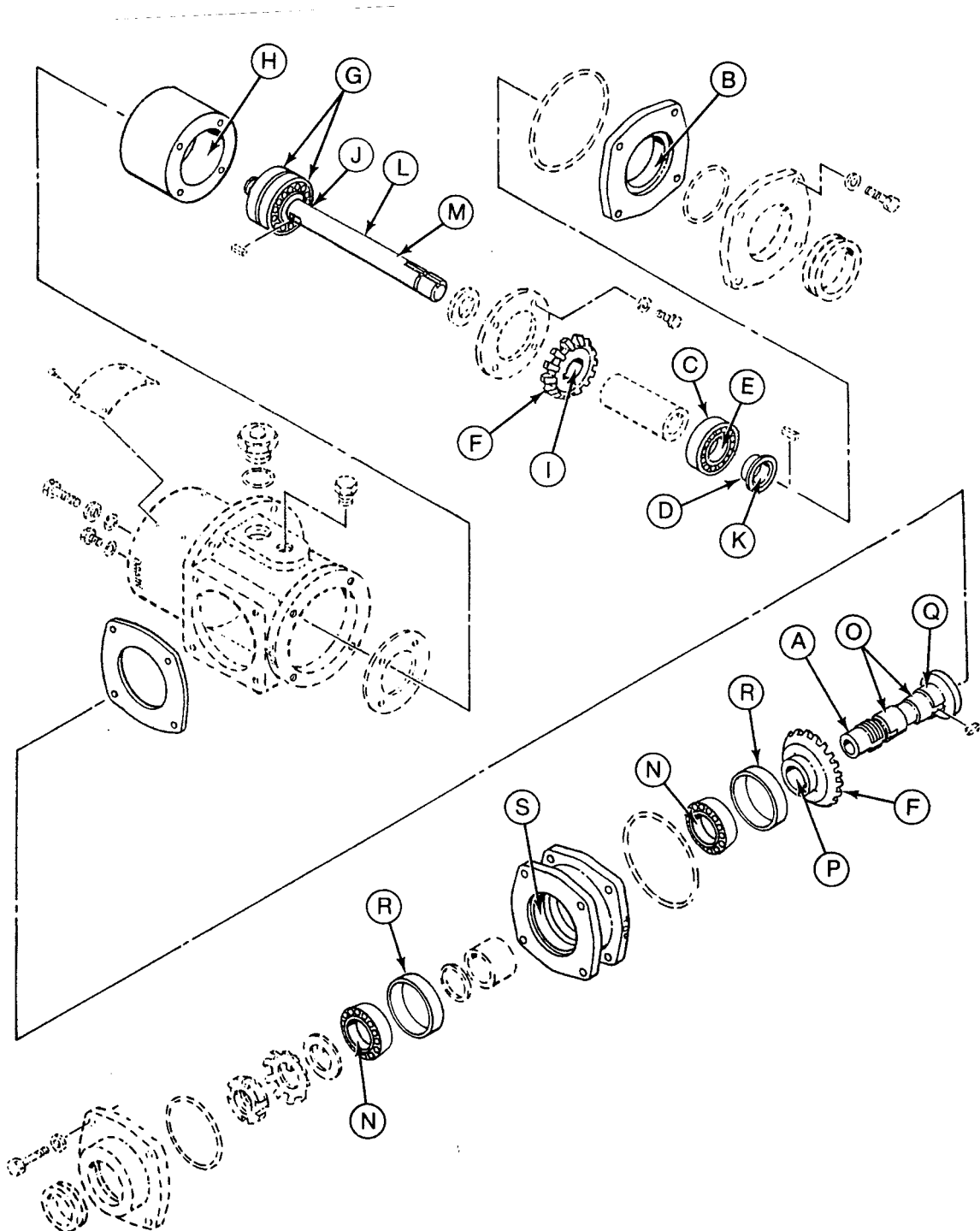


Table 1. COOLING FAN RIGHT ANGLE DRIVE C WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Outside diameter of shouldered shaft at seal surface	1.1220 to 1.1270	1.1200
B	Inside diameter of bearing retainer plate	2.1654 to 2.1666	2.1671
C	Outside diameter of ball bearing	2.1649 to 2.1654	(*)(**)
C-B	Fit of ball bearing in bearing retainer plate	0.0000 to 0.0017L	
D	Outside diameter of bearing sleeve	1.1814 to 1.1818	(*)(**)
E	Inside diameter of ball bearing	1.1807 to 1.1811	(*)(**)
E-D	Fit of ball bearing on bearing sleeve	0.0003T to 0.0011T	
F	Backlash between gears in plane of rotation	0.0050 to 0.0090	(*)(***)
G	Outside diameter of tapered roller bearing	2.4409 to 2.4419	(*)(**)
H	Inside diameter of bearing retainer plate	2.4429 to 2.4439	(*)(**)
H-G	Fit of tapered roller bearing in retainer plate	0.0010T to 0.0020L	
I	Inside diameter of pinion gear	0.9375 to 0.9380	(*)(****)
J	Outside diameter of shouldered shaft at gear surface	0.9380 to 0.9385	(*)(****)
J-I	Fit of pinion gear on shouldered shaft	0.0000 to 0.0010T	
K	Inside diameter of bearing sleeve	0.8760 to 0.8770	(*)(****)
L	Outside diameter of shouldered shaft at sleeve surface	0.8752 to 0.8756	(*)(****)
L-K	Fit of bearing sleeve on shouldered shaft	0.0004L to 0.0018L	
M	Outside diameter of shouldered shaft at seal surface	0.8752 to 0.8756	0.8732
N	Inside diameter of tapered roller bearing	1.3775 to 1.3780	(*)(**)
O	Outside diameter of shouldered shaft at bearing surface	1.3785 to 1.3790	(*)(****)
O-N	Fit of tapered roller bearing on shouldered shaft	0.0005T to 0.0015T	
P	Inside diameter of bevel gear	1.4375 to 1.4380	(*)(****)
Q	Outside diameter of shouldered shaft at gear surface	1.4380 to 1.4385	(*)(****)
Q-P	Fit of bevel gear on shouldered shaft	0.0000 to 0.0010T	
R	Outside diameter of tapered roller bearing	2.3612 to 2.3622	(*)(**)
S	Inside diameter of bearing retainer plate	2.3588 to 2.3598	2.3603
S-R	Fit of tapered roller bearing in retainer plate	0.0014T to 0.0034T	

* Must be within new parts dimensions.
** Measure only if there is visual indication of bearing turning.
*** Refer to repair cooling fans right angle drive A and B (WP 0015 00).
**** Measure only if there are visual signs of wearing or damage.

END OF TASK

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS
FOR REPAIR TRANSFER GEARCASES

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
REPAIR TRANSFER GEARCASES A, B, AND C.....	0017 00
REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER GEARCASE E.....	0018 00
REPAIR TRANSFER GEARCASE F.....	0019 00

REPAIR TRANSFER GEARCASES A, B, AND C

0017 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0017 00-2).
 - Cleaning (page 0017 00-12).
 - Assembly (page 0017 00-13).
 - Run-In Test (page 0017 00-25).
 - Wear Limits (page 0017 00-26).
-

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Bearing cup replacer (WP 0033 00, Item 27)
- Mechanical puller kit (WP 0033 00, Item 17)
- Portable electrical drill (WP 0033 00, Item 4)
- Remover/replacer (WP 0033 00, Item 21)
- Jack screw (4) (WP 0033 00, Item 30)
- Screwdriver bit set and handle (WP 0033 00, Item 31)
- Sling (WP 0033 00, Item 32)
- Soft plastic hammer (WP 0033 00, Item 10)
- Torque wrench (WP 0033 00, Item 41)
- Torque wrench (WP 0033 00, Item 44)
- Twist drill set (WP 0033 00, Item 5)

References

- See your -20
- See your -34
- See your -34P
- See your PMCS
- TM 9-214

Equipment Condition

- Power plant removed (see your -20)
- Power plant blocked (see your -34)
- Transmission removed from transfer gearcase A, B, or C (see your -34)
- Transfer gearcase A, B, or C removed from engine (see your -34)

Materials/Parts

- Antisieze compound (WP 0035 00, Item 1)
 - Engine lubricating oil (WP 0035 00, Item 5)
 - Grease (WP 0035 00, Item 6)
 - Petrolatum (WP 0035 00, Item 10)
 - Sealing compound (WP 0035 00, Item 12)
 - Sealing compound (WP 0035 00, Item 13)
 - Transfer gearcase parts kit
 - Cotter pin
 - Cotter pin
 - Grooved pin
 - Machine key
 - Plug
 - Preformed packing
 - Preformed packing
 - Solid rivet
 - Spring pin
-

DISASSEMBLY

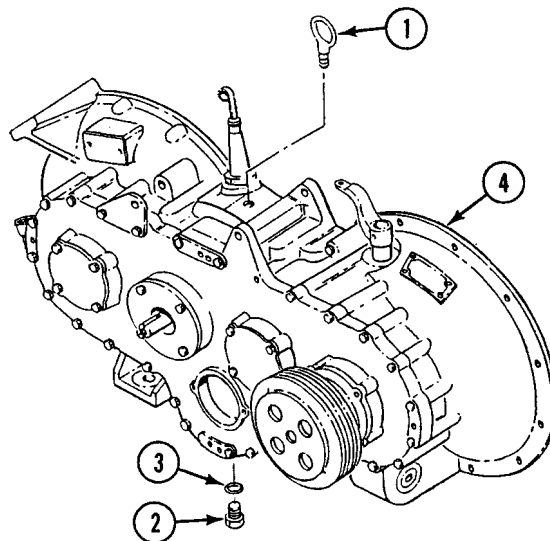
WARNING

Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

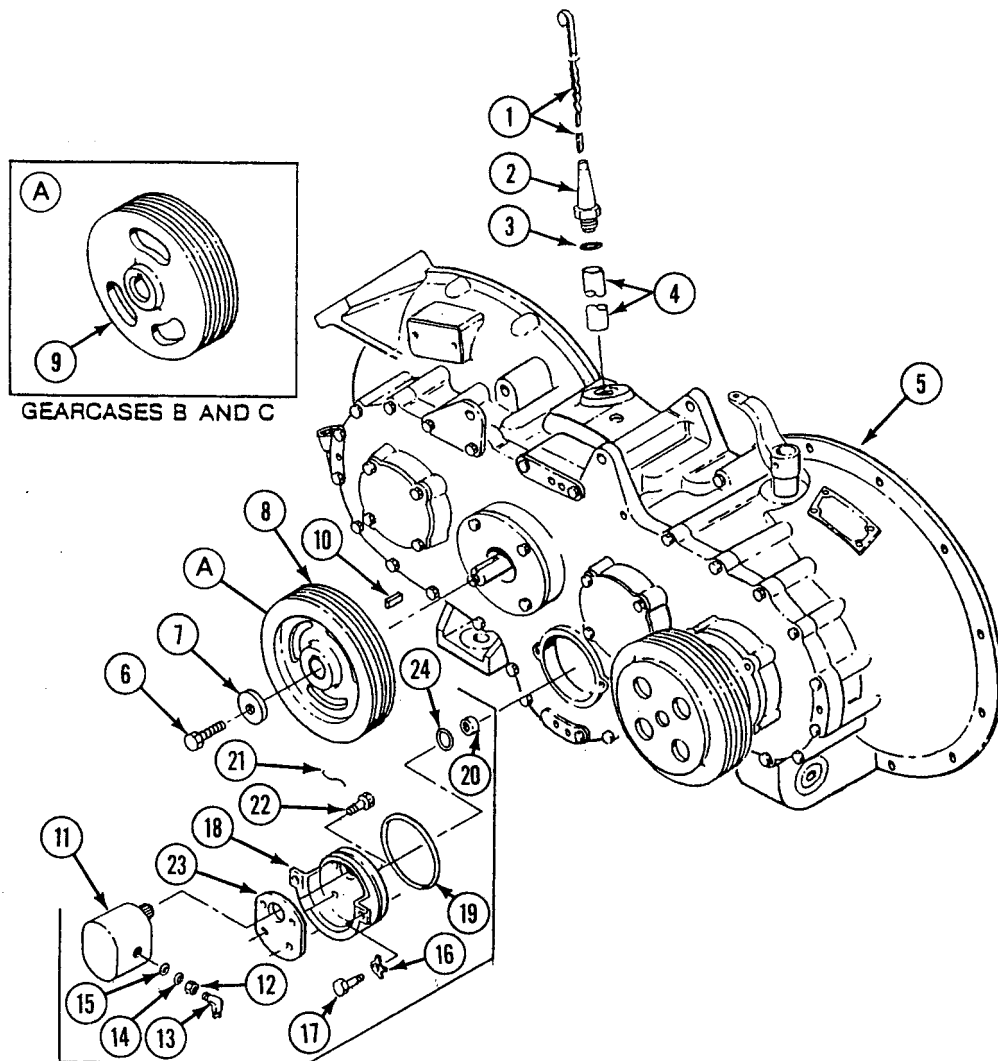
1. Lift transfer gearcase A, B, or C using suitable hoist and beam type sling, through eye bolt (1) and place gearcase in work station. Remove sling and hoist from eyebolt.
2. Remove oil drain plug (2) and packing (3) from housing (4). Drain oil from housing into a suitable container. Discard packing.
3. Remove eye bolt (1) from housing (4).



REPAIR TRANSFER GEARCASES A, B, AND C — Continued

0017 00

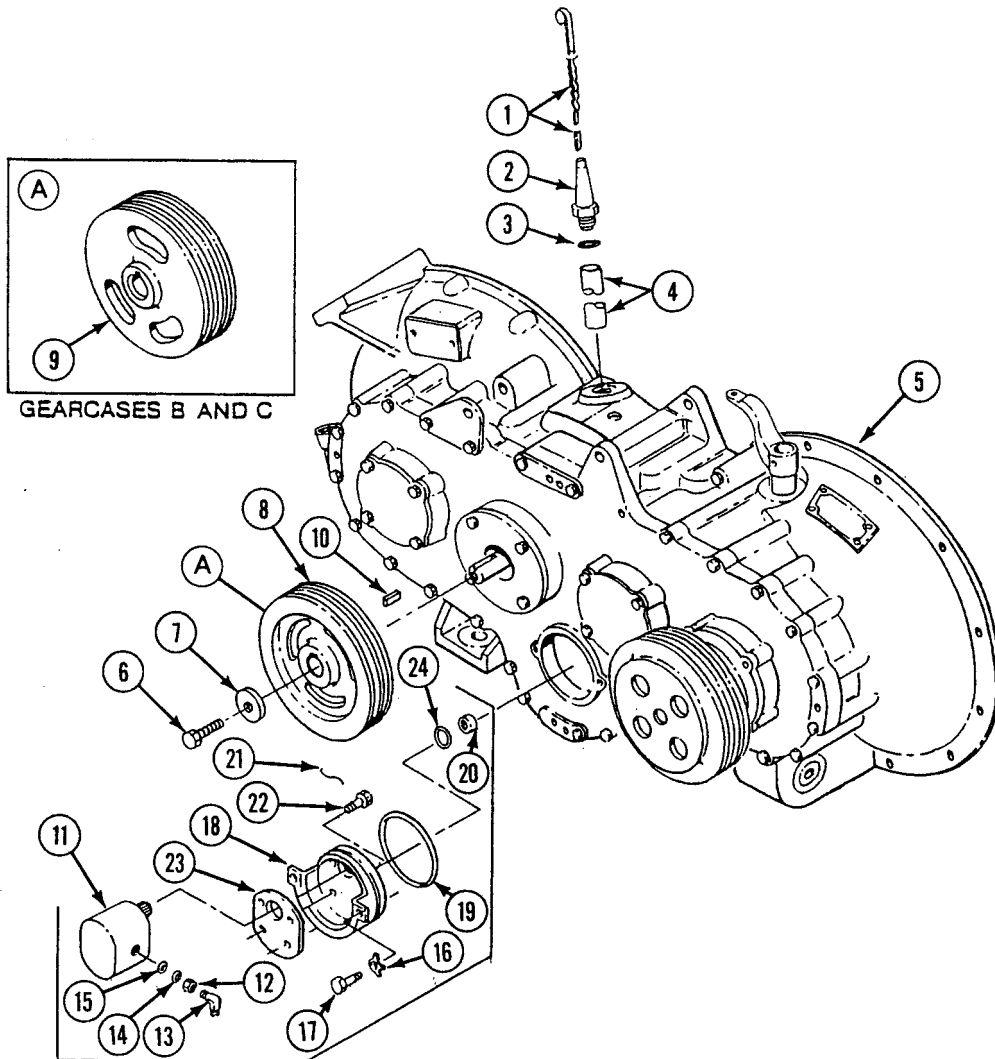
4. Remove liquid level gauge rod (1) from guide (2). Remove guide (2), packing (3), and guide (4) from housing (5). Discard packing.
5. Remove cap screw (6), and washer (7). On gearcase A, remove two-groove pulley (8). On gearcase B or C, remove three-groove pulley (9). Remove machine key (10) from hub of second intermediate gear. Discard machine key.
6. On gearcase A, B, or C, remove ramp hydraulic pump (11) from cover on housing (5). Remove hex nut (12), elbow (13), washer (14), and packing (15) from pump (11). Discard packing. Straighten tabs on two key washers (16). Remove two machine bolts (17) and key washers (16), and remove pump with bracket (18) and packing (19) from cover. Discard key washers and packing.



REPAIR TRANSFER GEARCASES A, B, AND C — Continued

0017 00

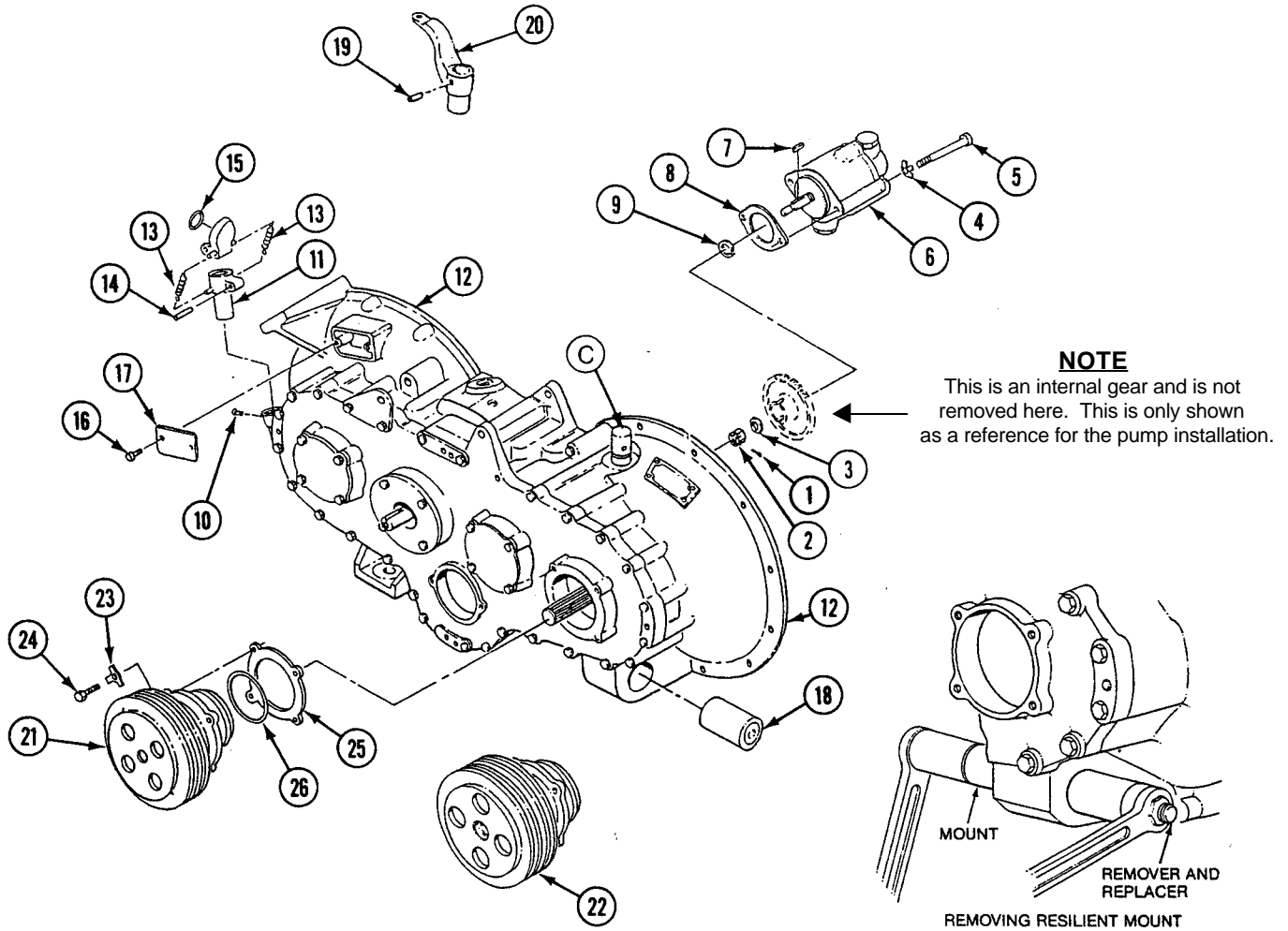
7. Remove coupling (20) from hub of secondary pump drive gear.
8. Remove lock wire (21) and four cap screws (22). Separate pump (11), bracket (18), and gasket (23). Discard lock wire and gasket.
9. Remove retaining ring (24) from pump shaft. Discard retaining ring.
10. Straighten tabs on two key washers (28). Remove two cap screws (29), key washers (28) and cover (26) from housing cover. Discard key washers.
11. Remove packing (30) from cover (26). Discard packing.



REPAIR TRANSFER GEARCASES A, B, AND C — Continued

0017 00

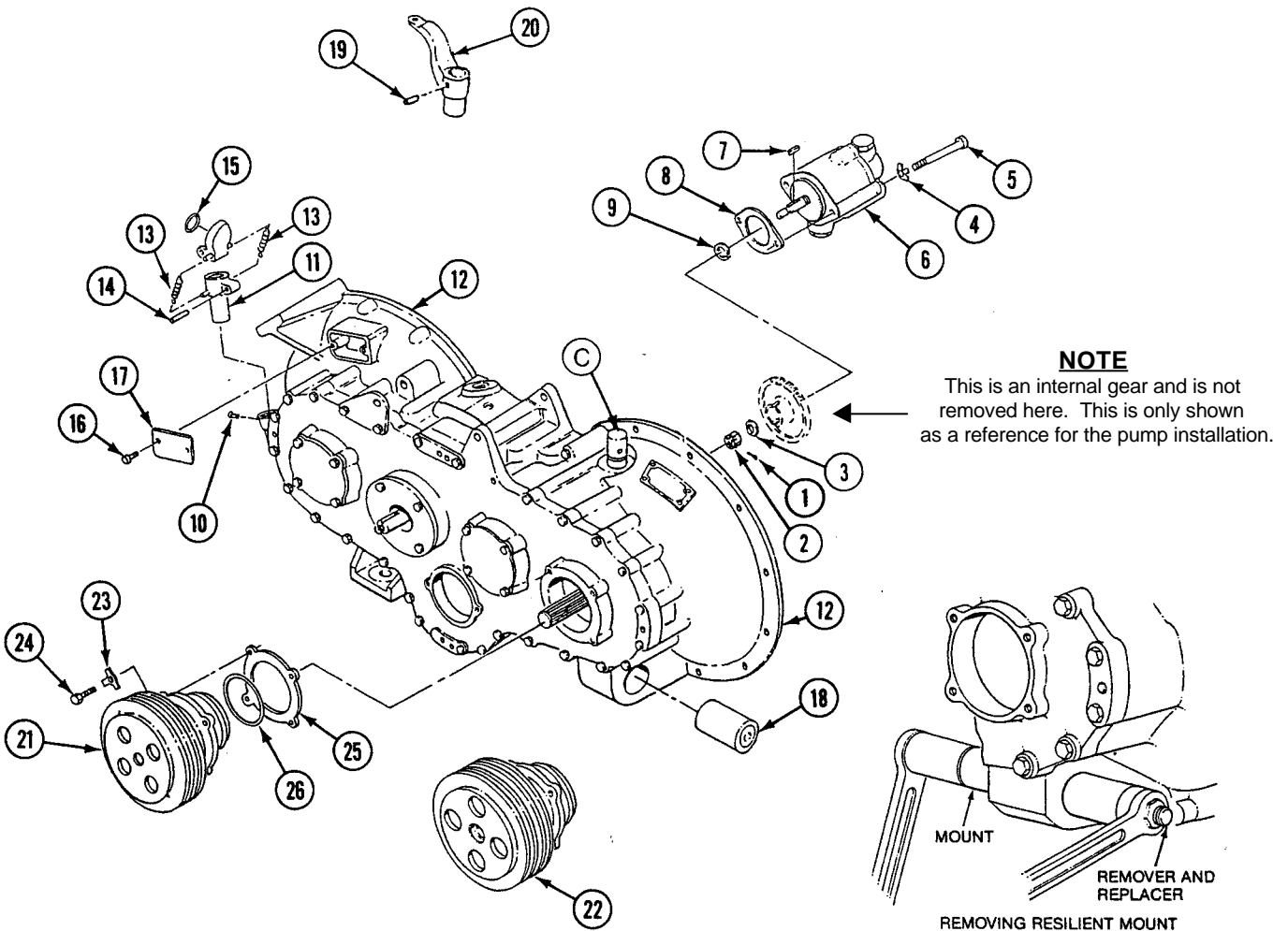
12. Remove cotter pin (1), slotted nut (2), and one or two washers (3) securing differential oil pump to secondary pump drive-gear. Discard cotter pin. Straighten tabs on two key washers (4). Remove two cap screws (5), key washers (4) and differential oil pump (6). Remove and discard machine key (7) and gasket (8).
13. If pump (6) is to be replaced, remove retaining ring (9) from shaft of pump. Discard retaining ring.
14. Remove and discard solid rivet (10) holding filler neck (11) in housing (12). Remove filler neck. Remove two helical springs (13) and spring pin (14) holding cap to filler cap head. Discard pin. Remove and discard packing (15).



NOTE

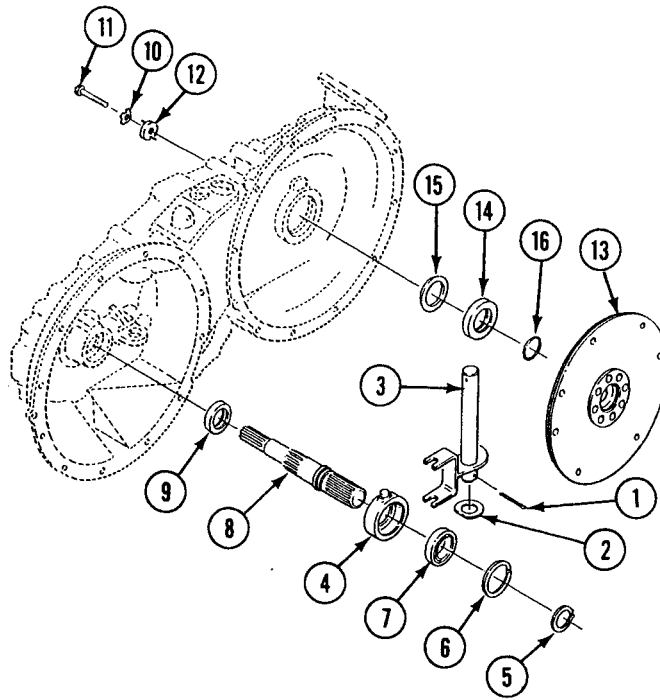
If needed, remove the following components.

15. Remove two cap screws (16) and cover (17) from housing (12).
16. Remove resilient mount (18) from housing (12) using remover and replacer shown.
17. On gearcase A, B, or C, remove groove pin (19) and manual remote control lever (20) from engine disconnect actuator.
18. Remove generator drive assembly (21) or generator drive assembly (22). Straighten tabs on four key washers (23). Remove four cap screws (24) and key washers (23).
19. Remove shim (25) from cover and packing (26) from generator drive (21) or generator drive (22). Discard shim and packing.

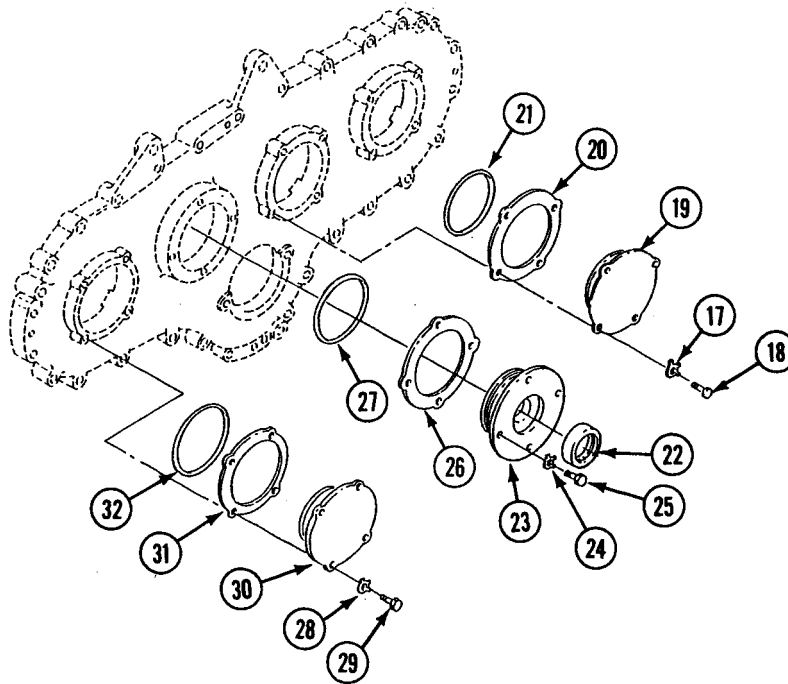


NOTE
 This is an internal gear and is not removed here. This is only shown as a reference for the pump installation.

20. Remove cotter pin (1) and washer (2) from engine disconnect actuator (3). Separate actuator from shift collar (4). Discard cotter pin. Remove retaining ring (5), retaining ring (6), ball bearing (7), shift collar (4), and input shouldered shaft (8) from housing. Discard retaining rings. Remove encased oil seal (9) from housing. Discard oil seal.
21. Straighten tabs on key washer (10). Remove cap screw (11), key washer (10), gearcase washer assembly (12), and disk assembly (13) from output gear. Discard key washer. Remove encased oil seal (14), dirt deflector (15), and packing (16) from disk assembly (13). Discard oil seal, dirt deflector, and packing.



22. Straighten tabs on four key washers (17). Remove four cap screws (18), key washers (17), and first intermediate bearing retaining plate (19) from cover. Discard key washers. Remove laminated shim (20) and packing (21) from retaining plate (19). Discard shim and packing.
23. Remove encased oil seal (22) from second intermediate bearing retaining plate (23). Discard seal. Straighten tabs on four key washers (24). Remove four cap screws (25), key washers (24), and retaining plate (23) from cover. Discard key washers. Remove laminated shim (26) and packing (27) from retaining plate (23). Discard shim and packing.
24. Straighten tabs on four key washers (28). Remove four cap screws (29), key washers (28), and output bearing retaining plate (30) from cover. Discard key washers. Remove laminated shim (31) and packing (32) from retaining plate (30). Discard shim and packing.

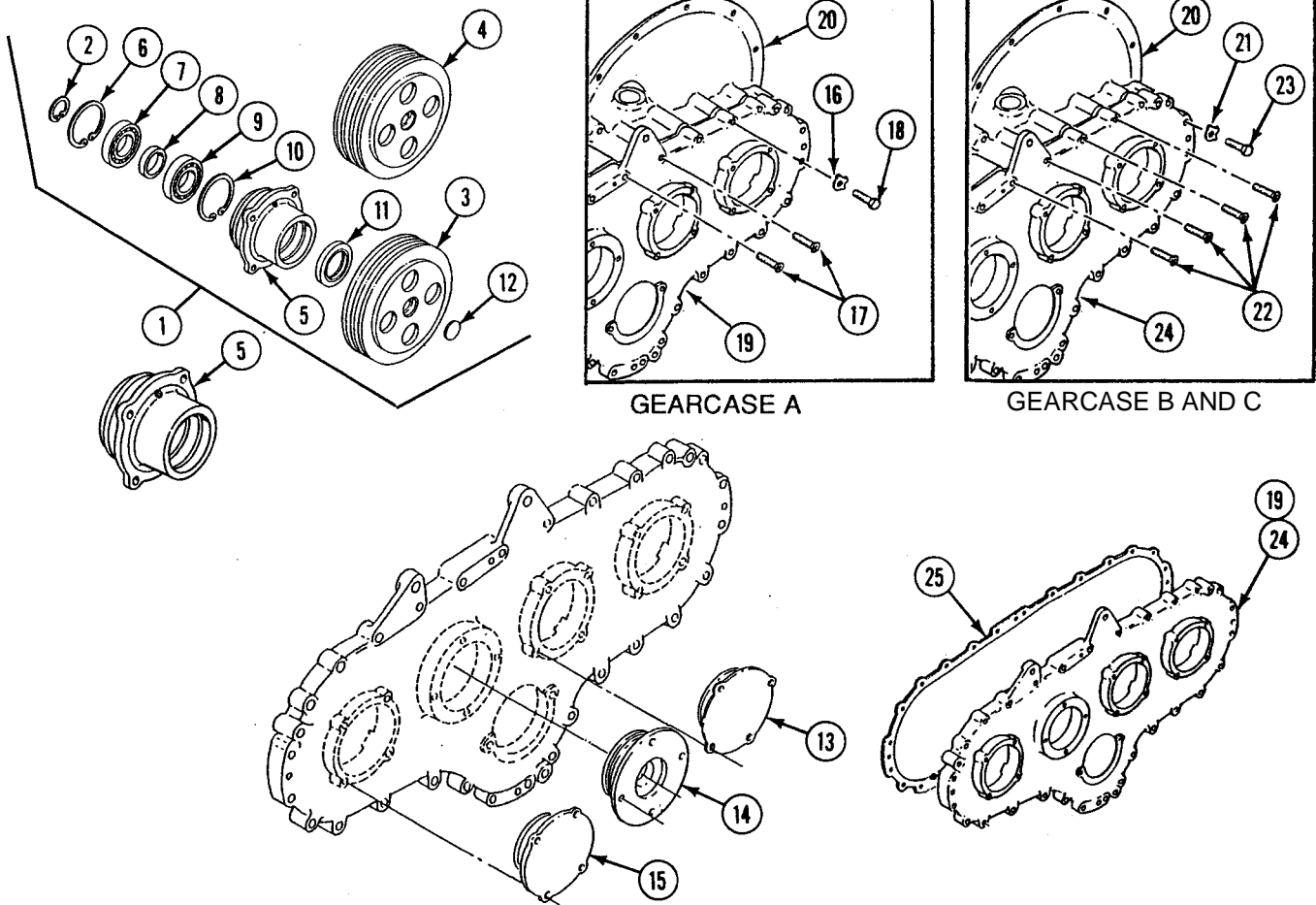


25. To disassemble generator drive assembly (1) on gearcases A or B, remove retaining ring (2) from hub of generator drive pulley (3). On gearcase C, remove retaining ring (2) from hub of drive pulley (4). Separate pulley (3) or pulley (4) from bearing retaining plate (5). Discard retaining ring. Remove retaining ring (6), ball bearing (7), sleeve spacer (8), ball bearing (9), and retaining ring (10) from bearing retaining plate (5). Discard retaining ring (6) and retaining ring (10). Remove and discard oil seal (11) from retaining plate (5). Remove and discard plug (12) from pulley (3) or pulley (4).

NOTE

Do not remove tapered roller bearing cups that are pressed in retaining plates unless inspection indicates a replacement is needed.

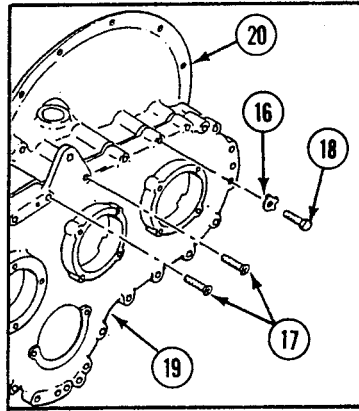
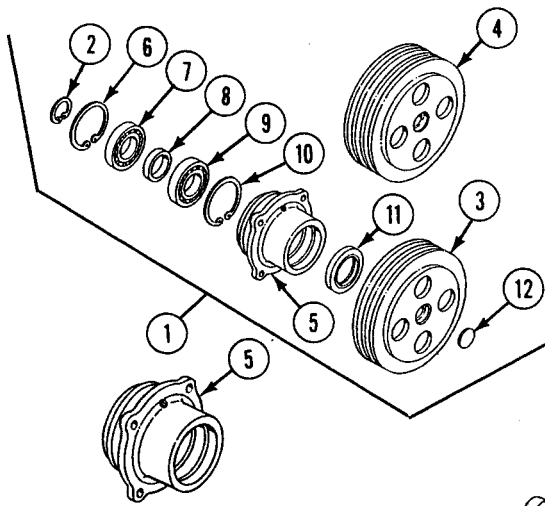
26. As needed, use a mechanical puller kit and remove bearing cup(s) from retaining plate (5), or retaining plate (13), or retaining plate (14), or retaining plate (15).



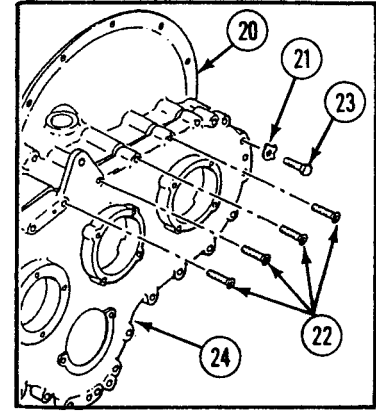
REPAIR TRANSFER GEARCASES A, B, AND C — Continued

0017 00

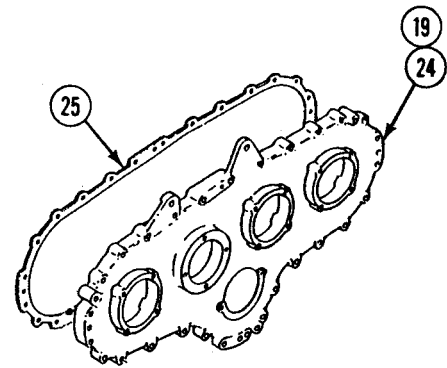
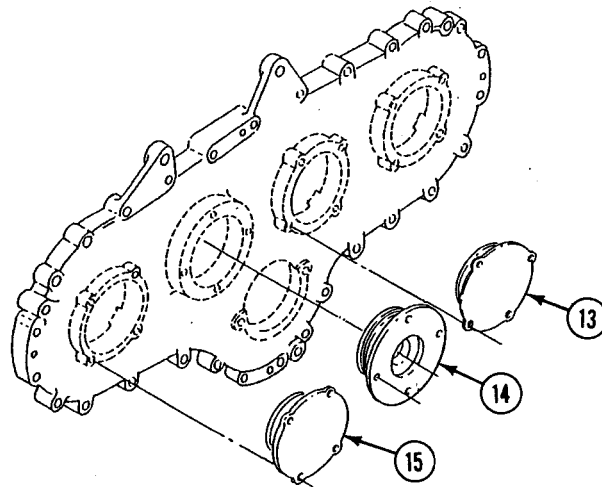
27. On gearcase A, straighten tabs on 26 key washers (16). Remove 2 machine screws (17), 26 cap screws (18), and key washers (16) securing housing cover (19) to gearcase housing (20). Discard key washers.
28. On gearcase B or C, straighten tabs on 24 key washers(21). Remove 4 machine screws (22), 24 cap screws (23), and key washers (21) securing housing cover (24) to housing (20). Discard 24 key washers.
29. Install four cap screws as jacking screws (WP 0033 00, Item 30) in flange of cover (19) or cover (24). Separate cover from housing (20) by tightening jacking screws evenly. Use longer screws if necessary. Remove and discard cover gasket (25).



GEARCASE A



GEARCASE B AND C

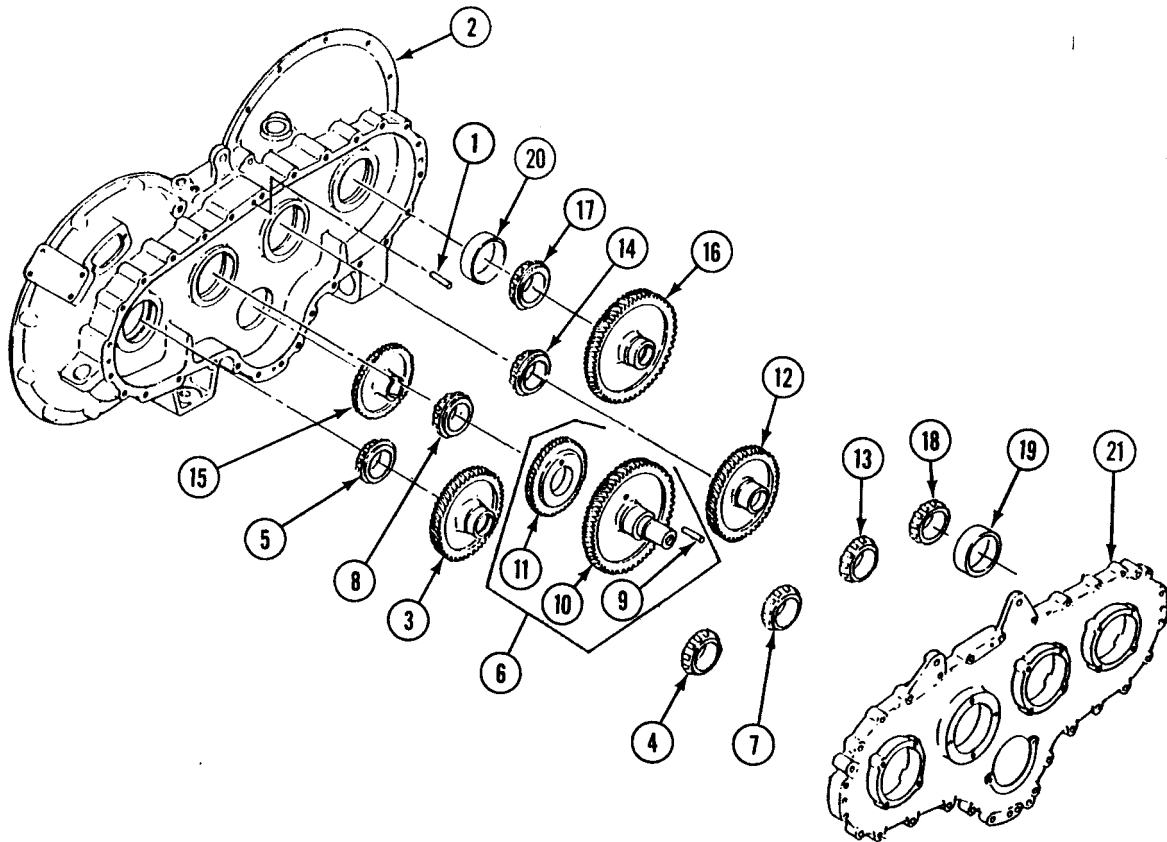


30. If inspection indicates damage, remove alignment pin(s) (1) from housing (2). Discard pin(s)

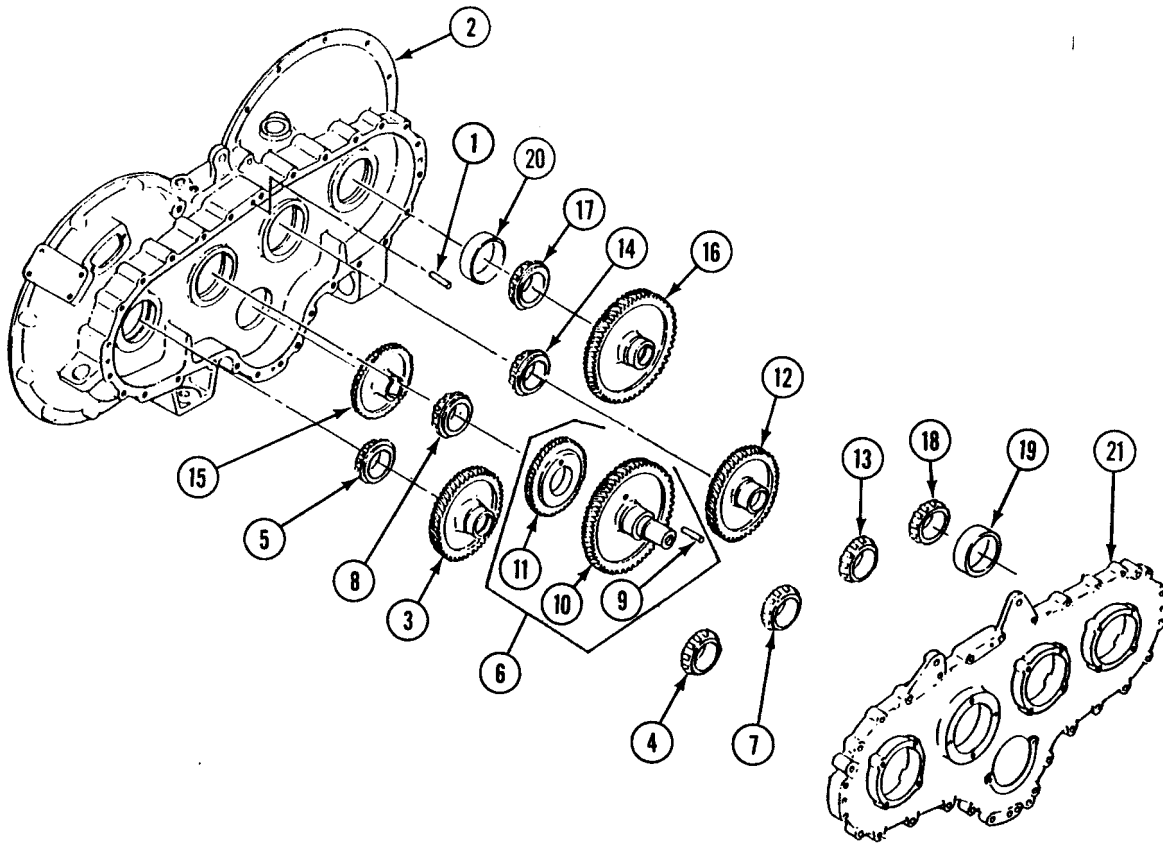
NOTE

Do not remove tapered roller bearing cones or cups that are pressed in place unless inspection indicates a replacement is needed.

31. Remove output gear (3) from housing (2). Separate bearing cone (4) and bearing cone (5) from gear.
32. Remove helical gearshaft cluster (6) as an assembly from housing (2). Separate bearing cone (7) and bearing cone (8) from cluster. If replacement is needed, use brass drift pin and hammer to remove spring pin (9). Separate primary pump-drive gear (10) from second intermediate gear (11). Discard spring pin.



33. Remove first intermediate gear (12) from housing (2). Separate bearing cone (13) and bearing cone (14) from gear.
34. Remove secondary pump-drive gear (15) from housing (2).
35. Remove input gear (16) from housing (2). Separate bearing cone (17) and bearing cone (18) from gear.
36. If needed, remove bearing cup (19) and bearing cup (20) from cover (21) and housing (2) with hammer and punch. Discard cups.



CLEANING

CLEAN, INSPECT, AND REPAIR

1. Inspect all parts of the transfer gearcase. See (WP 0014 00) for general inspection and repair procedures. Check wear limits on transfer gearcases A, B, and C page 0017 00-26. Repair or replace defective parts as needed.

ASSEMBLY

CAUTION

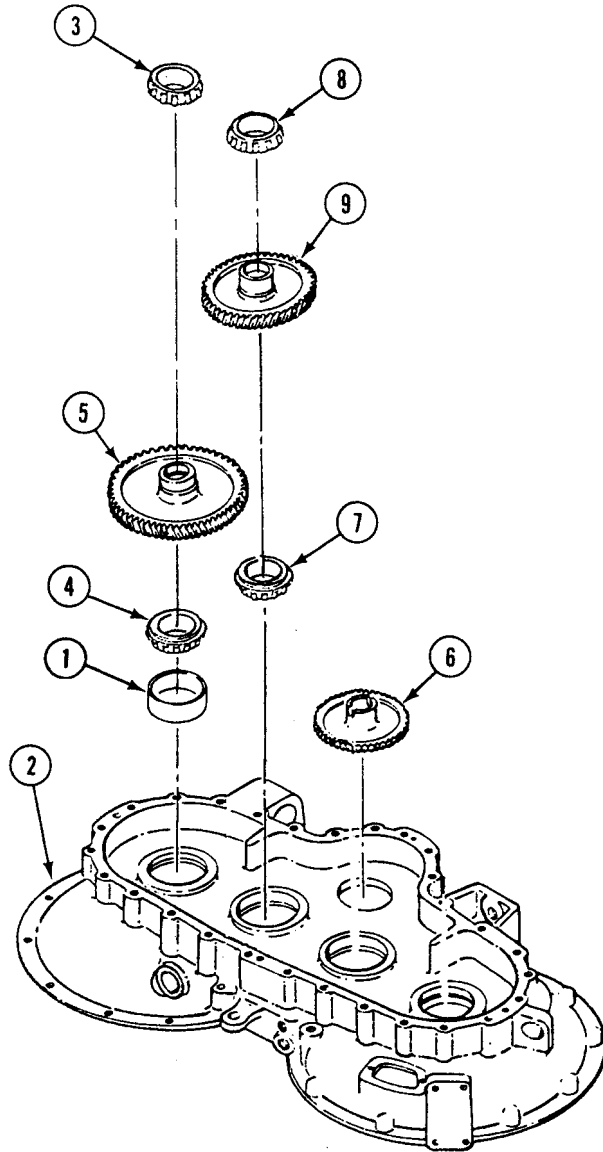
Do not weld aluminum castings. If replacement of a bearing cup or cone is required, its associated cup or cone must also be replaced. The gearcase mechanical housing includes the housing and cover. They are machined as a unit and must be replaced as an assembly.

1. If bearing cup (1) was removed during disassembly, install new bearing cup in housing (2). Heat bearing bore to 250-300°F (121-158°C), and freeze bearing cup. Position bearing cup to its associated bearing bore. Using bearing cup replacer and soft plastic hammer, tap cup in place.

NOTE

If roller bearing cones were removed during disassembly, install new ones. New cones may be heated in oil to 250°F (121°C) to aid installation.

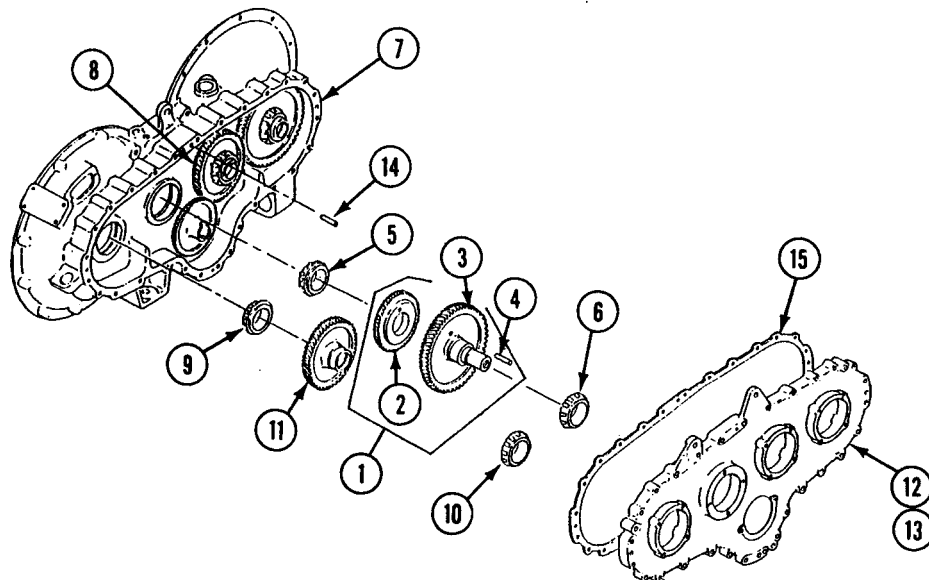
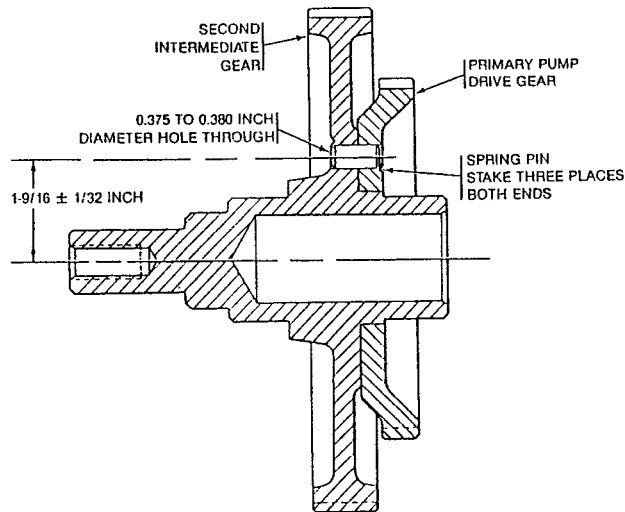
2. Place gearcase housing (2) flat on smooth surface with cover side up.
3. If removed, install bearing cone (3) and bearing cone (4) on input gear (5). Install gear in housing (2).
4. Install secondary pump-drive gear (6) in housing (2) with smaller diameter hub toward housing.
5. If removed, install bearing cone (7) and bearing cone (8) on first intermediate gear (9). Install gear in housing (2) meshing teeth with input gear (5).



NOTE

Check that mating surfaces of second intermediate gear and primary pump-drive gear are clean. Alignment of gear teeth is not necessary.

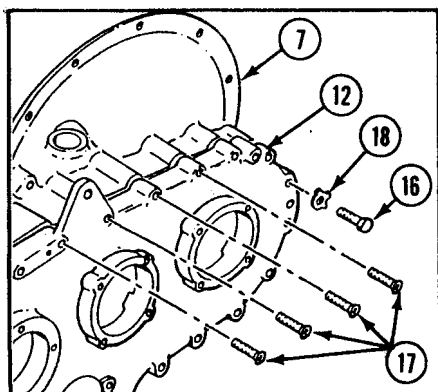
6. Assemble helical gearshaft cluster (1). If dowel holes exist in second intermediate gear (2) and primary pump-drive gear (3), align holes in each gear. Secure gears together with new spring pin (4). Stake pin three equal places at both ends. If dowel holes do not exist in either gears (2) or (3), assemble gears and drill a 0.375 to 0.380 inch diameter hole using a 3/8 inch drill. Secure gear (2) and gear (3) together with new spring pin (4). Stake pin three equal places at both ends.
7. If removed, install bearing cone (5) and bearing cone (6) on helical gearshaft cluster (1). Install cluster in housing (7) meshing teeth of second intermediate gear (2) with first intermediate gear (8).
8. If removed, install bearing cone (9) and bearing cone (10) on output gear (11). Install gear in housing (7) meshing teeth with second intermediate gear (2).



CAUTION

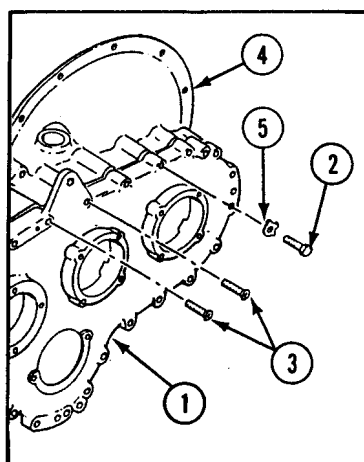
Gearcase cover and housing are machined as a unit and must be replaced as a matched set.

9. Install housing cover (12) or housing cover (13) on housing (7). If removed, install new alignment pin(s) (14) in housing. Tap in place using soft plastic hammer. Install new gasket (15) on housing (7). Align cover (12) or cover (13) with four pins (14) and place cover on housing.
10. On gearcase B or C, install housing cover (12). Apply a light coat of antiseize compound to clean threads of 24 cap screws (16) and 4 machine screws (17). Install cover (12) on housing (7) with 24 new key washers (18), cap screws (16), and 4 machine screws (17). Tighten 24 cap screws (16) and 4 machine screws (17) to 144-192 lb-in (17-21 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on 24 key washers (18).



GEARCASE B AND C

11. On gearcase A, install housing cover (1). Apply a light coat of antiseize compound to clean threads of 26 cap screws (2) and 2 machine screws (3). Install cover (1) on housing (4) with 26 new key washers (5), cap screws (2), and 2 machine screws (3). Torque 26 cap screws (2) and 2 machine screws (3) to 144-192 lb-in (17-21 N•m). Use torque wrench (WP 0033 00, Item 41). Bend tabs on 26 key washers (5).



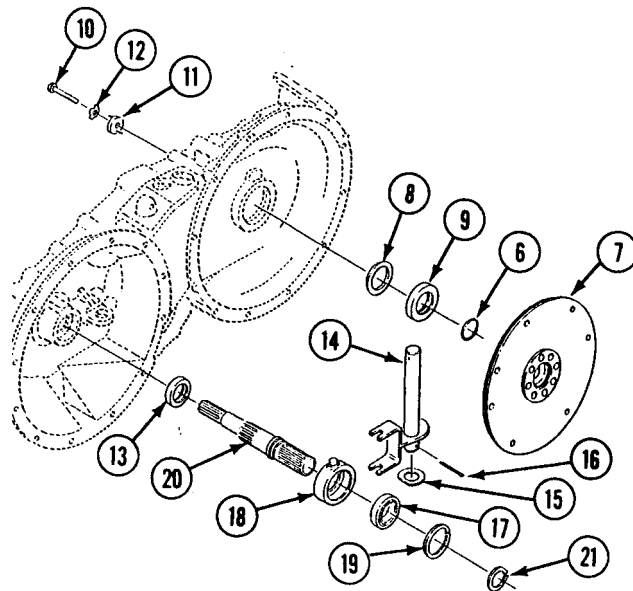
GEARCASE A

12. Lubricate new packing (6) with grease or petrolatum, and install packing on shaft of disk assembly (7).
13. Install new dirt deflector (8) in gearcase housing.

CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

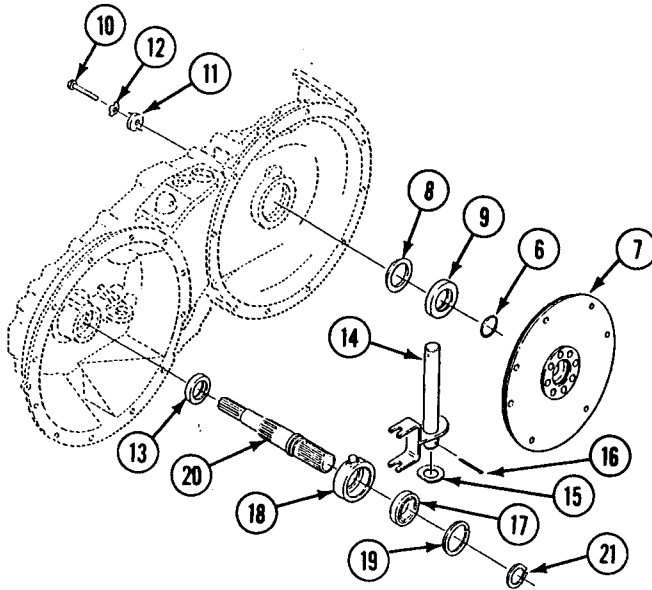
14. Install new encased oil seal (9). Apply a thin even film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to clean mating surface of seal. Apply a thin even film of sealing compound (WP0035 00, Item 12 or 13) to the outside edge of seal to prevent leaking. Position seal with lip toward bore. Use a flat block of wood and soft plastic hammer and tap seal in place.
15. Align splines of disk assembly (7) with splines of output gear and insert disk assembly shaft into output gear.
16. Clean threads of cap screw (10). Apply a light coat of antiseize compound to screw threads. Secure disk assembly (7) with gearcase washer assembly (11), new key washer (12), and cap screw (10). Torque screw to 360-420 lb-in (41-47 N•m). Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.



CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

17. Install new encased oil seal (13). Apply a thin even film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to clean mating surface of seal. Position seal with lip toward bore. Use a flat block of wood and mallet and tap seal in place.
18. Insert engine disconnect actuator (14) through hole in top of gearcase housing. Secure to housing bracket with washer (15) and new cotter pin (16).
19. Insert ball bearing (17) into shift collar (18). Secure in place with new retaining ring (19).
20. Install shift collar (18) on input shouldered shaft (20). Secure with new retaining ring (21).
21. Align splines of input shaft (20) with input gear. Install input shaft with shift collar (18) aligned with actuator (14).

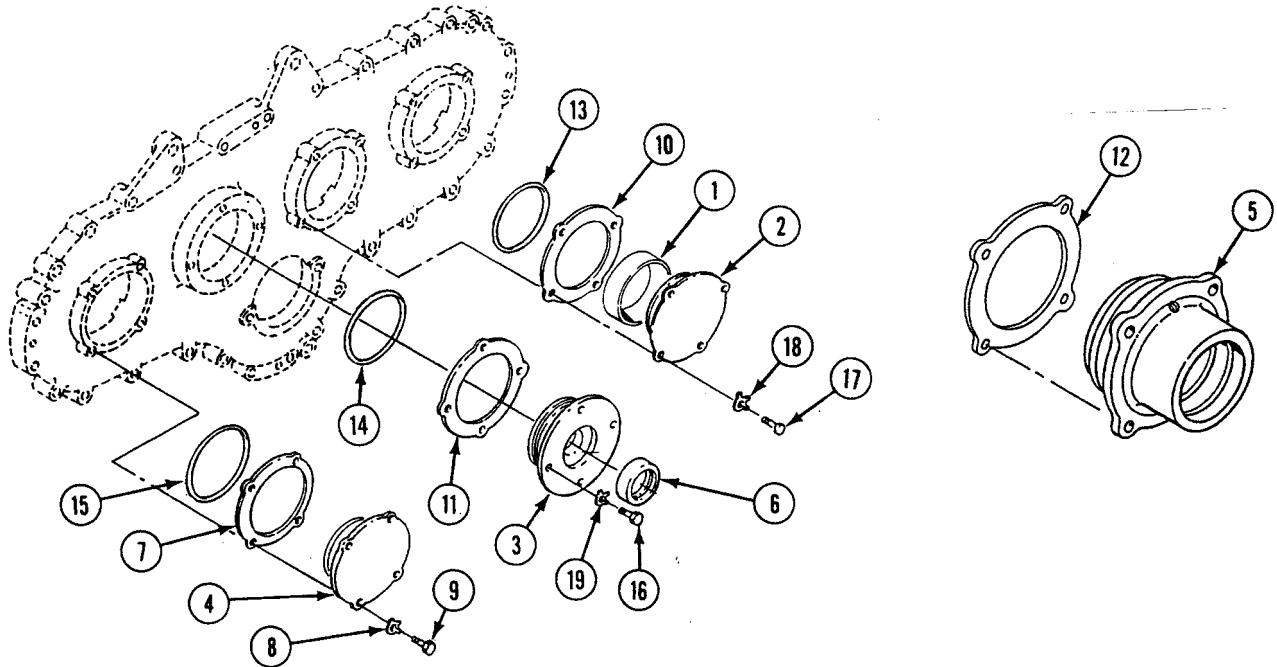


22. If removed, install bearing cups (1) in retaining plate (2), or retaining plate (3), or retaining plate (4), or retaining plate (5) with bearing cup replacer and a soft plastic hammer.
23. Install new encased oil seal (6) in second intermediate bearing retaining plate (3). Apply a thin even film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to clean mating surface of seal. Position seal with lip toward bore. Use a flat block of wood and mallet and tap seal in place so that top surface is .09 to .15 inch below surface of retaining plate.

NOTE

Install bearing retaining plate with oil hole up. Most retaining plates have the word TOP marked on metal near oil hole.

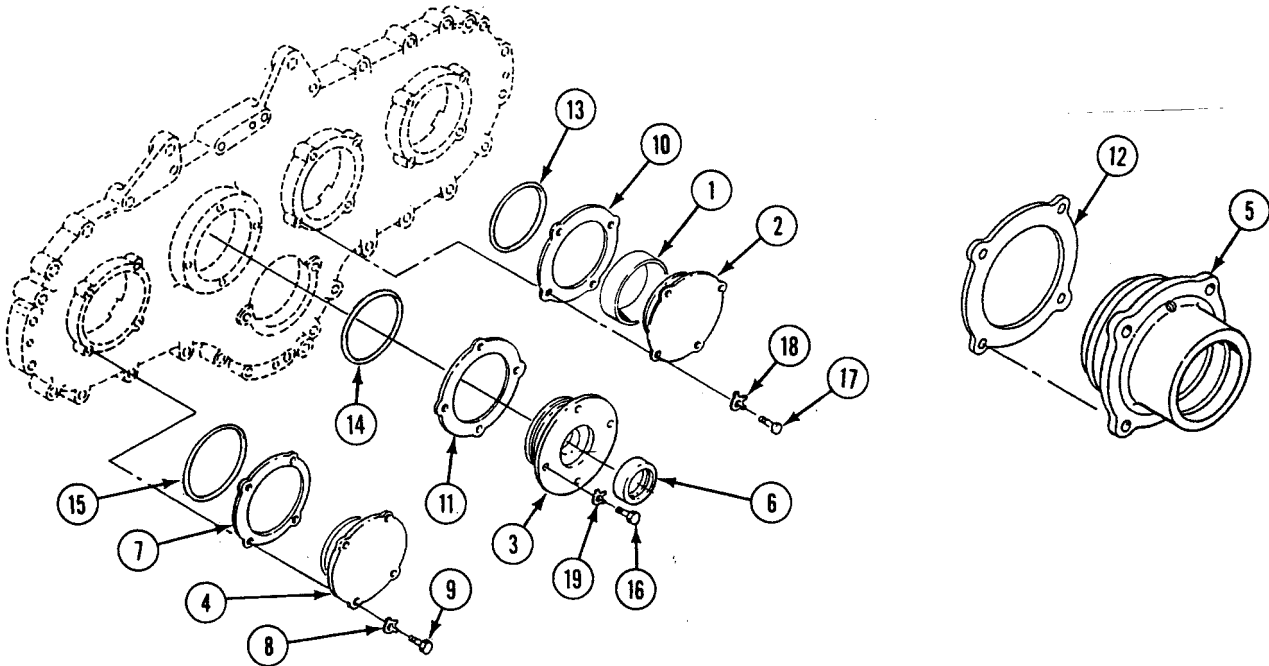
24. Determine thickness of new laminated shim (7) for bearing preload. Without shim and four new key washers (8) installed, place output bearing retaining plate (4) on gearcase cover. Lube four cap screws (9) with engine oil. Secure plate to cover with screws. Tighten screws (9) uniformly to 14–16 lb-in (1.5–1.8 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Rotate gear train by hand one revolution in each direction to check freedom of movement. Recheck installation procedures if binding is detected.



NOTE

Ensure that the secondary pump-drive gear does not interfere with gear rotation. This gear is nonfunctional until the differential oil pump is installed.

25. Using a thickness gauge, measure the gap between bearing retaining plate (4) and gearcase cover at three equal places around cover. Determine the average of these readings and record.
26. Peel laminated shim (7) to 0.003-0.005 inch less than the average recorded in step above.
27. Remove four cap screws (9) and retaining plate (4) from gearcase cover.
28. Repeat Steps 24 - 27 above using retaining plate (2), retaining plate (3), laminated shim (10), shim (11), retaining plate (5), and laminated shim (12).
29. Install new packing (13), packing (14), and packing (15) on retainer (2), retainer (3), and retainer (4).
30. Secure retaining plate (2), retaining plate (3), and retaining plate (4) on housing cover. Apply a light coat of antiseize compound to clean threads of cap screw (9), cap screw (16), and cap screw (17). Place laminated shim (7), peeled laminated shim (10), and laminated shim (11) and retaining plates on cover. Secure plates with new key washer (8), new key washer (18), new key washer (19), cap screw (9), cap screw (16), and cap screw (17). Tighten screws to 252-300 lb-in (29-33 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.

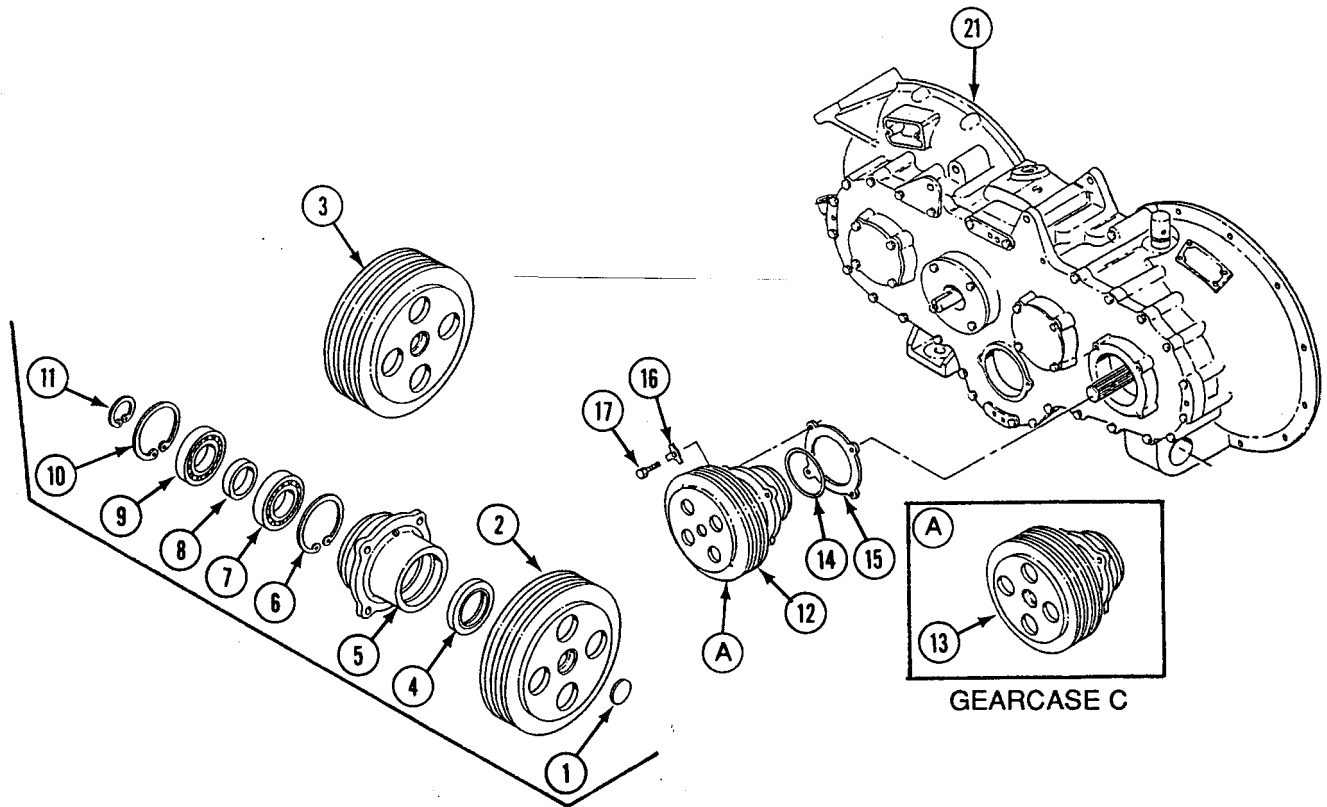


31. If removed, install expansion plug (1) in generator drive pulley (2) or drive pulley (3). Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to clean mating surface of plug. Install plug in pulley (2) or pulley (3).

CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

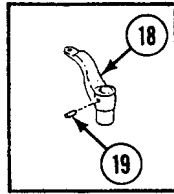
32. Install new encased oil seal (4) in bearing retaining plate (5). Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to outer edge of clean oil seal. Install oil seal in retaining plate.
33. Install new retaining ring (6), ball bearing (7), sleeve spacer (8), ball bearing (9), and new retaining ring (10) in retaining plate (5).
34. Install generator drive pulley (2) or drive pulley (3) in retaining plate (5) and secure with new retaining ring (11).
35. Install generator drive assembly (12) or generator drive assembly (13) on housing cover. Lubricate new packing (14) with grease or petrolatum, and install packing on bearing retaining plate on generator drive assembly. Place new peeled shim (15), and generator drive assembly on cover. Secure drive assembly with four new key washers (16) and cap screws (17). Tighten screws to 252-300 lb-in (29-33 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.



NOTE

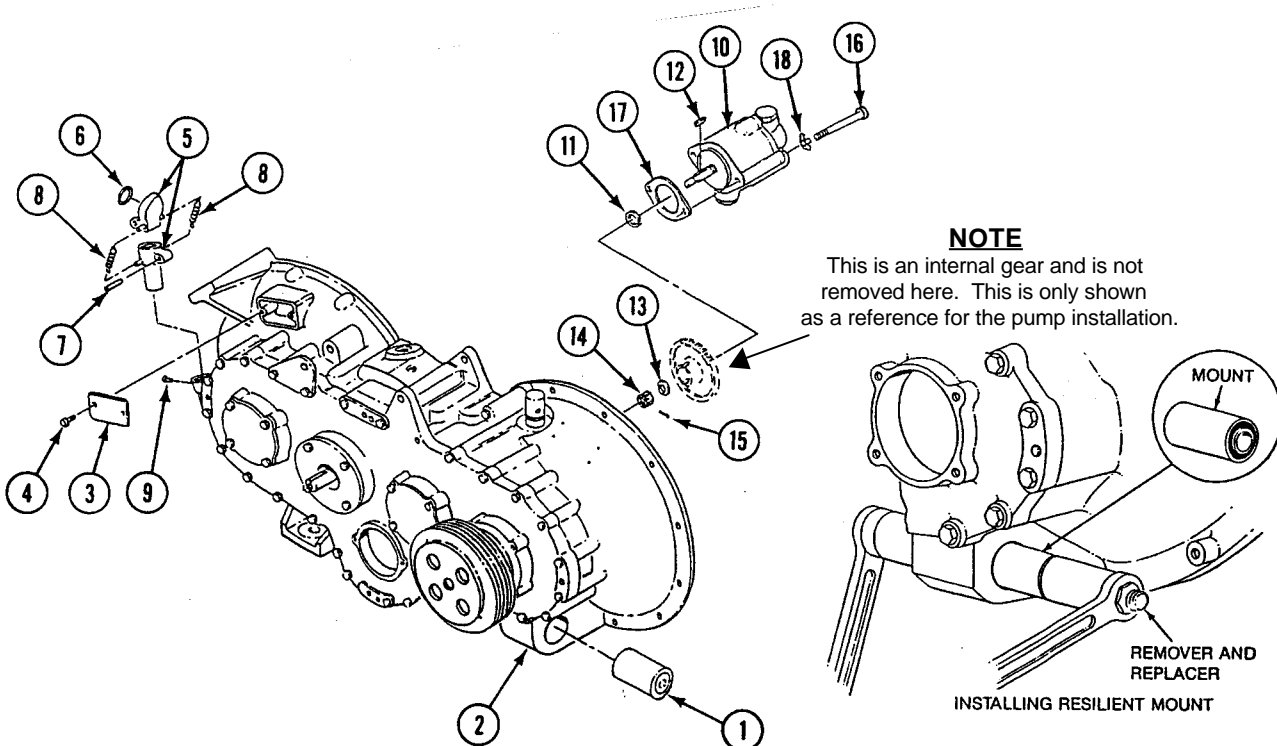
If removed, install the following components.

36. On gearcase A, B, or C, install manual remote control lever (18). Secure with new groove pin (19).

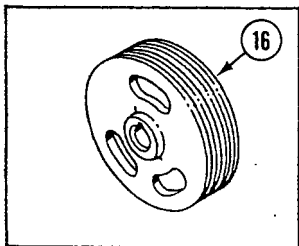


GEARCASES
A, B, AND C

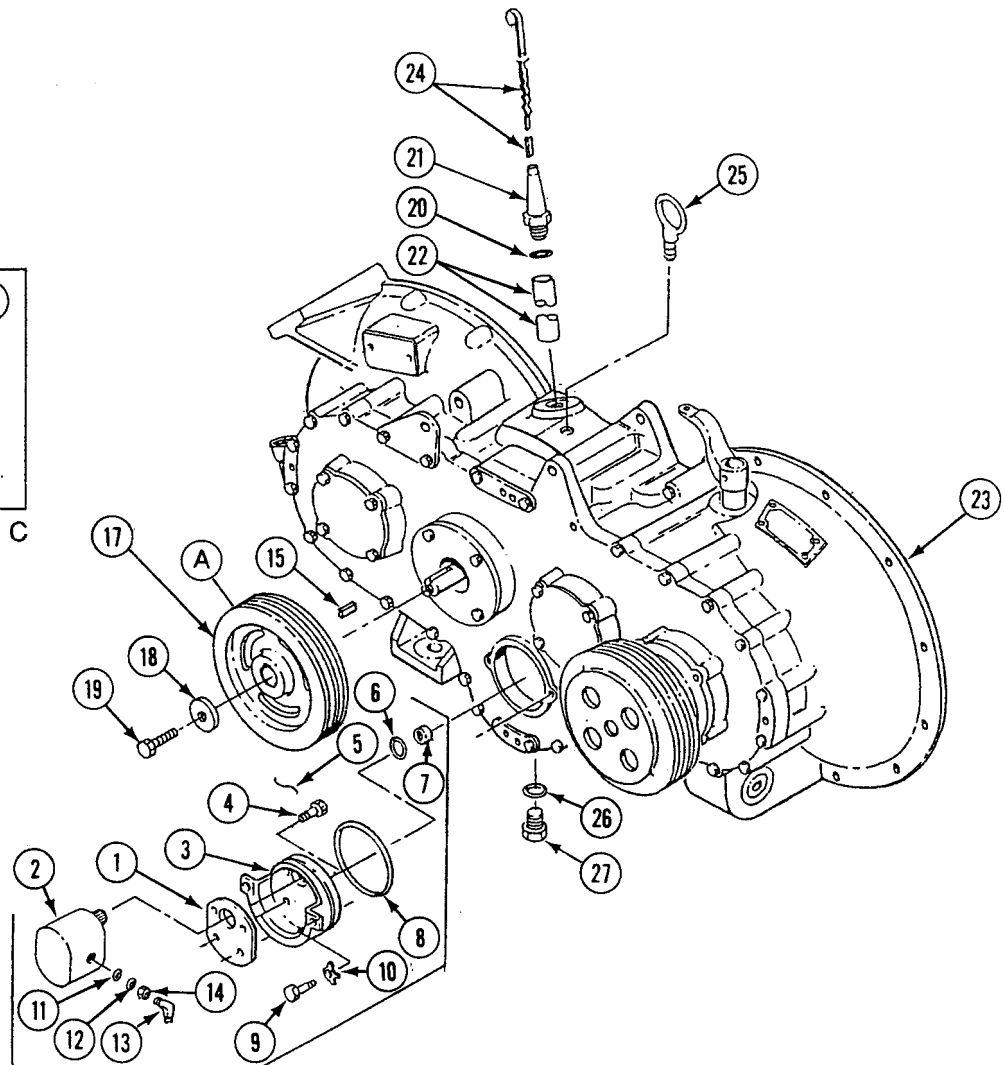
37. Install resilient mount (1) in housing (2) using remover and replacer shown.
38. Install cover (3) on housing (2) with two cap screws (4).
39. Assemble and install filler neck (5) in housing (2). Lubricate new packing (6) with grease, or petrolatum, and install packing in filler cap. Install cap on filler cap head with new spring pin (7). Install two helical springs (8) to hold cap tight to filler cap head. Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to clean outer base of filler neck (5). Place filler neck (5) in housing. Secure with new solid rivet (9).
40. Install differential oil pump (10) on housing (2). Install new retaining ring (11) on oil pump. Install machine key (12) in shaft of oil pump. Secure oil pump to secondary pump-drive gear with two washers (13), slotted head nut (14), and new cotter pin (15). Apply antiseize compound to clean threads of two cap screws (16). Place new gasket (17) on housing. Install oil pump in housing with two new key washers (18) and cap screws (16). Tighten screws to 35-40 ft-lb (47-54 N•m) torque. Use torque wrench (WP 0033 00, Item 44). Bend tabs on key washers.



41. On gearcase A, B, or C, place new gasket (1) on hydraulic pump (2). Secure pump to bracket (3) with four cap screws (4). Secure screws with new lock wire (5). Install new retaining ring (6) on shaft of hydraulic pump. Install coupling (7) in hub of secondary pump-drive gear. Lubricate new packing (8) with grease or petrolatum, and install packing on bracket (3).
42. Position hydraulic pump with attached bracket (3) to housing cover with pump shaft engaged in coupling (7). Apply antiseize compound to clean threads of two cap screws (9). Secure bracket (3) with two new key washers (10) and cap screws (9). Tighten screws to 144-180 lb-in (17-20 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers. Lubricate new packing (11) with grease or petrolatum, and install packing, washer (12), elbow (13), and hex nut (14) on hydraulic pump.
43. On gearcase B or C, install machine key (15) on hub of second intermediate gear and install three-groove pulley (16) on hub. On gearcase A, install two-groove pulley (17) on hub. Secure pulley (16) or pulley (17) with washer (18) and cap screw (19). Tighten screw to 32-38 lb-ft (44-51 N•m) torque. Use torque wrench (WP 0033 00, Item 44).
44. Lubricate new packing (20) with grease or petrolatum, and install guide (21), packing (20), and guide (22) in housing (23). Insert liquid level rod (24) in guide (22).
45. Install eye bolt (25) in housing (23). Lubricate new packing (26) with grease or petrolatum, and install packing on oil drain plug (27). Install plug in housing (23).



GEARCASES B AND C



WARNING

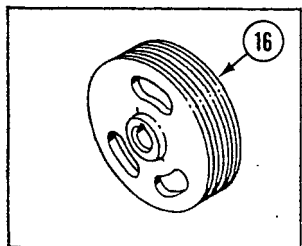


Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

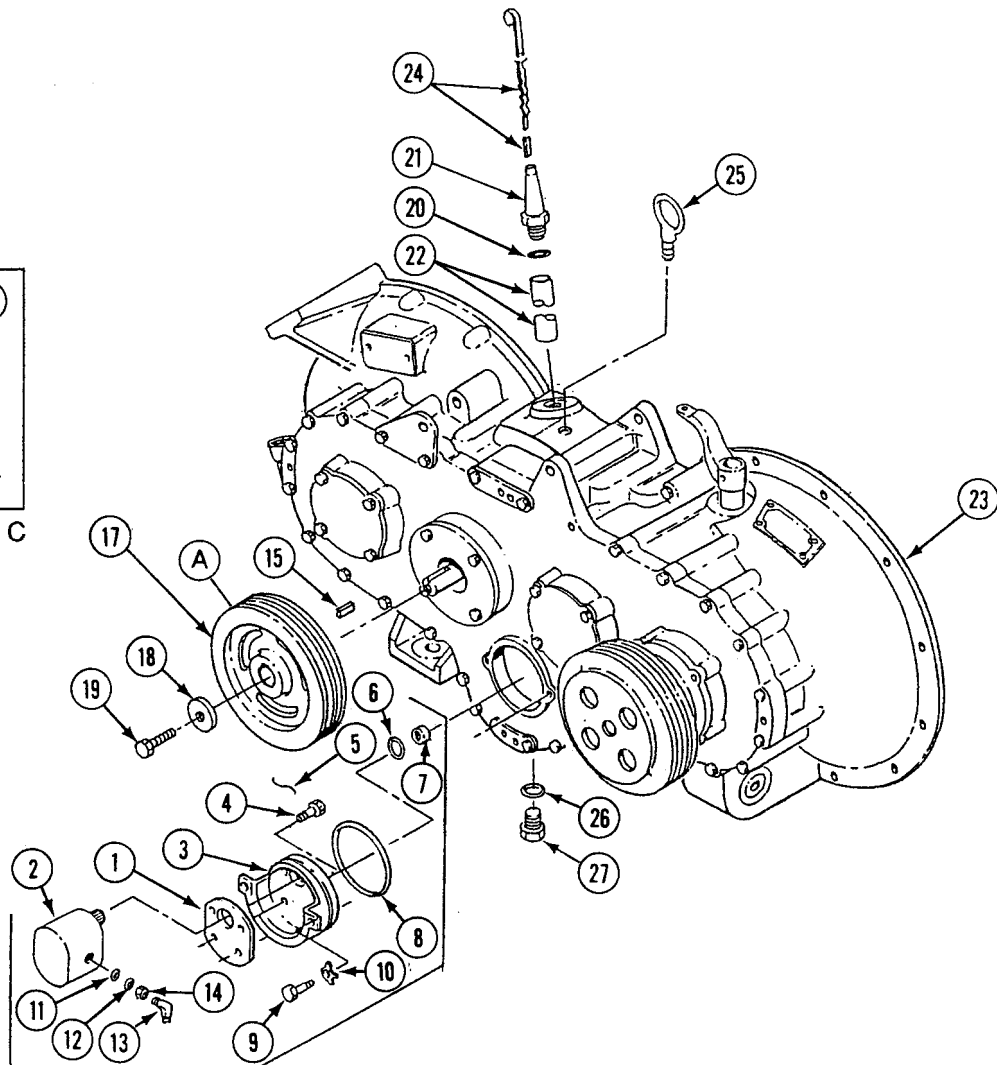
CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

46. Lift transfer gearcase A, B, or C using a suitable hoist and beam type sling through eyebolt (25). Place gearcase on test stand for run-in test.



GEARCASES B AND C



RUN-IN TEST

1. Mount gearcase on test stand in the same position as when installed in the carrier.
2. Fill gearcase with 5 pints of oil so level is between ADD and FULL marks on liquid level gauge rod. Provide suitable external lubricating oil supply for differential oil pump and the hydraulic pump (if installed).

NOTE

Provide artificial heating and cooling, if needed.

Do not allow oil temperature to exceed 280°F (138°C) at any time during run-in tests. At each stage, watch for over-heating, undue noise, and vibration. Check all seals and covers for oil leakage.

3. Run gearcase in the following minimum time duration stages:

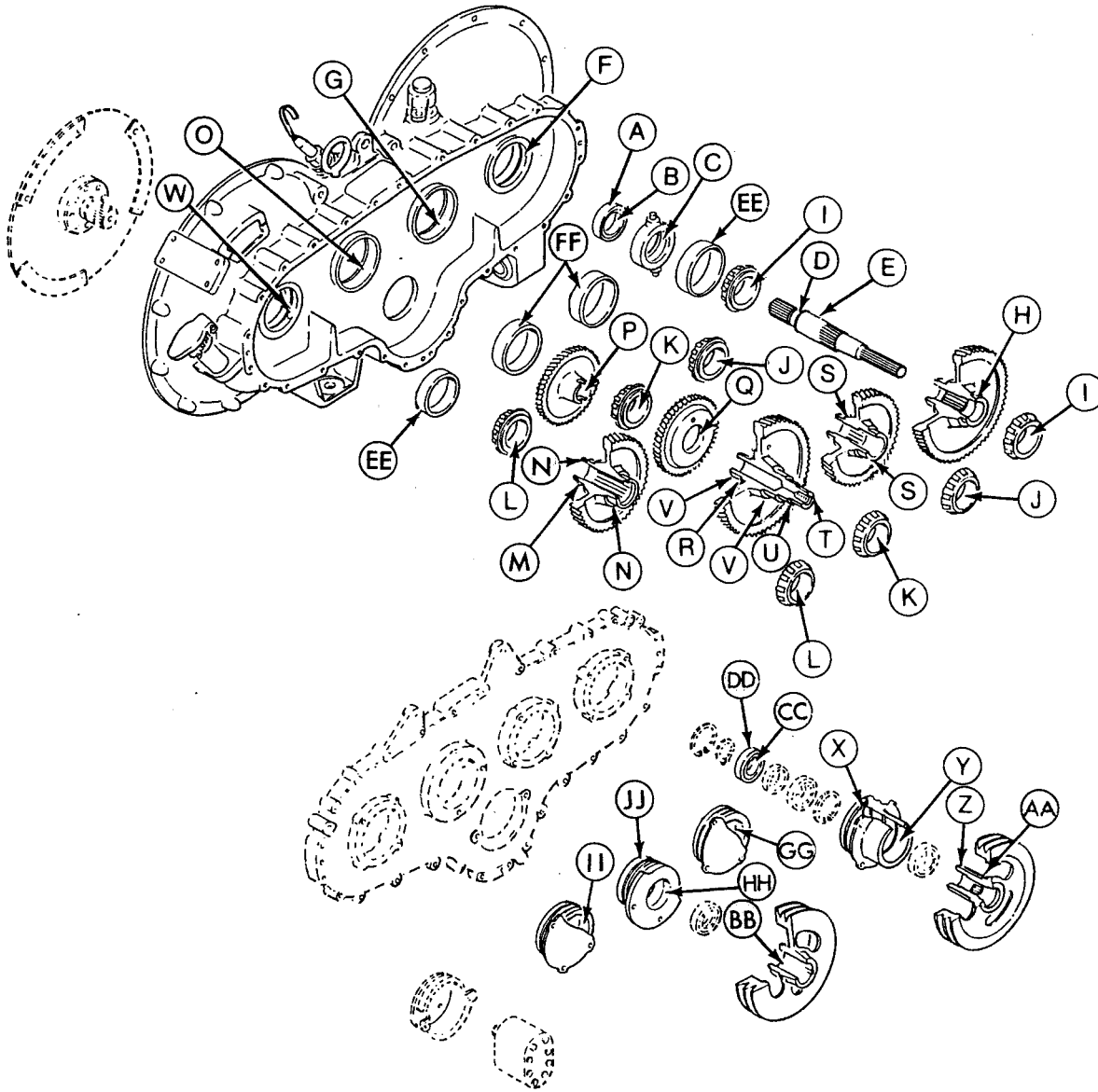
Table 1. TIME DURATION STAGES

Stage (rpm)	Load (pound-foot)	Stage Time (minutes)
1100 to 1300	No load	5
1900 to 2100	No load	5
2800 to 3000	No load	5

4. Remove drain plug and drain oil for at least 15 minutes into a suitable container. Install drain plug. Leave oil residue in gearcase for rust prevention.
5. Remove sling and lifting device from transfer gearcase.

WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figures.



3. Check the parts dimensions with chart below to determine replacement.

Table 2. TRANSFER GEARCASES A, B, AND C WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Outside diameter of shift collar bearing	2.4404 to 2.4409	(*)(***)
B	Inside diameter of shift collar bearing	1.3774 to 1.3780	(*)(***)
C	Inside diameter of shift collar at bearing surface	2.4408 to 2.4413	(***) 2.4418
C-A	Fit of shift collar bearing in shift collar	0.0009L to 0.0001T	0.0014L
D	Outside diameter of shaft at shift collar	1.3781 to 1.3785	(*)(***)
D-B	Fit of shift collar bearing on input shaft	0.0001T to 0.0010T	(*)
E	Outside diameter of input shaft at oil seal surface	1.4850 to 1.4870	1.4830
F	Bore diameter of housing at bearing surface (input)	3.3414 to 3.3434	(*)(***)
G	Bore diameter of housing at bearing surface (first intermediate)	3.5375 to 3.5395	(*)(***)
H	Outside diameter of input gear hub at bearing surface	2.0010 to 2.0015	(*)(***)
I	Inside diameter of input bearing cone	2.0000 to 2.0015	(*)(***)
I-H	Fit of input bearing to input gear	0.0005T to 0.0015T	(*) 10
J	Inside diameter of first intermediate bearing cone	1.9680 to 1.9685	(*)(***)
K	Inside diameter of second intermediate bearing cone	1.9680 to 1.9685	(*)(***)
L	Inside diameter of output bearing cone	2.0000 to 2.0005	(*)(***)
M	Outside diameter of output gear hub at oil seal surface	1.8730 to 1.8770	(*)(***)
N	Outside diameter of output gear hub at bearing surface	2.0010 to 2.0015	(*)(***)
N-L	Fit of output bearing on output gear hub	0.0005T to 0.0015T	(*)
O	Bore diameter of housing at bearing surface (second intermediate)	3.5375 to 3.5395	(*)(***)
P	Inside diameter of bore in secondary pump-drive gear	0.7487 to 0.7495	(*)(***)
Q	Inside diameter of bore in primary pump-drive gear	2.0620 to 2.0630	(*)(***)
R	Outside diameter of second intermediate gear hub (gear pilot)	2.0625 to 2.0635	(*)(***)
R-Q	Fit of primary pump-drive gear on hub of second intermediate gear	0.0005L to 0.0015T	(*)
S	Outside diameter of first intermediate gear hub at bearing surface	1.9690 to 1.9695	(*)(***)
S-J	Fit of first intermediate bearing on first intermediate gear hub	0.0005T to 0.0015T	(*)
T	Outside diameter of second intermediate gear hub at fan pulley surface	1.0000 to 1.0010	(*)(***)
U	Outside diameter of second intermediate gear hub at oil seal surface	1.5000 to 1.5010	1.4980
V	Outside diameter of second intermediate gear hub at bearing surface	1.9690 to 1.9695	(*)(***)
V-K	Fit of second intermediate bearing on gear	0.0005T to 0.0015T	(*)

REPAIR TRANSFER GEARCASES A, B, AND C — Continued

0017 00

W	Bore diameter of housing at bearing surface (output)	3.3414 to 3.3434	(*)(***)
X	Inside diameter of bore of input retainer at tapered bearing surface	3.3449 to 3.3459	(*)(***)
Y	Inside diameter of ball bearing and seal bore in input retainer...	2.4408 to 2.4413	(*)(***)
Z	Outside diameter of generator pulley hub at bearing surface	1.3779 to 1.3783	(*)(***)
AA	Outside diameter of generator pulley hub at oil seal surface	1.7480 to 1.7520	1.7460
BB	Inside diameter of pulley hub	1.0000 to 1.0020	(*)
BB-T	Fit of fan pulley hub on second intermediate gear hub	0.0010T to 0.0020L	(*)(***)
CC	Inside diameter of retaining bearing (input)	1.3775 to 1.3780	(*)(***)
CC-Z	Fit of input bearing to generator pulley hub	0.0000T to 0.0008T	
DD	Outside diameter of retaining bearing (input)	2.4404 to 2.4409	(*)(***)
DD-Y	Fit of input bearing to retainer	0.0001T to 0.0009L	
EE	Bearing cup outside diameter, input and output housing and retainers	3.3464 to 3.3474	(*)(***)
EE-F	Fit of input bearing cup to housing bore	0.0030T to 0.0060T	(*)
EE-W	Fit of output bearing cup to housing bore	0.0030T to 0.0060T	(*)
EE-X	Fit of input bearing cup to retainer bore	0.0005 to 0.0025T	(*)
FF	Bearing cup outside diameter, first and second intermediate housing and retainers	3.5425 to 3.5435	(*)(***)
FF-G	Bearing cup to housing bore	0.0030T to 0.0060T	(*)
FF-O	Fit of second intermediate bearing cup to housing bore	0.0030T to 0.0060T	(*)
GG	Inside diameter of bore in first intermediate retainer at bearing surface	3.5410 to 3.5420	(*)
GG-FF	Fit of first intermediate bearing cup to retainer bore	0.0005T to 0.0025T	(*)
HH	Inside diameter of bore in second intermediate retainer at bearing surface	3.5410 to 3.5420	(*)(***)
HH-FF	Fit of second intermediate bearing cup to retainer bore	0.0005T to 0.0025T	(*)
II	Inside diameter of bore in output retainer at bearing surface	3.3449 to 3.3459	(*)(***)
II-EE	Fit of output bearing cup to retainer bore	0.0005T to 0.0025T	(*)
JJ	Inside diameter of seal bore in second intermediate retainer	2.1240 to 2.1260	(*)

* Must be within new parts dimensions.

** Measure only if there are visual signs of wear or damage.

*** Measure only if there is visual indication of bearing turning.

END OF TASK

**REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE
TRANSFER GEARCASE E**

0018 00

THIS WORK PACKAGE COVERS:

Disassembly (page 0018 00-28).
Assembly (page 0018 00-7).

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)
Sling (WP 0033 00, Item 32)
Torque wrench (WP 0033 00, Item 41)
Torque wrench (WP 0033 00, Item 44)

References

See your -34

Materials/Parts

Antiseize compound (WP 0035 00, Item 1)
Grease (WP 0035 00, Item 6)
Sealing compound (WP 0035 00, Item 12)
Transfer gearcase parts kit
Cotter pin
Machine key

Equipment Condition

Transfer gearcase A, B, or C removed from carrier (see your -34)
Transfer gearcase removed from engine (see your -34)

REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER
GEARCASE E — Continued

0018 00

DISASSEMBLY

WARNING



Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

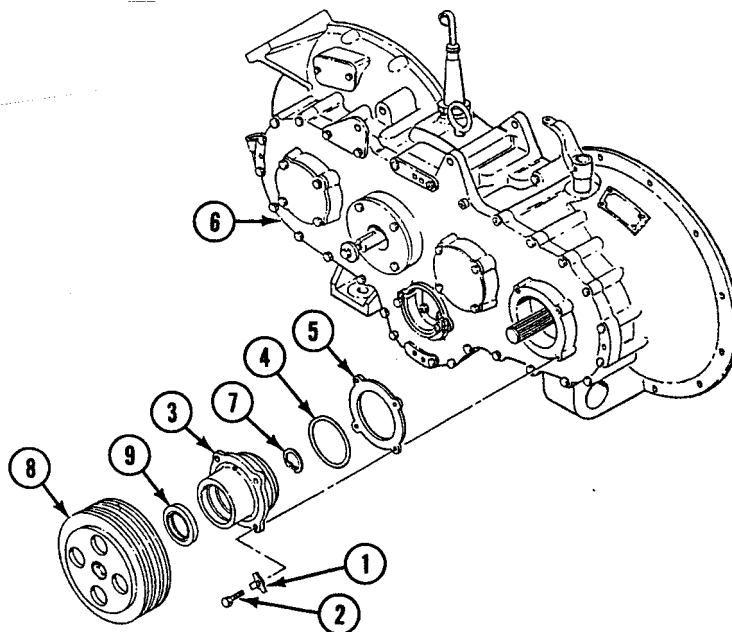
CAUTION

Laminated shim and input bearing retainer are matched for bearing preload at initial assembly. Retain shim and retainer with same gearcase. When replacing gearcase C, replace pulley instead of retainer. Failure to comply may cause bearing failure.

NOTE

Steps 1 - 8 apply to service spare transfer gearcase E only. Steps 1 - 3 apply to removing pulley for transfer gearcase C. When replacing gearcases A or B, start with Step 4.

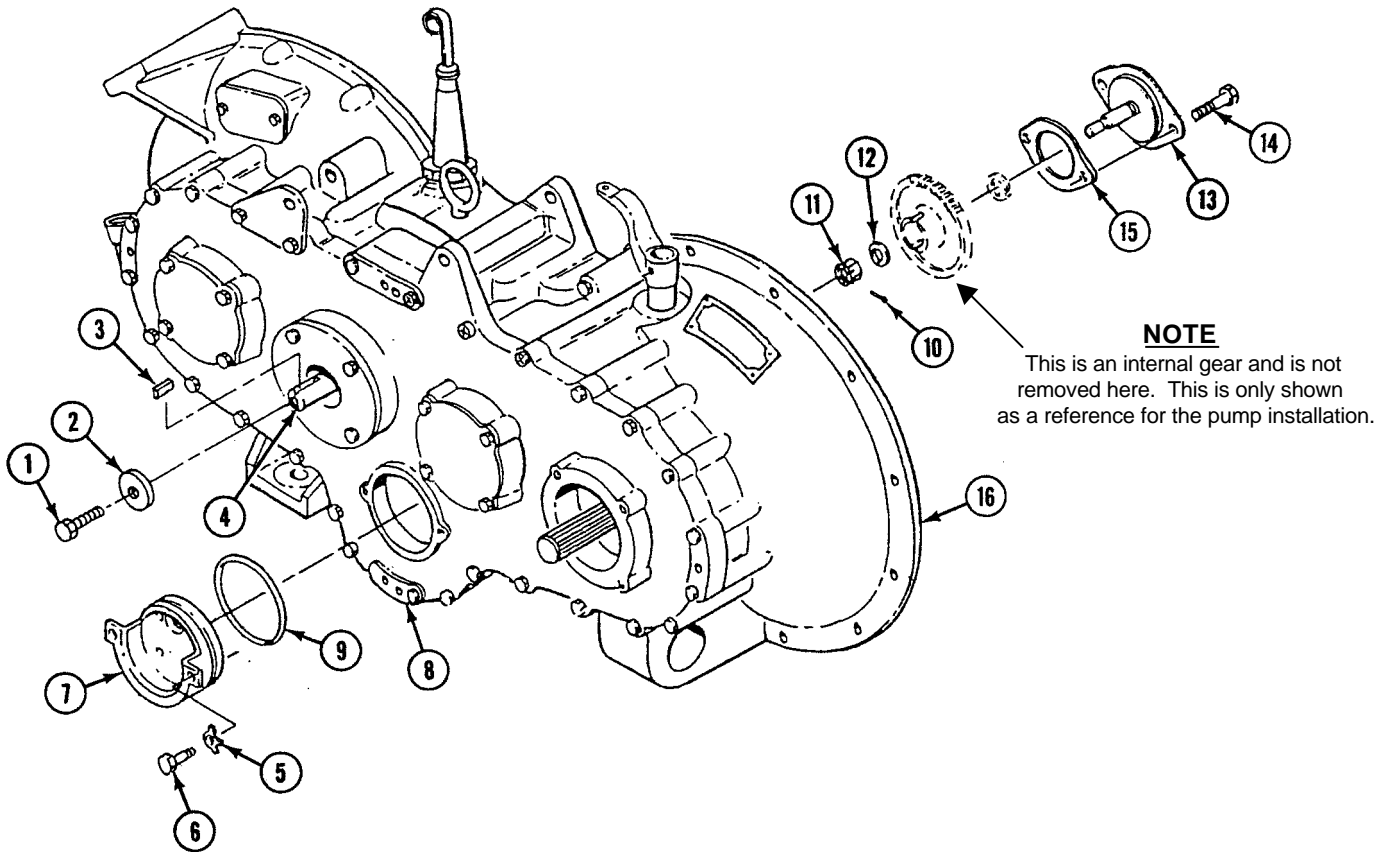
1. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers, bearing retainer (3), packing (4), and laminated shim (5) from housing cover (6). Retain retainer and laminated shim with gearcase. Discard key washers and packing.
2. Remove retaining ring (7) and two-grooved pulley (8) from retainer (3). Discard retaining ring.
3. Remove encased oil seal (9) from retainer (3). Discard oil seal.



REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER GEARCASE E — Continued

0018 00

4. Remove cap screw (1), washer (2), and machine key (3) from fan drive pulley shaft (4). Discard machine key.
5. Straighten tabs on two key washers (5). Remove two machine bolts (6), key washers, and hydraulic pump mounting bracket (7) from gearcase cover (8). Discard key washers.
6. Remove packing (9) from bracket. Discard packing.
7. Remove cotter pin (10), slotted nut (11), and one or two washers (12) from dummy shaft assembly (13). Discard cotter pin.
8. Remove two cap screws (14), dummy shaft (13), and gasket (15) from gearcase housing (16). Discard gasket.



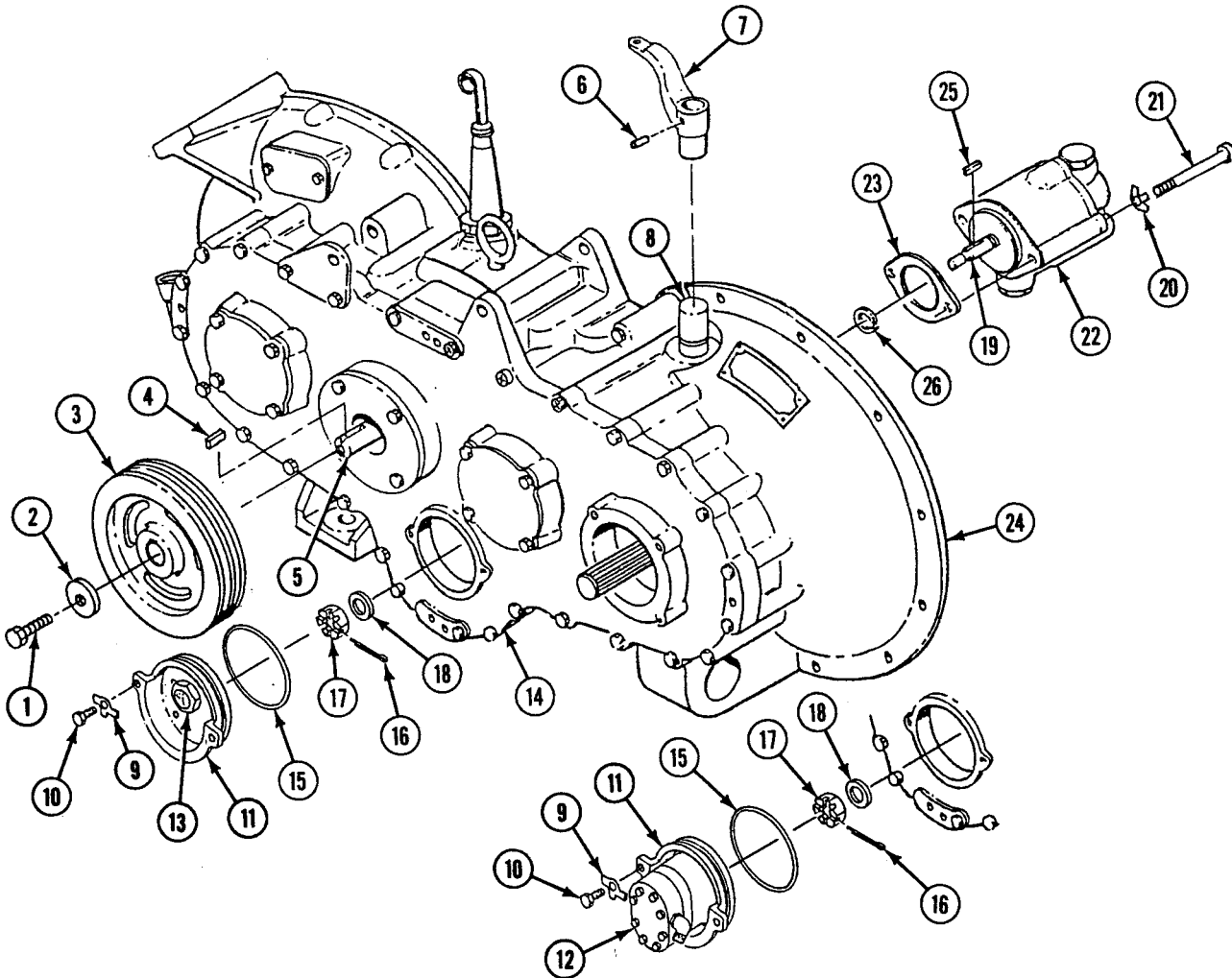
REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER
GEARCASE E — Continued

0018 00

NOTE

Steps 9 - 15 apply to any unserviceable transfer gearcase.

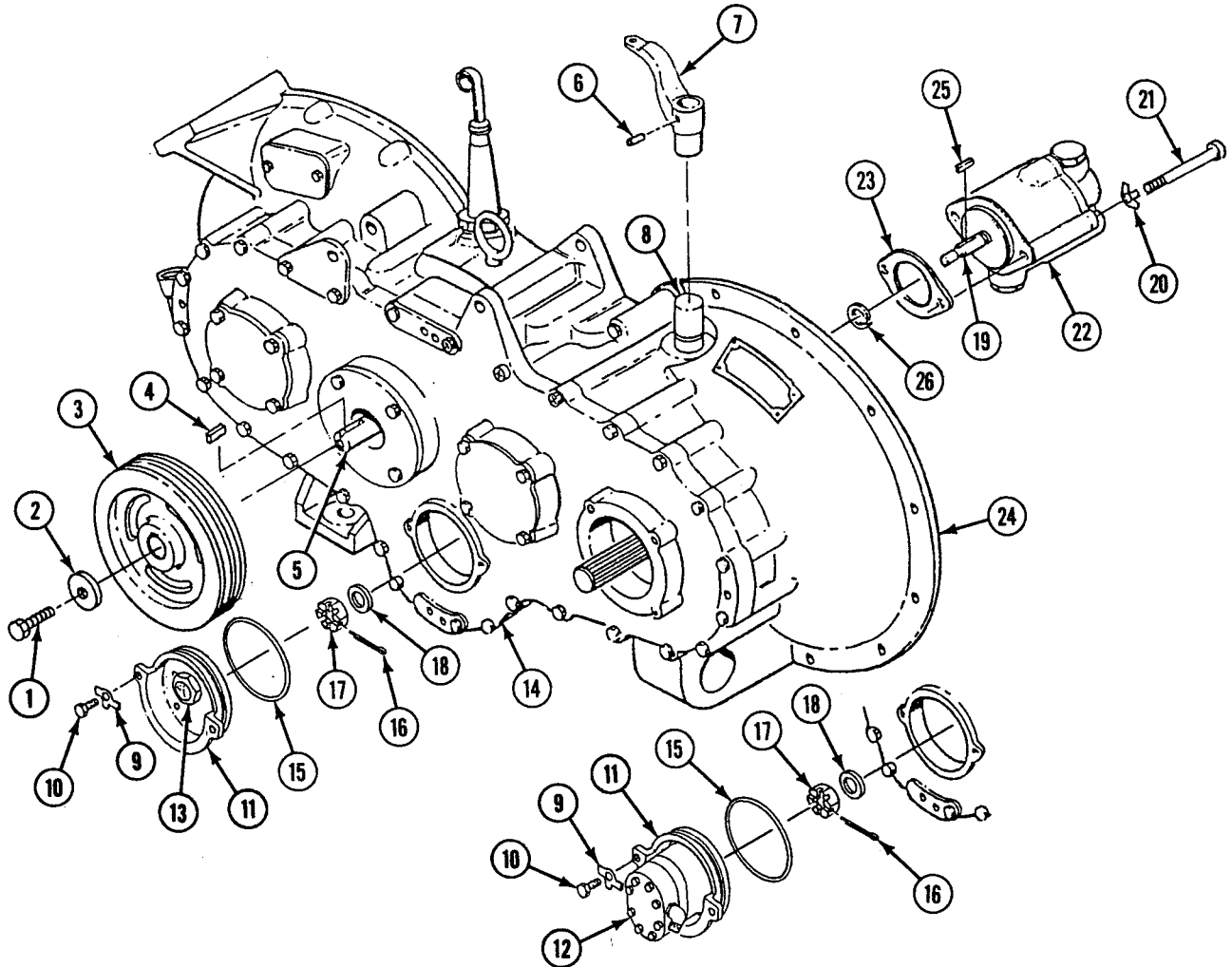
9. Remove cap screw (1), washer (2), pulley (3), and machine key (4) from fan drive shaft (5). Retain cap screw from transfer gearcase B or C. Discard machine key.
10. Remove grooved pin (6) and remote control lever (7) from engine disconnect actuator (8).
11. Straighten tabs on two key washers (9). Remove two cap screws (10), key washers, and bracket (11) with attached ramp hydraulic pump (12) or liquid sight indicator (13) from housing cover (14). Discard key washers.



REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER GEARCASE E — Continued

0018 00

12. Remove packing (15) from bracket (11). Discard packing.
13. Remove cotter pin (16), slotted nut (17), and washer (18) from differential oil pump shaft (19). Discard cotter pin.
14. Straighten tabs on two key washers (20). Remove two cap screws (21), key washers, oil pump (22), and gasket (23) from gearcase housing (24). Discard key washers and gasket.
15. Remove machine key (25) and retaining ring (26) from oil pump shaft (19). Discard retaining ring.



**REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER
GEARCASE E — Continued**

0018 00

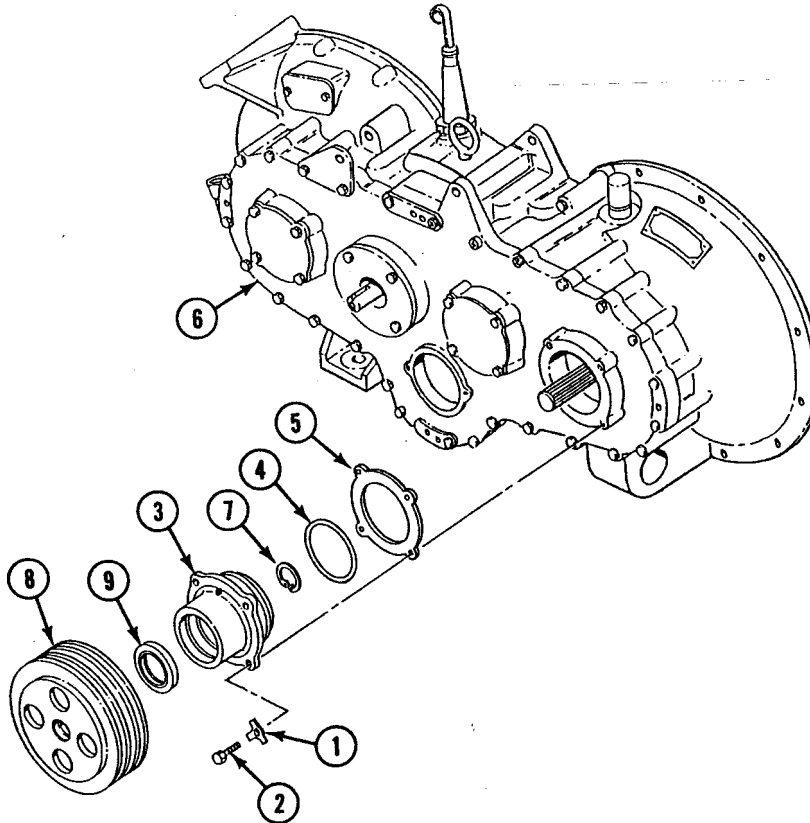
CAUTION

Laminated shim and input bearing retainer are matched for bearing preload at initial assembly. Retain shim and retainer with same gearcase. When replacing gearcase C, replace pulley instead of retainer. Failure to comply may cause bearing failure.

NOTE

Steps 16 - 18 apply to unserviceable transfer gearcase C.

16. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers, bearing retainer (3), packing (4), and laminated shim (5) from housing cover (6). Retain retainer and laminated shim with gearcase. Discard key washers and packing.
17. Remove retaining ring (7) and three-grooved pulley (8) from retainer (3). Discard retaining ring.
18. Remove encased oil seal (9) from retainer (3). Discard oil seal.



**REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER
GEARCASE E — Continued**

0018 00

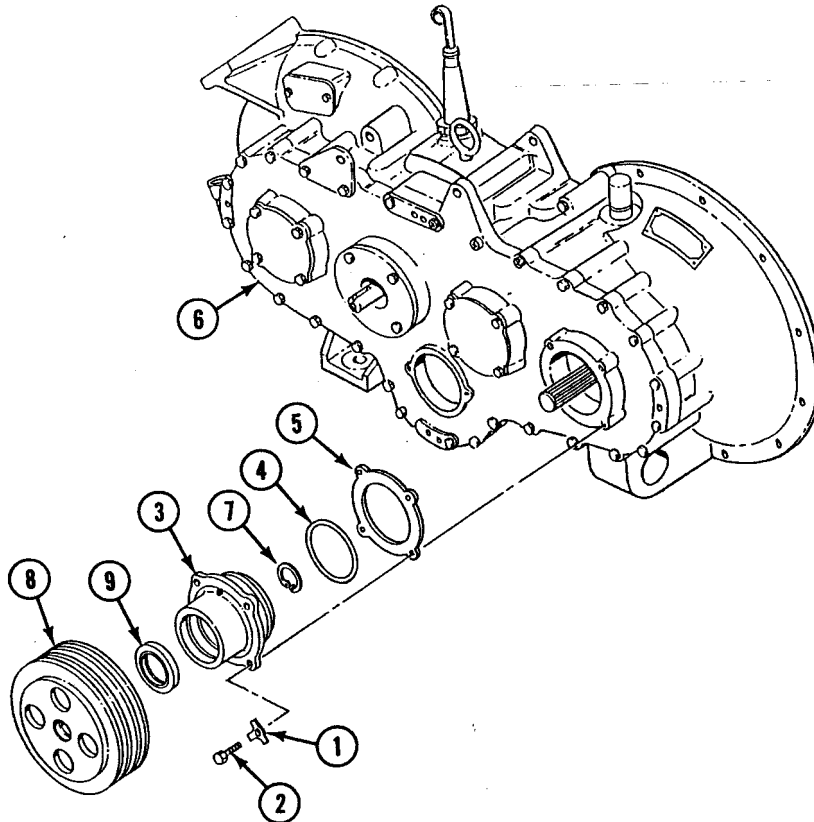
ASSEMBLY**CAUTION**

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation, seal must be flush with outer surface.

NOTE

Steps 1 - 12 apply to service spare transfer gearcase E.

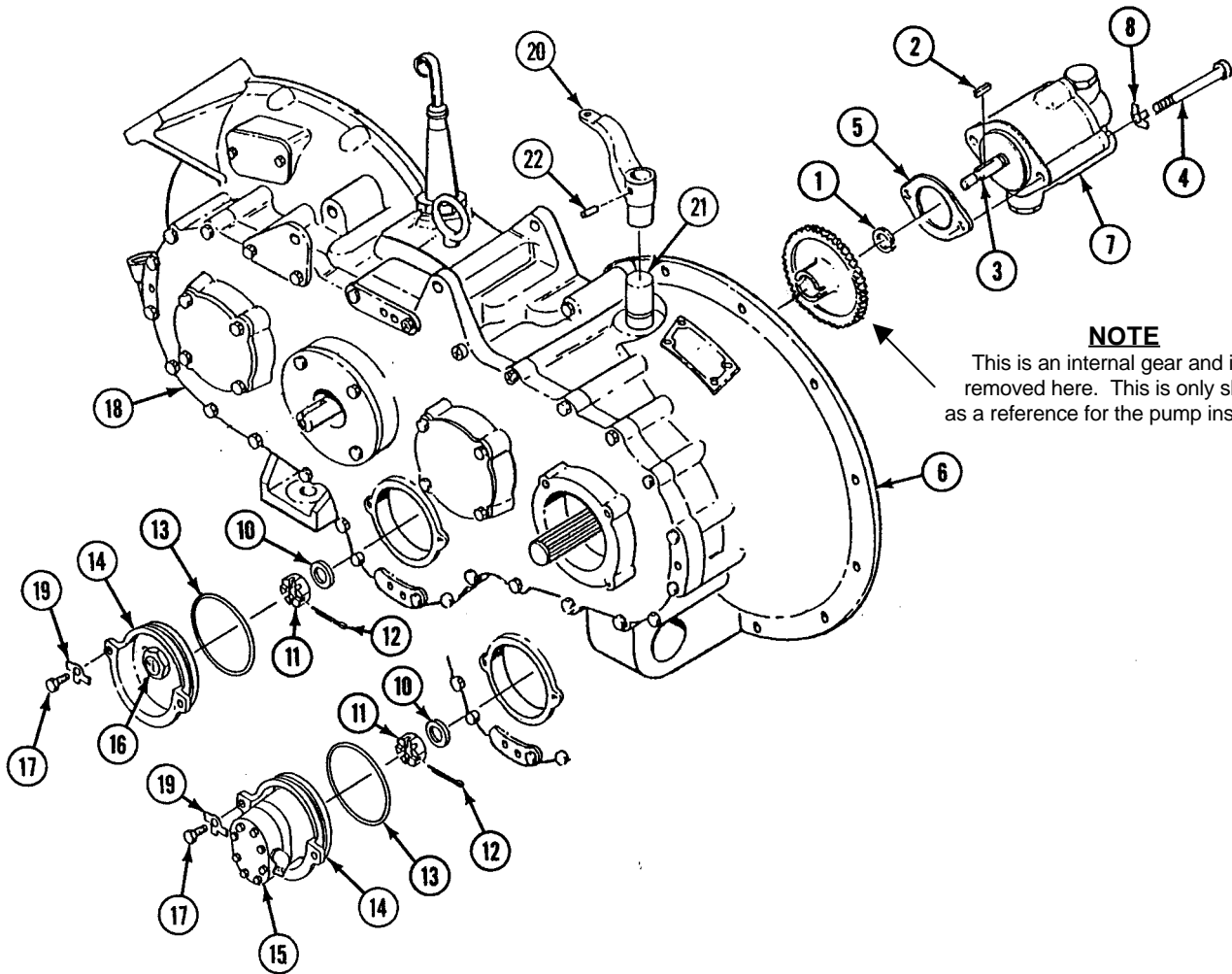
1. Clean mating surface of encased oil seal (9). Apply a shim film of sealing compound on outer edge of seal. Install seal in retainer (3).
2. Install three-grooved pulley (8) on retainer (3) with new retaining ring (7).
3. Lubricate new packing (4) with grease. Install packing on retainer (3).
4. Apply antiseize compound to threads of four clean cap screws (2) at installation. Install laminated shim (5), packing (4), and retainer (3) on cover (6) with four new key washers (1) and cap screws. Tighten screws to 144-180 lb-in (17-20 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.



REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER GEARCASE E — Continued

0018 00

5. Install new retaining ring (1) and new machine key (2) on oil pump shaft (3).
6. Apply antiseize compound to clean threads of two cap screws (4) at installation. Place new gasket (5) on gearcase housing (6). Install oil pump (7) in housing with two new key washers (8) and cap screws. Tighten screws to 35-40 lb-ft (48-54 N•m) torque. Use torque wrench (WP 0033 00, Item 44). Bend tabs on key washers.
7. Secure oil pump (7) to secondary pump-drive gear with two (maximum) washers (10), slotted nut (11), and new cotter pin (12).
8. Lubricate new packing (13) with grease. Install packing on bracket (14) with ramp hydraulic pump (15) or liquid sight indicator (16) attached.



NOTE
This is an internal gear and is not removed here. This is only shown as a reference for the pump installation.

REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER GEARCASE E — Continued

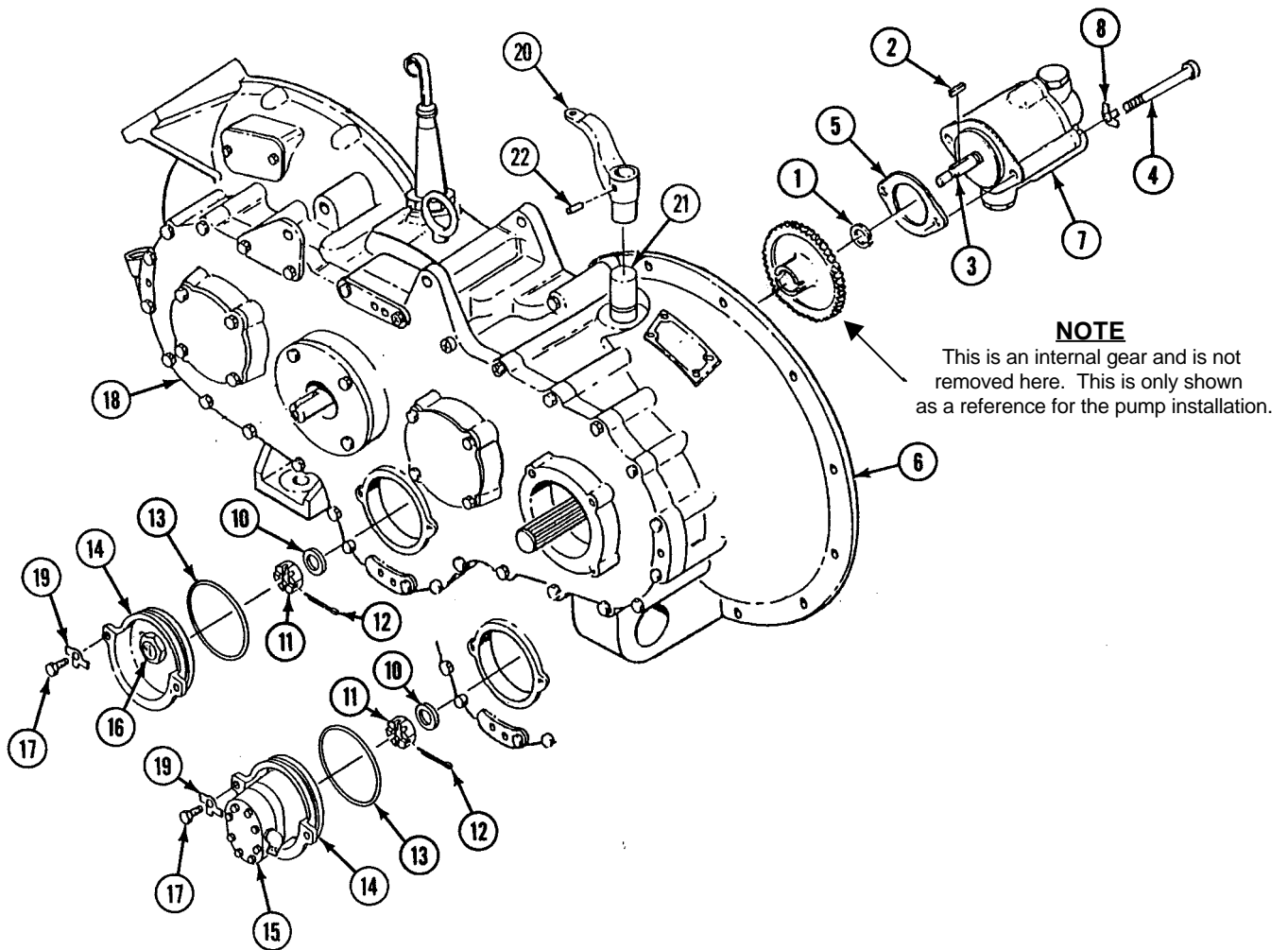
0018 00

9. Apply antiseize compound to threads of two clean cap screws (17) at installation. Install bracket (14) on housing cover (18) with two key washers (19) and cap screws. Tighten cap screws to 144-180 lb-in (17-20 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.
10. Install remote control lever (20) on engine disconnect actuator (21).

NOTE

Pin must be a press-fit into remote control lever on engine disconnect actuator. If necessary, ream the pin hole with a 5/16 inch (31 cm) drill bit. Do not ream hole larger than 0.313 inch (.6 cm).

11. Secure remote control lever (20) to actuator (21) by pressing or driving grooved pin (22) into pin hole.



REPLACE TRANSFER GEARCASE A, B, OR C WITH SERVICE SPARE TRANSFER GEARCASE E — Continued

0018 00

NOTE

If transfer gearcase B or C is being replaced, use retained screw.

12. Install machine key (1) on fan drive shaft (2). Install two-grooved pulley (3) on shaft with washer (4) and cap screw (5). Tighten screw to 32-38 lb-ft (44-51 N•m) torque. Use torque wrench (WP 0033 00, Item 44).

WARNING

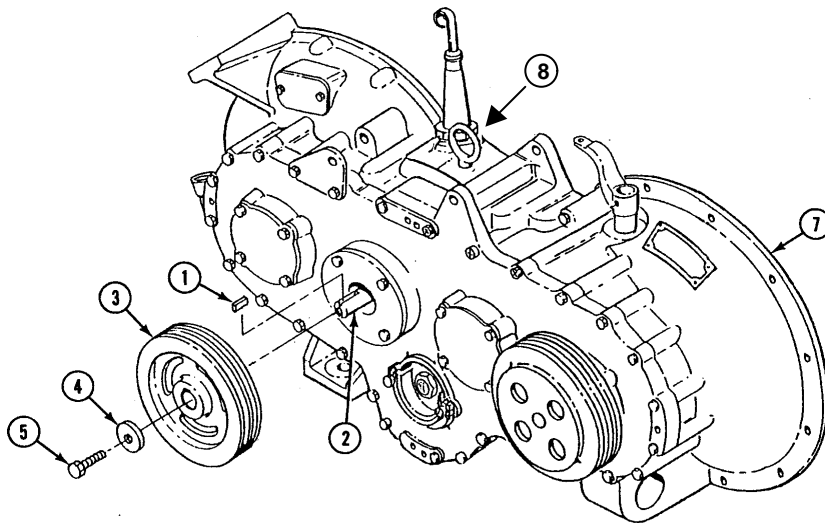


Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

13. Install suitable hoist and sling through eyebolt (8).
14. If testing is needed, perform run-in test, see page 0017 00-25, setps 1 through 5.
15. Install all unused parts on unserviceable transfer gearcase.
16. Tag transfer gearcase as unserviceable. Identify gearcase by part number or national stock number and ship to repair facility.



END OF TASK

REPAIR TRANSFER GEARCASE F

0019 00**THIS WORK PACKAGE COVERS:**

Disassembly (page 0019 00-10).
 Cleaning (page 0019 00-11).
 Assembly (page 0019 00-12).
 Run-In Test (page 0019 00-24).
 Wear Limits (page 0019 00-25).

INITIAL SETUP:Maintenance Level

Direct Support

Tools and Special Tools

General mechanic's tool kit (WP 0033 00, Item 37)
 Bearing inserter (WP 0033 00, Item 1)
 Portable electrical drill (WP 0033 00, Item 4)
 Twist drill set (WP 0033 00, Item 5)
 Soft plastic hammer (WP 0033 00, Item 10)
 Mechanical puller kit (WP 0033 00, Item 18)
 Remover/Replacer (WP 0033 00, Item 21)
 Bearing cups replacer (WP 0033 00, Item 27)
 Jack screw (2) (WP 0033 00, Item 28)
 Jack screw (4) (WP 0033 00, Item 29)
 Sling (WP 0033 00, Item 32)
 Screwdriver socket wrench attachment
 (WP 0033 00, Item 38)
 Torque wrench (WP 0033 00, Item 40)
 Torque wrench (WP 0033 00, Item 41)
 Torque wrench (WP 0033 00, Item 44)

Materials/Parts

Antiseize compound (WP 0035 00, Item 1)
 Cleaning compound (WP 0035 00, Item 4)
 Engine lubricating oil (WP 0035 00, Item 5)
 Grease (WP 0035 00, Item 6)
 Non-electrical wire (WP 0035 00, Item 9)
 Petrolatum (WP 0035 00, Item 10)
 Sealing compound (WP 0035 00, Item 12)
 Sealing compound (WP 0035 00, Item 13)
 Transfer gearcase parts kit
 Cotter pin
 Cotter pin
 Grooved pin
 Machine key
 Plug
 Solid rivet
 Spring pin

Personnel Required

Track Vehicle Repairer

References

See your -20
 See your -34
 See your PMCS
 TM 9-214

Equipment Condition

Power plant removed (see your -34)
 Power plant blocked (see your -34)
 Transmission removed from transfer gearcase (see your
 -34)
 Transfer gearcase removed (see your -34)

DISASSEMBLY

WARNING

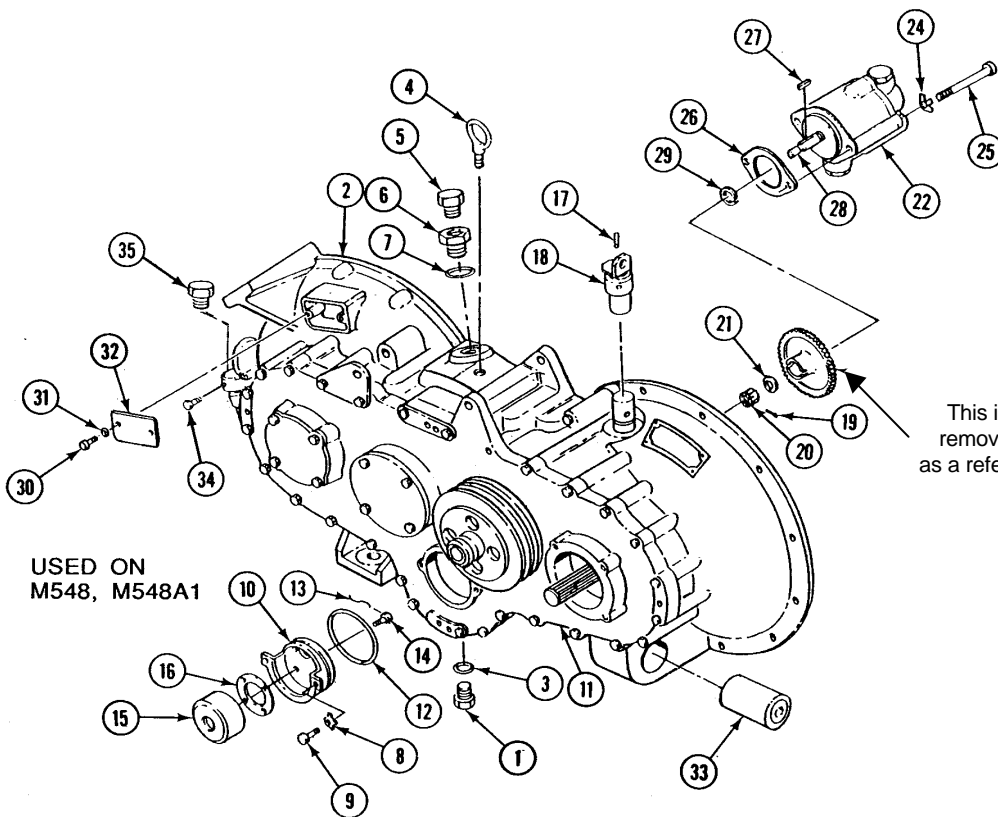


Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

1. Lift transfer gearcase F and place on work station. Use suitable lifting device and sling through eye bolt (4). Remove sling and lifting device from eye bolt.
2. Remove oil drain plug (1) from housing (2). Drain oil from housing into a suitable container. Remove packing (3) from plug. Discard packing. Remove eye bolt (4) from housing.



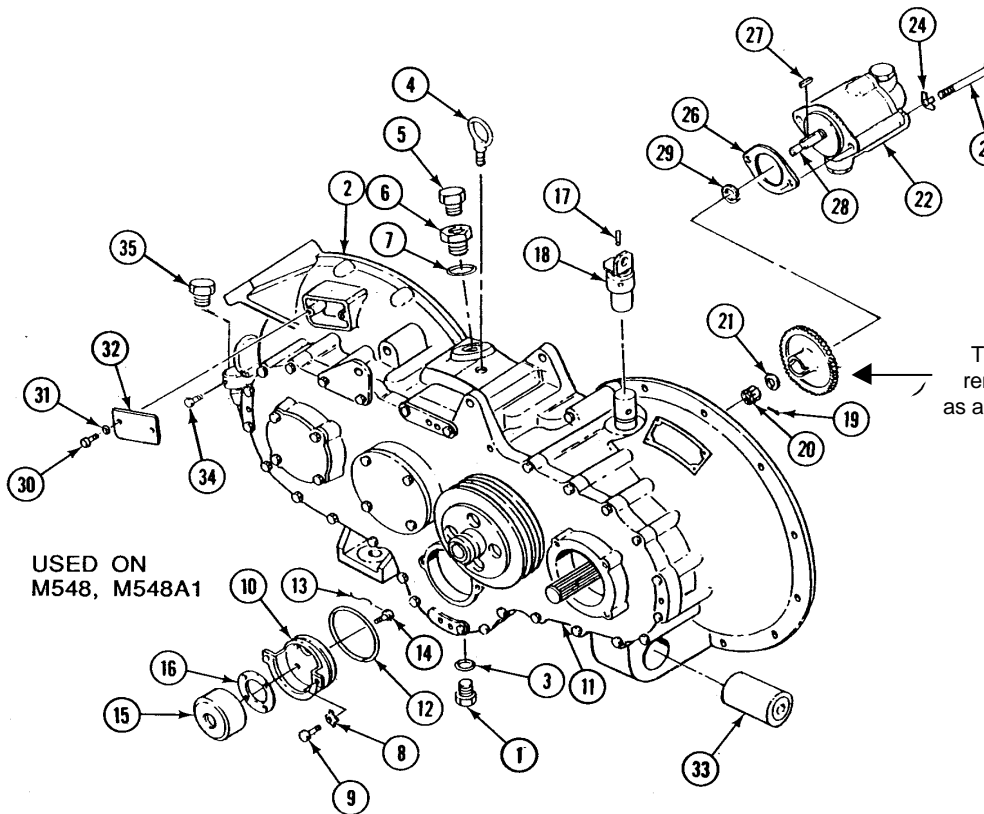
USED ON
M548, M548A1

NOTE
This is an internal gear and is not removed here. This is only shown as a reference for the pump installation.

REPAIR TRANSFER GEARCASE F — Continued

0019 00

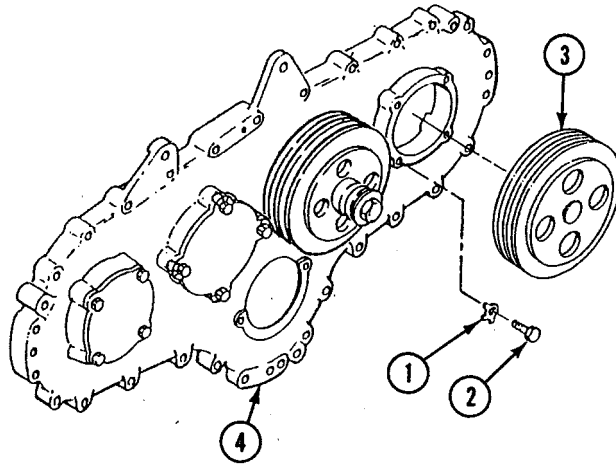
3. Remove drive screw (34) and plug (35) from housing.
4. Remove breather (5) and straight pipe adapter (6) from housing (2). Remove packing (7) from breather. Discard packing.
5. Straighten tabs on two key washers (8). Remove two machine bolts (9) and key washers, and separate bracket (10) from cover (11). Remove packing (12) from bracket. Discard packing and key washers.
6. Remove lockwire (13) and four cap screws (14). Separate sleeve spacer (15) and gasket (16) from bracket (10). Discard lockwire and gasket.
7. Remove headless grooved pin (17) and actuating coupling (18) from housing (2). Discard pin.
8. Remove cotter pin (19), slotted head nut (20), and one or two washers (21) securing differential oil pump (22) to secondary pump drive-gear. Discard cotter pin.
9. Straighten tabs on two key washers (24). Remove two cap screws (25), key washers, oil pump (22) and gasket (26) from housing (2). Discard key washers and gasket.
10. Remove machine key (27) from shaft (28) on oil pump (22). If pump is to be replaced, remove retaining ring (29) from shaft of oil pump. Discard retaining ring and machine key.
11. If required, remove two cap screws (30), lockwashers (31), and cover (32) from housing (2). Remove resilient mount (33) from housing. Use remover and replacer.



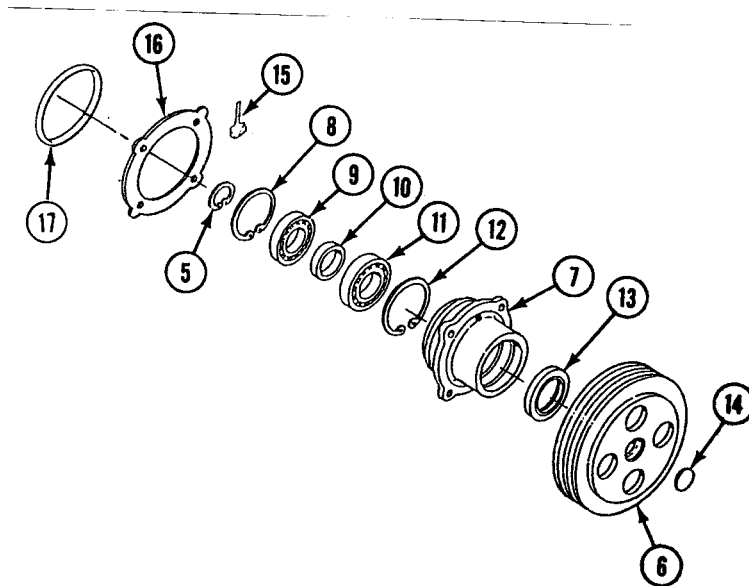
USED ON
M548, M548A1

NOTE
This is an internal gear and is not removed here. This is only shown as a reference for the pump installation.

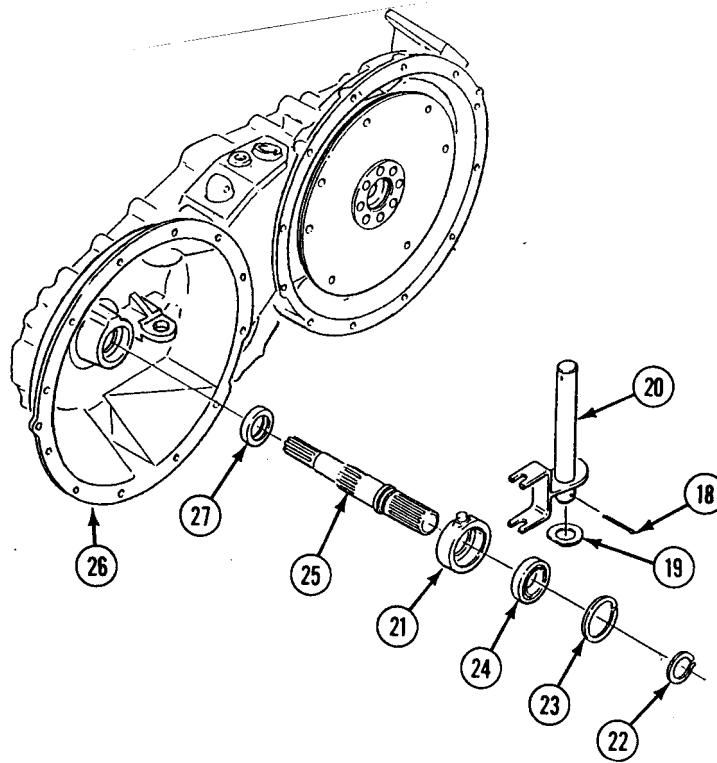
12. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers, and generator drive assembly (3) from cover (4). Discard key washers.



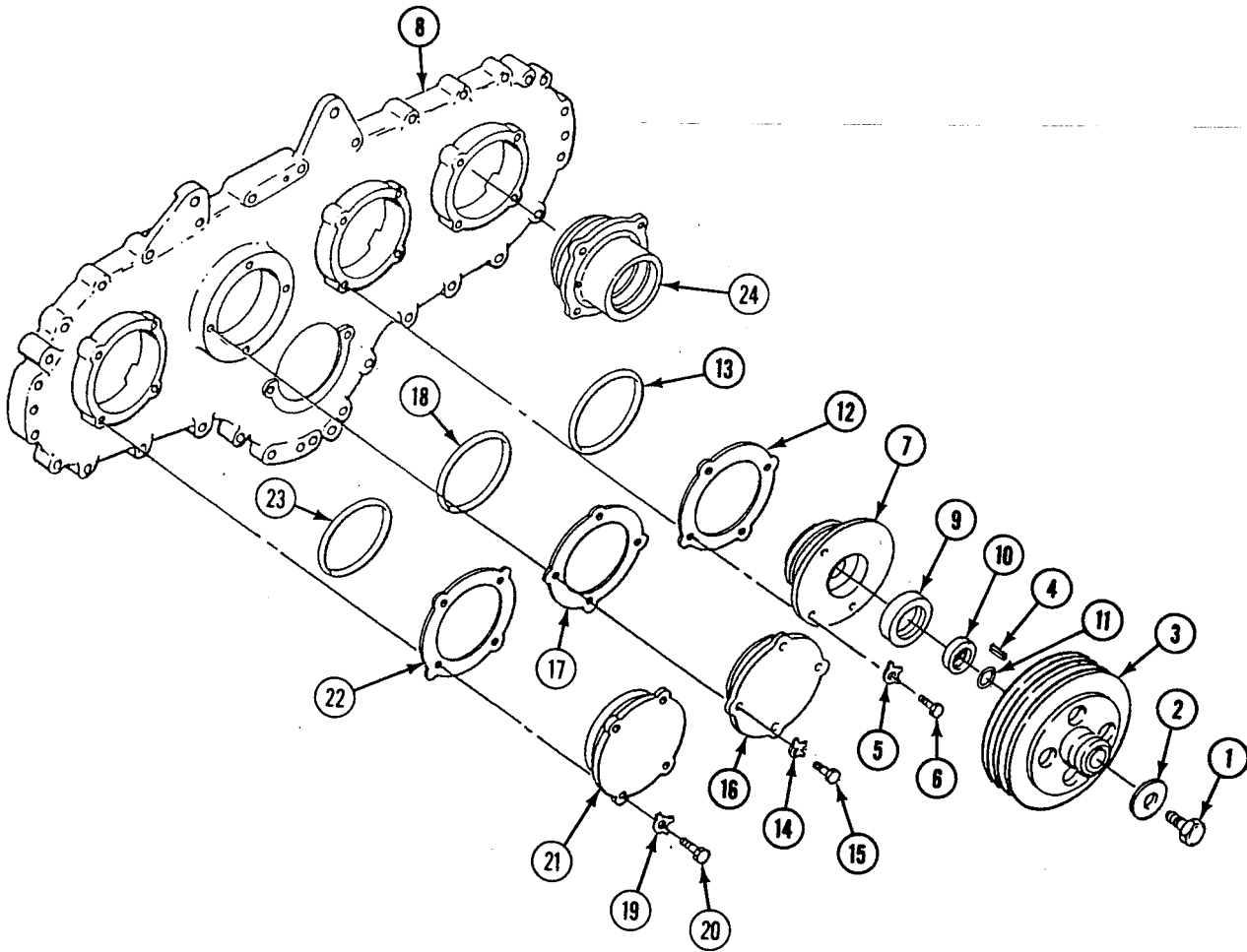
13. Remove retaining ring (5) from hub on generator drive pulley (6). Separate pulley from input bearing retaining plate (7). Discard retaining ring. Remove retaining ring (8), ball bearing (9), sleeve spacer (10), ball bearing (11), and retaining ring (12) from retaining plate. Remove encased oil seal (13) from retaining plate. Discard retaining ring (5), retaining ring (8), retaining ring (12), and oil seal. If needed, remove expansion plug (14) from pulley (6).
14. Remove dust deflector (15) from hole connecting annular oil groove and bearing area.
15. Remove laminated shim (16) and packing (17) from retaining plate (7). Discard shim and packing.



16. Remove cotter pin (18) and washer (19) from engine disconnect actuator (20). Separate engine disconnect actuator from shift collar (21). Discard cotter pin. Remove retaining rings (22) and (23), ball bearing (24), shift collar, and input shouldered shaft (25) from housing (26). Remove encased oil seal (27) from housing. Discard retaining rings and oil seal.



17. Remove cap screw (1), washer (2), fan drive pulley (3), and machine key (4) from first intermediate gear shaft.
18. Straighten tabs on four key washers (5). Remove four cap screws (6), key washers, and retaining plate (7) from cover (8). Remove encased oil seal (9), packing retainer (10), preformed packing (11), laminated shim (12), and packing (13) from retaining plate. Discard packings, oil seal, shim, and key washers.
19. Straighten tabs on four key washers (14). Remove four cap screws (15), key washers, and retaining plate (16) from cover (8). Remove laminated shim (17) and packing (18) from retaining plate. Discard packing, shim, and key washers.

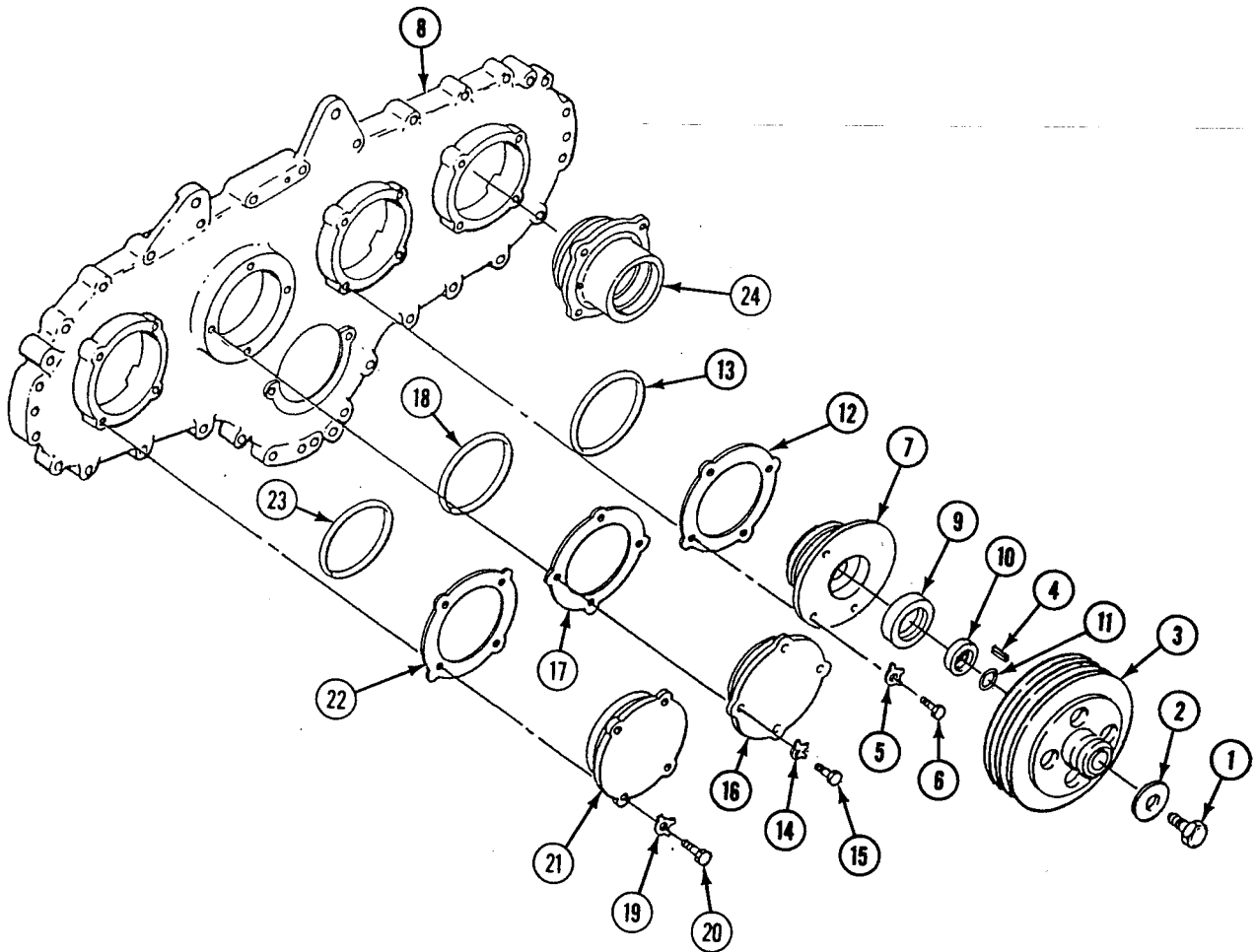


20. Straighten tabs on four key washers (19). Remove four cap screws (20), key washers, and retaining plate (21) from cover (8). Remove laminated shim (22) and packing (23) from retaining plate. Discard packing, shim, and key washers.

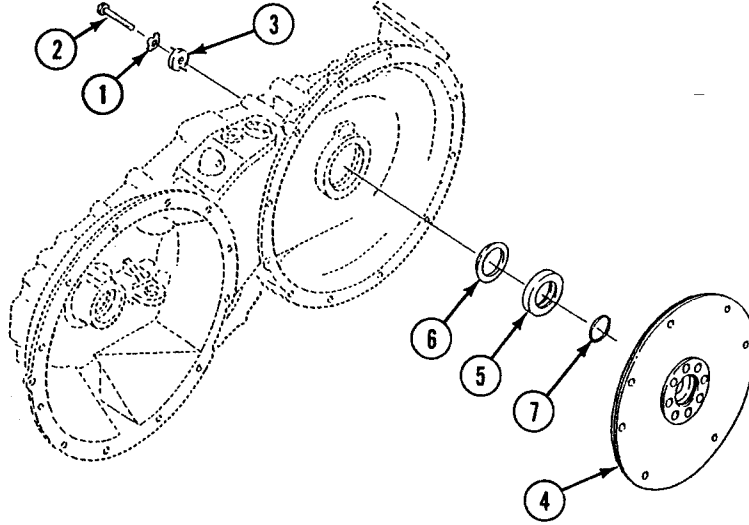
NOTE

Do not remove roller bearing cups that are pressed in retaining plates unless inspection indicates a replacement is needed.

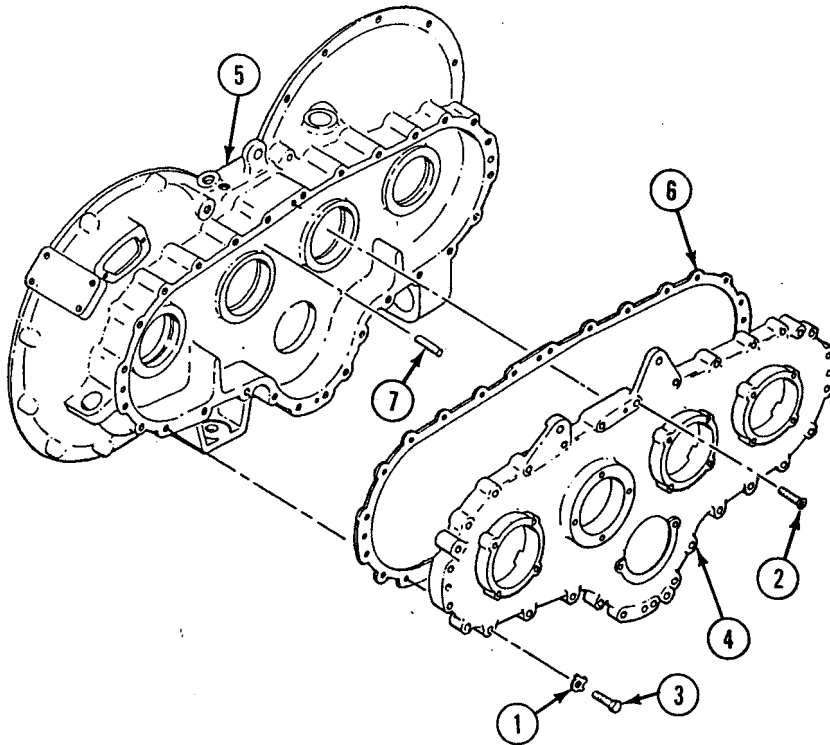
21. If needed, remove bearing cup(s) in retaining plate (7), retaining plate (16), retaining plate (21), or retaining plate (24) with mechanical puller kit. Discard cup(s).



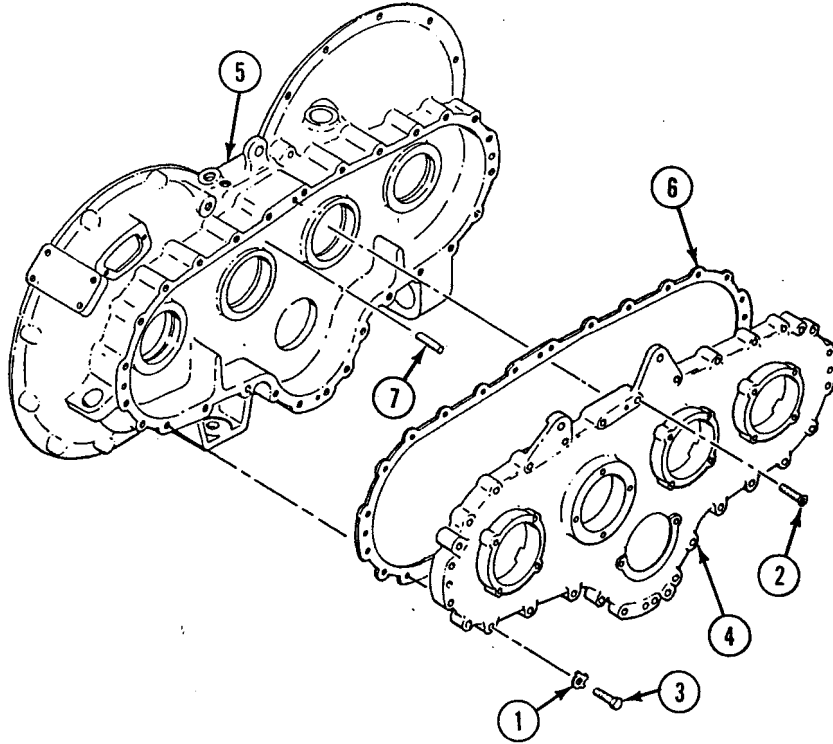
22. Straighten tabs on key washer (1). Remove cap screw (2), key washer, gearcase washer assembly (3), and disk assembly (4) from output gear. Discard key washer. Remove encased oil seal (5), dirt deflector (6), packing (7) from disk assembly. Discard packing, deflector and oil seal.



23. Straighten tabs on 20 key washers (3) on gearcase F. Remove 8 machine screws (4), 20 cap screws (5) and key washers holding cover (6) to housing (7). Discard key washers.



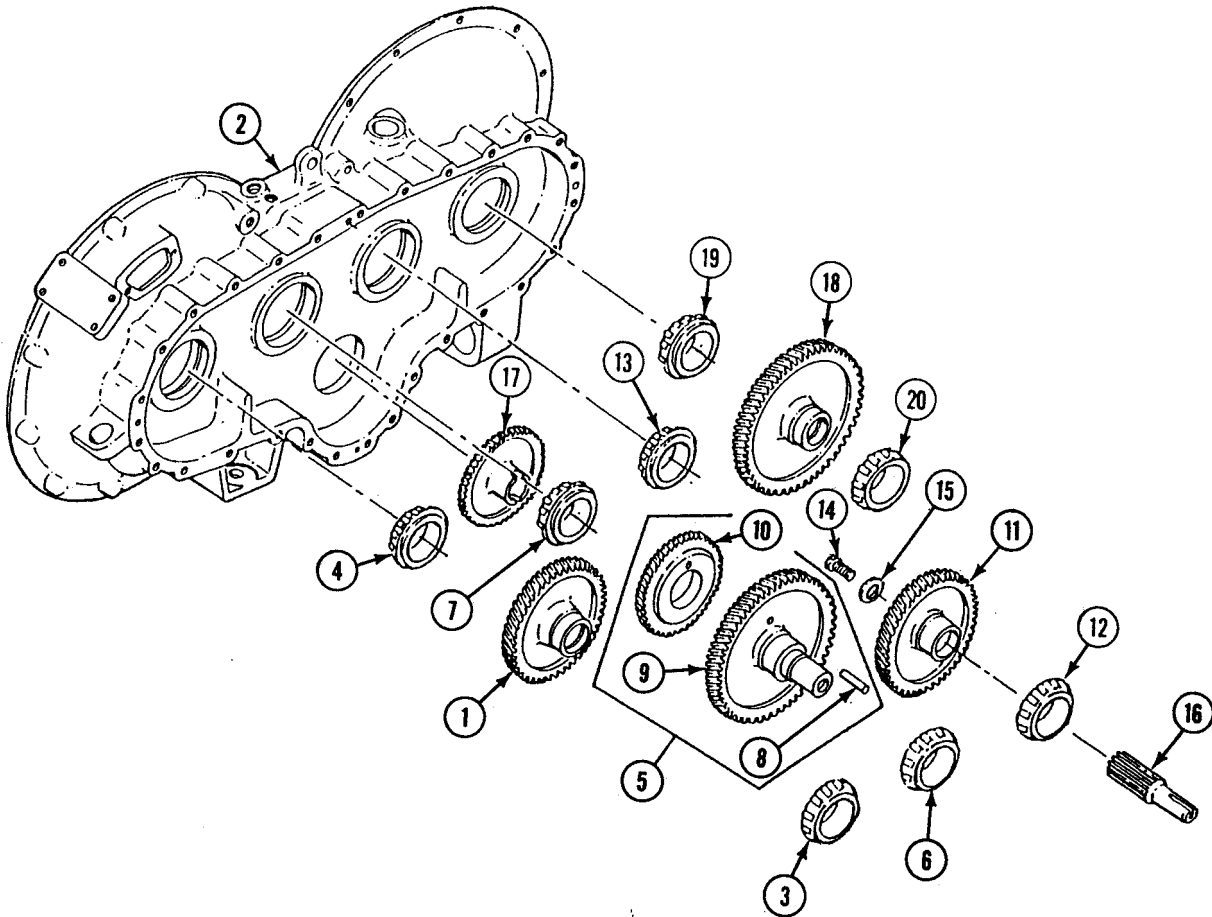
24. Install four jack screws (WP 0033 00, Item 29) in flange of cover (6). Separate cover from housing (7) by tightening jack screws evenly. Use longer screws if needed. Remove and discard gasket (8). If alignment pin (9) in housing (7) is damaged, remove alignment pin(s) and discard.



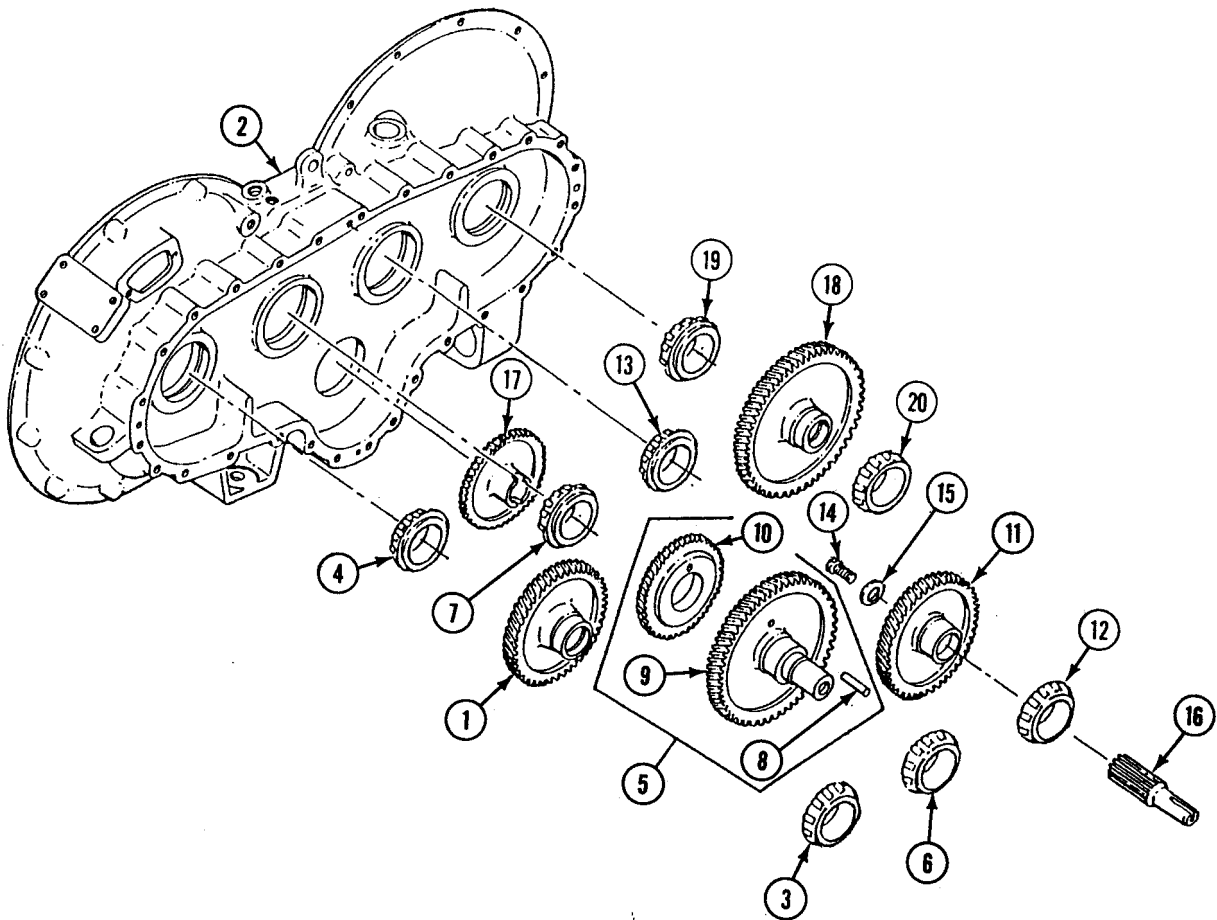
NOTE

Do not remove tapered roller bearing cones or cups that are pressed in plates unless inspection indicates a replacement is needed.

25. Remove output gear (1) from gearcase housing (2). Separate bearing cone (3) and bearing cone (4) from gear.
26. Remove helical gearshaft cluster (5) as an assembly from housing (2). Separate bearing cone (6) and bearing cone (7) from cluster. If replacement is needed, use brass drift pin and hammer to remove spring pin (8). Separate second intermediate gear (9) from primary pump-drive gear (10). Discard spring pin.
27. Remove first intermediate gear (11) from housing (2). Separate bearing cone (12) and bearing cone (13) from gear.



28. Remove self-locking bolt (14), washer (15), and shouldered shaft (16) from gear (11). Discard bolt.
29. Remove secondary pump-drive gear (17) from housing (2).
30. Remove input gear (18) from housing (2). Separate bearing cone (19) and bearing cone (20) from gear.
31. As needed, remove bearing cup(s) from cover and housing (2) with mechanical puller kit. Discard cup(s).



CLEANING

CLEAN, INSPECT AND REPAIR

1. Before inspection, repair or assembly, clean all parts (WP 0014 00).

CAUTION

Do not weld aluminum castings. If replacement of a bearing cup or cone is required, its associated cup or cone must be replaced. The housing and cover are machined as an unit and must be replaced as an assembly.

2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures. Check parts for wear limits and important clearances page 0019 00-25. Repair or replace defective parts as needed.

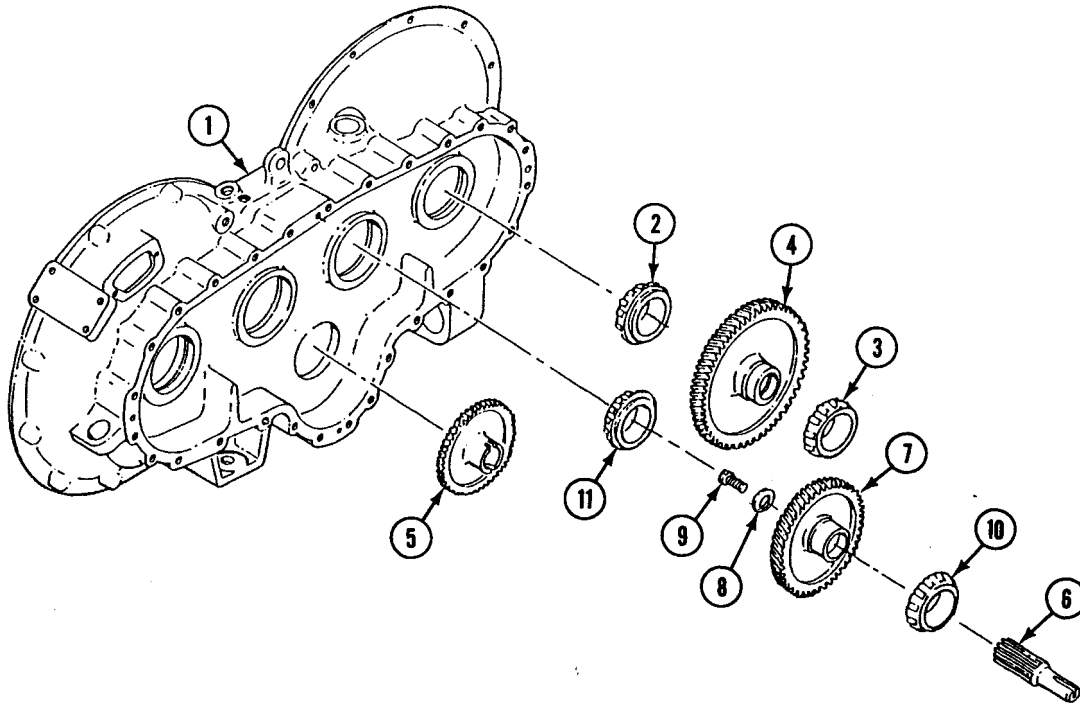
ASSEMBLY

1. If bearing cup(s) were removed during disassembly, heat bearing bore to 250 degrees F 300 degrees F (121 degrees C -148 degrees C), and freeze bearing cup. Position bearing cup to its associated bearing bore. Use bearing cups replacer and soft plastic hammer to tap cup(s) in place.

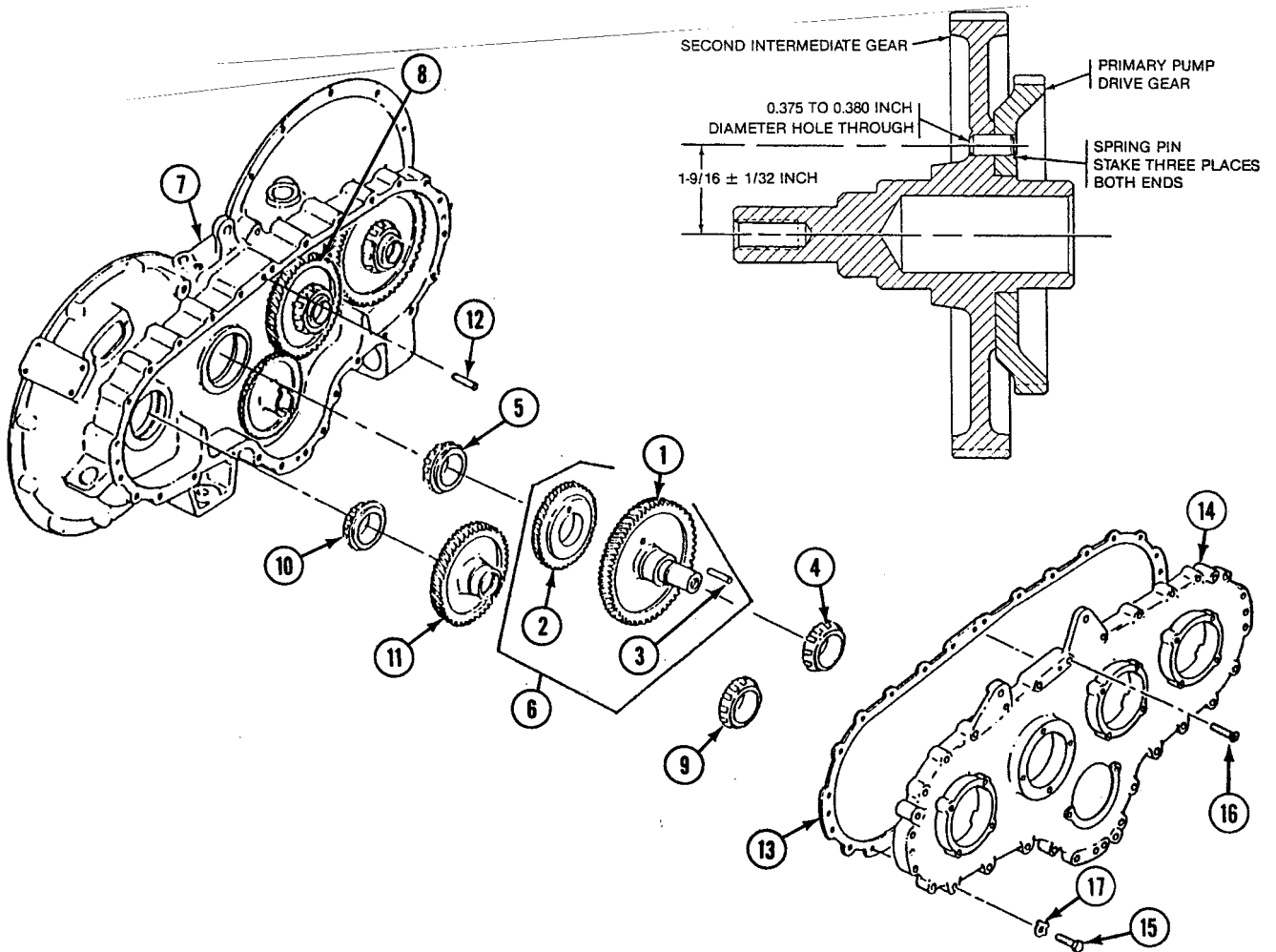
NOTE

If roller bearing cone(s) were removed during disassembly, install new ones. New cone(s) may be heated in oil 250 degrees F (121 degrees C) to aid in installation.

2. Place housing (1) flat on smooth surface with cover side up.
3. If removed, install bearing cone (2) and bearing cone (3) on input gear (4). Install gear in housing (1).
4. Install secondary pump-drive gear (5) in housing (1) with smaller diameter hub toward housing.
5. Install shouldered shaft (6) on first intermediate gear (7) with washer (8) and new self-locking bolt (9). Tighten bolt to 32-38 lb-ft (44-51 N•m) torque. Use torque wrench (WP 0033 00, Item 44).
6. If removed, install bearing cone (10) and bearing cone (11) on first intermediate gear (7). Install gear in housing (1) meshing teeth with input gear (4).



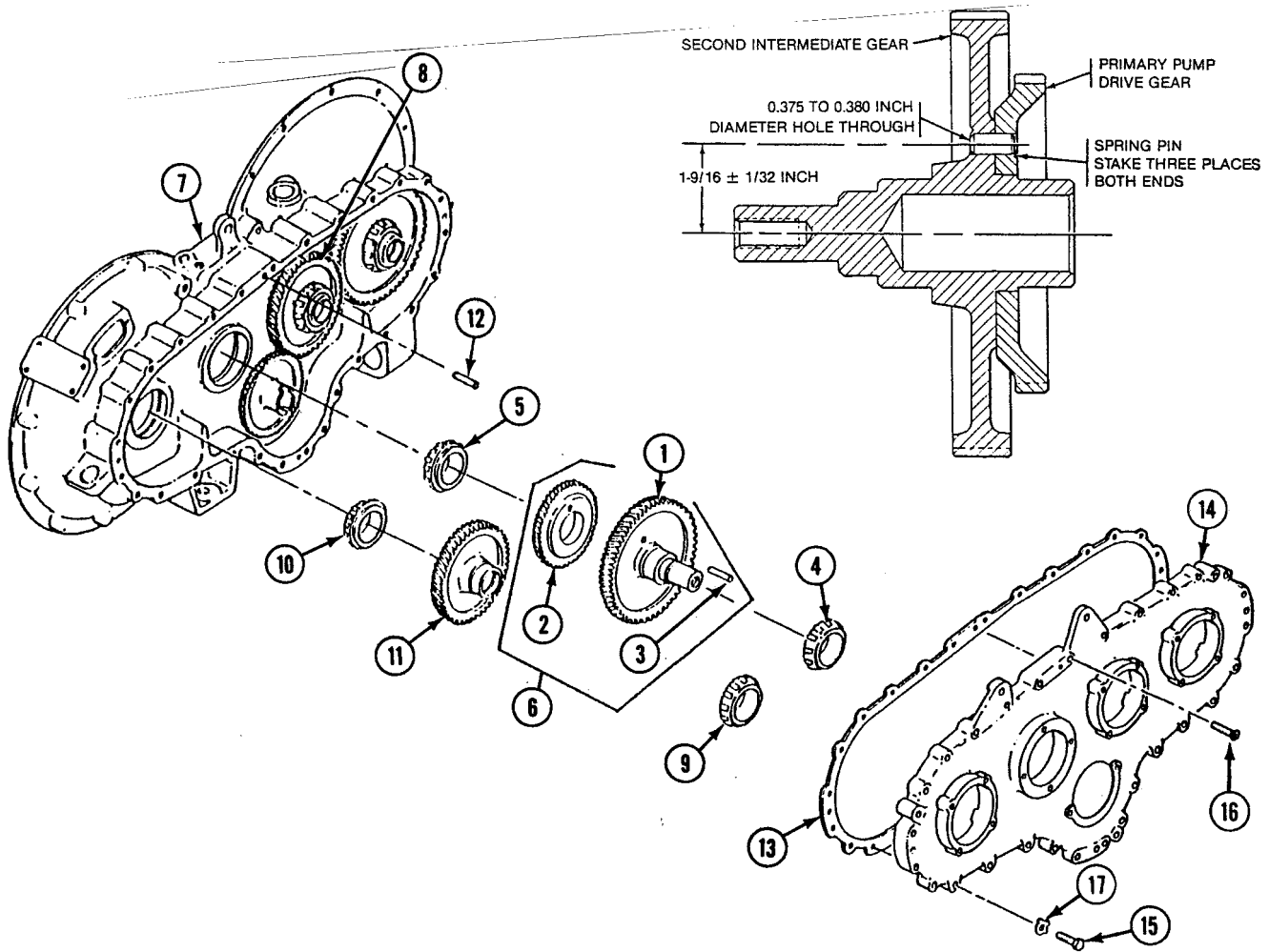
7. If dowel holes exist in second intermediate gear (1) and primary pump-drive gear (2), align holes in each gear. Secure gears together with new spring pin (3). Stake pin three equal places at both ends.
8. If dowel holes do not exist in either second intermediate gear (1) or primary pump-drive gear (2), assemble gears and drill a 0.375 to 0.380 inch diameter hole using a 3/8 inch drill bit. Use twist drill set and portable electric drill. Secure second intermediate gear (1) and primary pump-drive gear (2) together with new spring pin (3). Stake pin three equal places at both ends.
9. If removed, install bearing cone (4) and bearing cone (5) on helical gearshaft cluster (6). Install helical gearshaft cluster in housing (7) meshing teeth of second intermediate gear (1) with first intermediate gear (8).
10. If removed, install bearing cone (9) and bearing cone (10) on output gear (11). Install output gear in housing (7) meshing teeth with second intermediate gear (1).



CAUTION

Gearcase cover and housing are machined as a unit and must be replaced as a matched set.

11. If removed, install new alignment pin(s) (12) in housing (7). Tap in place using a soft plastic hammer.
12. Install new gasket (13) on housing (7). Align cover (14) with four pins (12) and place cover on housing.
13. Clean threads of cap screws (15) and machine screws (16). Apply a light coat of antiseize compound to screw threads. Secure cover (14) to housing (7) with 20 cap screws (15) on gearcase F, 20 new key washers (17), and 8 machine screws (16). Tighten screws to 144-192 lb-in (17-21 N.m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.



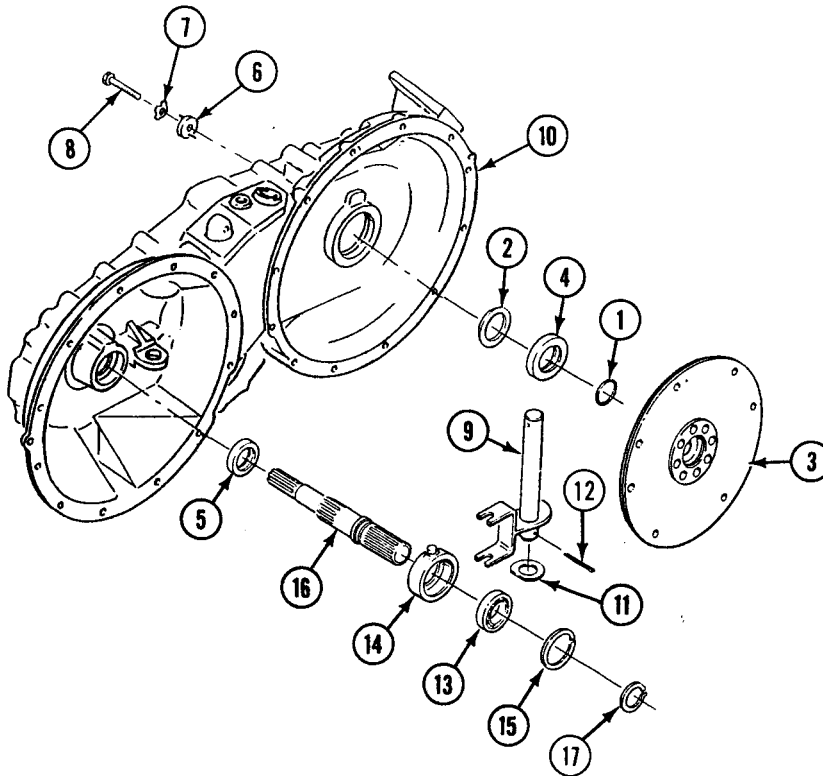
- Lubricate new packing (1) with grease or petrolatum. Install packing and dust deflector (2) on shaft on disk assembly (3).

CAUTION

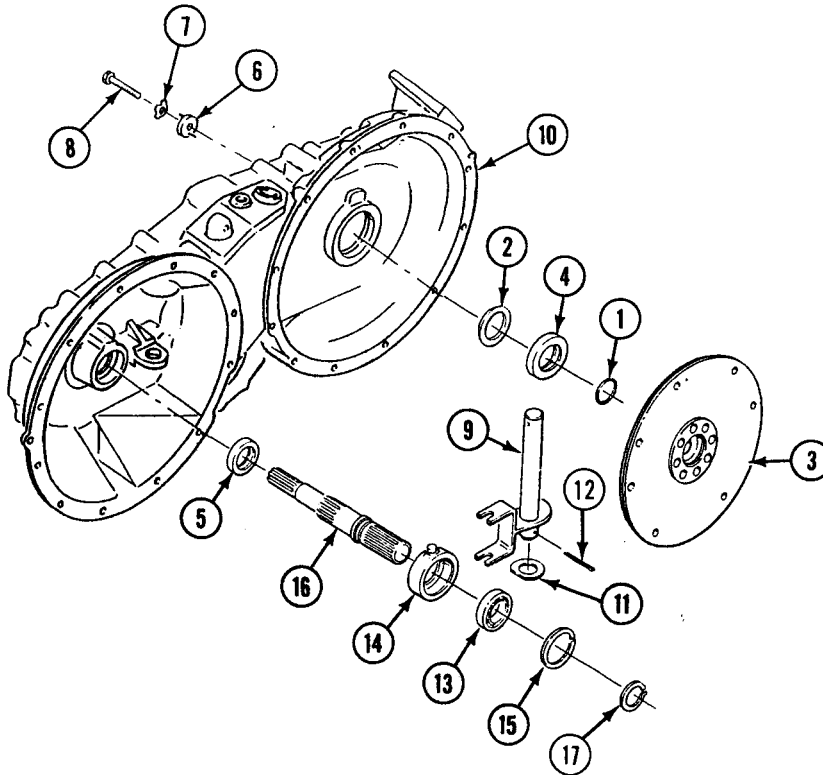
To prevent damage to encased oil seals, do not place housing in upright position until bearing retainers are installed.

To prevent damage to encased oil seals, do not press seals beyond face of bore. After installation seal must be flush with outer surface.

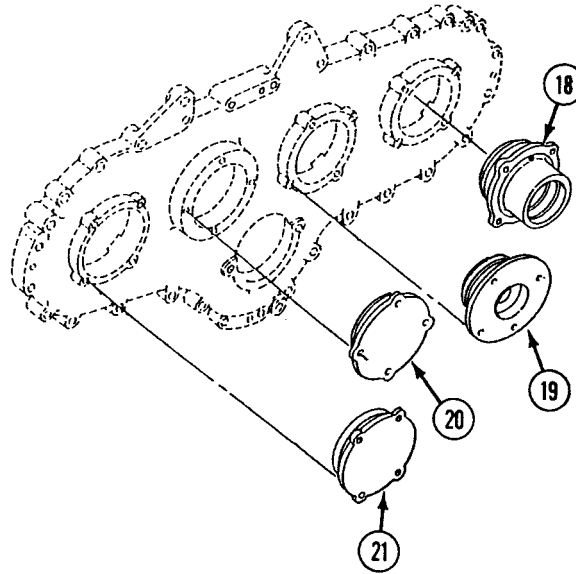
- Clean encased oil seals. Apply a thin even film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to mating surface of seal (4) and seal (5). Position each seal with lip toward bore. Use a flat block of wood and soft plastic hammer to tap seals in place.
- Align splines of disk assembly (3) with splines of output gear and insert disk assembly shaft into output gear.



17. Secure disk assembly (3) to output gear with gearcase washer assembly (6), new key washer (7), and cap screw (8). Tighten screw to 30-35 lb-ft (41-46 N.m) torque. Use torque wrench (WP 0033 00, Item 44). Bend tabs on key washer.
18. Insert engine disconnect actuator (9) through hole in top of housing (10). Secure housing bracket with washer (11) and new cotter pin (12).
19. Insert ball bearing (13) into shift collar (14). Secure with new retaining ring (15).
20. Install shift collar (14) on input shouldered shaft (16). Secure with new retaining ring (17).
21. Align splines of input shaft (16) with input gear. Install input shaft with shift collar (14) aligned with actuator (9).



22. If removed from gearcase F, install bearing cup(s) in retaining plate (18), retaining plate (19), retaining plate (20), or retaining plate (21) with bearing cups replacer and soft plastic hammer.



23. Determine thickness of laminated shims (1), (2), (3), and (4) for bearing preload and install shims on cover (5) as directed in Steps 24 - 30.

NOTE

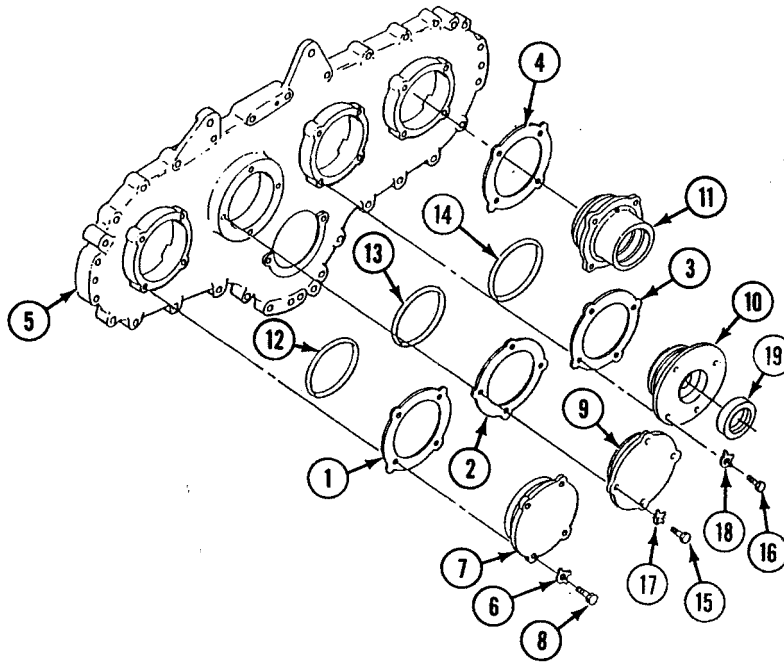
Install output bearing retaining plate with oil hole up. Most retaining plates have the word TOP stamped in metal near oil hole.

24. Without new laminated shim (1) and four new key washers (6) installed, place output bearing retaining plate (7) on cover (5). Lube four cap screws (8) with engine oil and secure retaining plate (7) to cover with four screws. Tighten screws uniformly to 168-192 lb-in (19-21 N.m). Use torque wrench (WP 0033 00, Item 41).
25. Rotate gear train one revolution by hand in each direction to check freedom of movement. Recheck installation procedures if binding is detected.

NOTE

Ensure that the secondary pump-drive gear does not interfere with gear rotation. This gear is nonfunctional until the differential oil pump is installed.

26. Use a thickness gage to measure the gap between output bearing retaining plate (7) and cover (5) at three equal places around cover. Take the average of these readings and record. Peel shim (1) to 0.003-0.005 inch less than the average recorded in step above. Remove four cap screws (8) and retaining plate from cover.

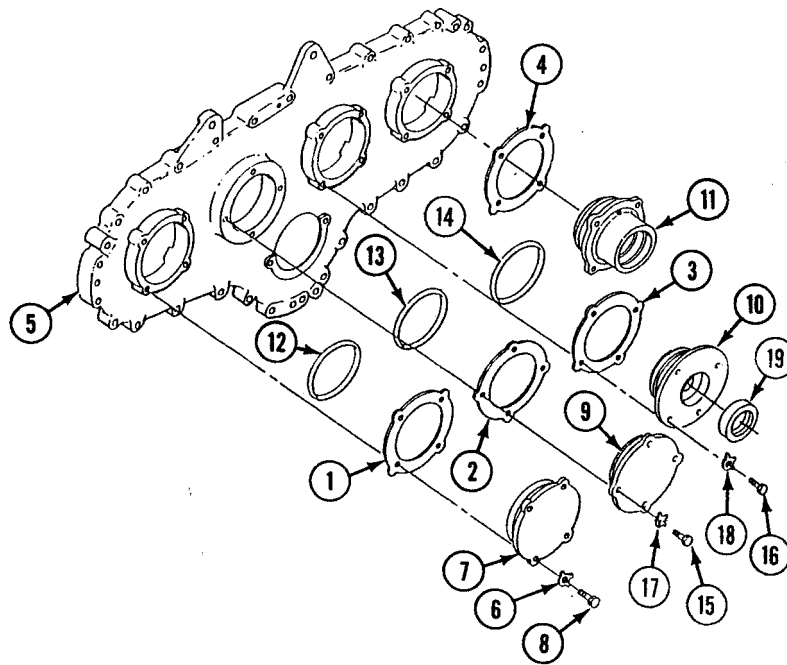


27. Repeat Steps 23 - 26 above using retaining plate (9), retaining plate (10), retaining plate (11), laminated shim (2), laminated shim (3), and laminated shim (4).
28. Lubricate new packing (12), packing (13), and packing (14) with grease or petrolatum. Install packings on retaining plate (7), retaining plate (9), and retaining plate (10).
29. Install retaining plate (7), retaining plate (9), and retaining plate (10) on cover (5). Apply a light coat of antiseize compound to clean threads of cap screw (8), cap screw (15), and cap screw (16). Place laminated shims (1), (2), and (3) and retaining plate (7), retaining plate (9), and retaining plate (10) on cover. Secure plates with new key washer (6), new key washer (17), new key washer (18), and cap screw (8), cap screw (15), and cap screw (16). Tighten screws to 252-300 lb-in (25-33 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.

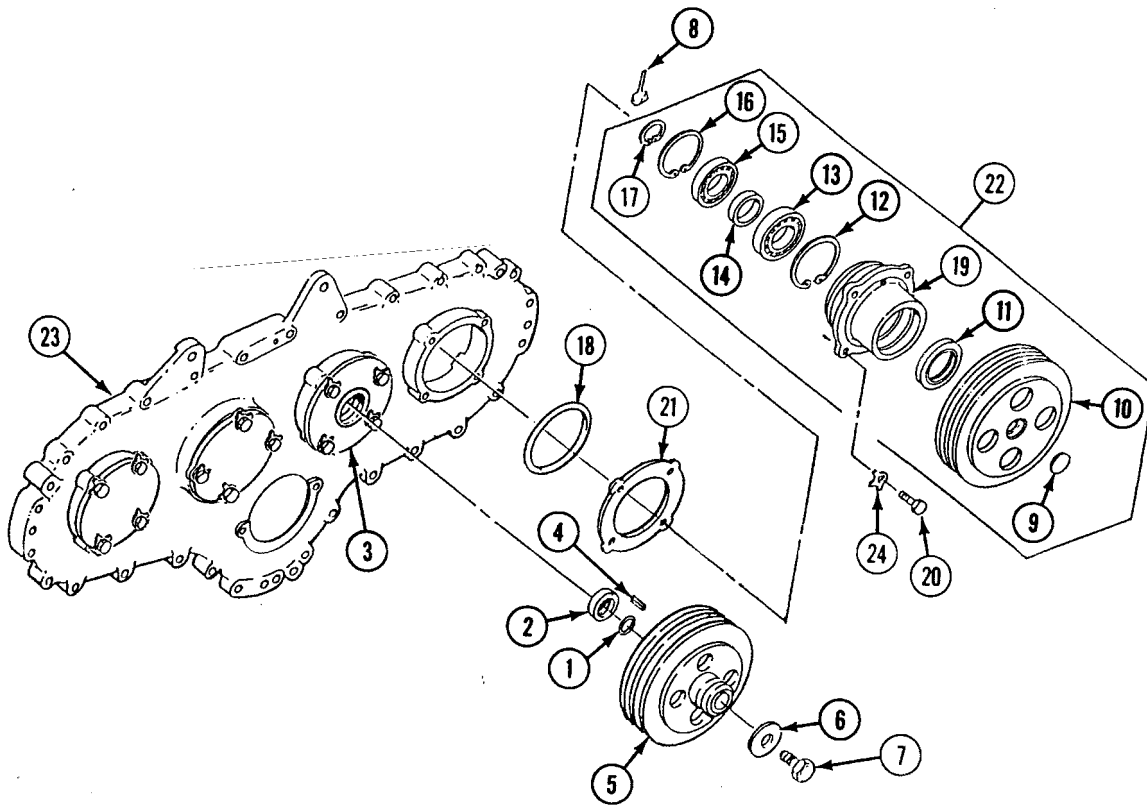
CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

30. Clean mating surface of new encased oil seal (19). Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to outer edge of oil seal. Install encased oil seal in first intermediate bearing retaining plate (10).



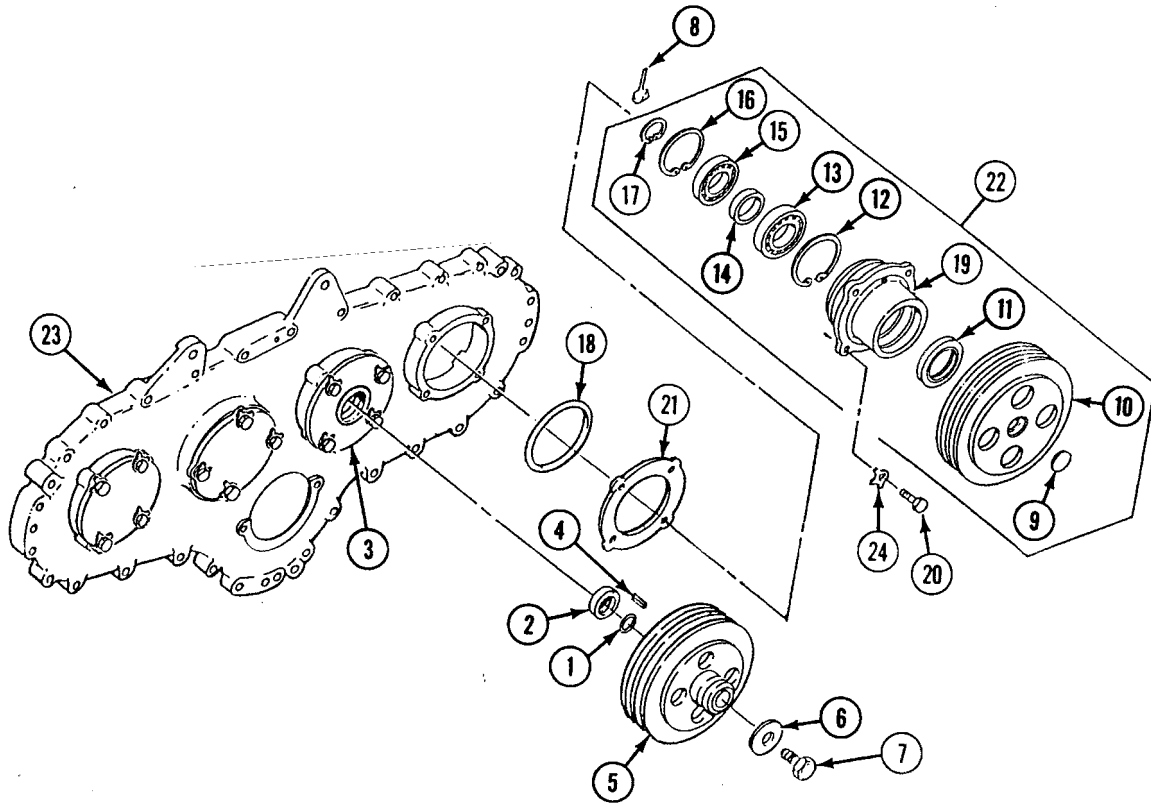
31. Lubricate new packing (1) with grease or petrolatum. Install packing and packing retainer (2) on shouldered shaft of first intermediate gear in retaining plate (3).
32. Install new machine key (4) and fan drive pulley (5) on shouldered shaft. Secure with washer (6) and cap screw (7). Tighten screw to 32-38 lb-ft (44-51 N.m) torque. Use torque wrench (WP 0033 00, Item 44).
33. Insert tail of new dust deflector (8) through hole connecting annular oil groove and bearing area. Pull tail tight, twist 90 degrees, and fold tightly into groove.
34. If removed, install expansion plug (9) in generator drive pulley (10). Clean mating surface of plug with cleaning compound. Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to mating surface of plug. Install plug in pulley.



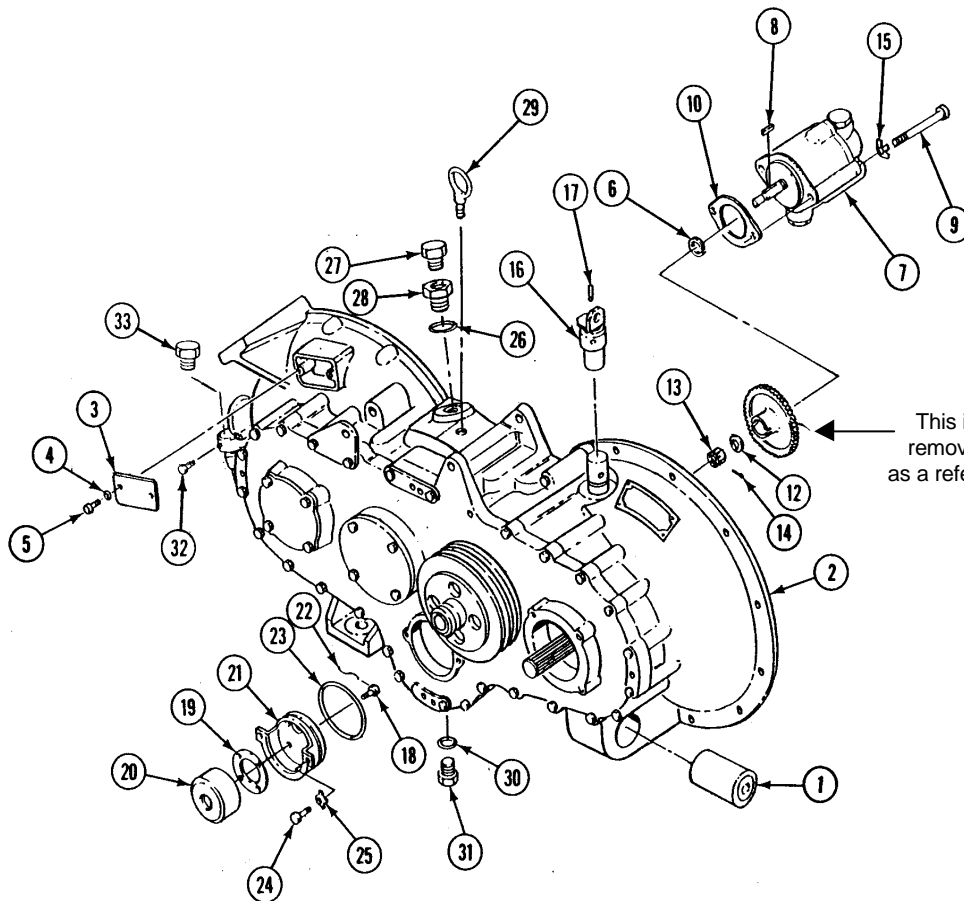
CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

35. Clean mating surface of encased oil seal (11). Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to outer edge of oil seal. Install oil seal in retaining plate.
36. Install new retaining ring (12), ball bearing (13), sleeve spacer (14), ball bearing (15), and new retaining ring (16) on pulley (10). Secure with new retaining ring (17).
37. Lubricate new packing (18) with grease or petrolatum. Install packing on retaining plate (19).
38. Apply a light coat of antiseize compound to clean threads of four cap screws (20). Install laminated shim (21) and generator drive assembly (22) on cover (23) with four new key washers (24) and cap screws (20). Tighten screws to 252-300 lb-in (25-33 N.m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.



39. Install resilient mount (1) in housing (2). Use remover and replacer. Install cover (3) on housing with two new lockwashers (4) and cap screws (5).
40. Install new retaining ring (6) on pump (7). Install new machine key (8) in shaft of pump. Apply a light coat of antiseize compound to clean threads of two cap screws (9). Place new gasket (10) on housing (2). Secure pump to secondary pump-drive gear with two (maximum) washers (12), slotted head nut (13), and new cotter pin (14).
41. Install pump in housing (2) with two new key washers (15) and cap screws (9). Tighten screws to 35-40 lb-ft (47-54 N.m) torque. Use torque wrench (WP 0033 00, Item 44).
42. Install actuating coupling (16) on housing (2) with new headless grooved pin (17).
43. Apply a light coat of antiseize compound to clean threads of four cap screws (18). Install new gasket (19) and sleeve spacer (20) in bracket (21) with four cap screws. Secure screws with new lockwire (22).
44. Lubricate new packing (23) with grease or petrolatum. Install packing on bracket (21). Apply a light coat of antiseize compound to clean threads of two cap screws (24). Install bracket in cover (3) with two key washers (25) and cap screws. Tighten screws to 168-192 lb-in (19-21 N.m). Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.
45. Lubricate new packing (26) with grease or petrolatum. Install packing and breather (27) on straight adapter (28). Install adapter in housing (2).
46. Install eye bolt (29) in housing (2).
47. Apply sealing compound around side of plug (33). Install plug and drive screw (32).



NOTE
 This is an internal gear and is not removed here. This is only shown as a reference for the pump installation.

48. Lubricate new packing (30) with grease. Install packing on drain plug (31). Install plug in housing (2).

WARNING

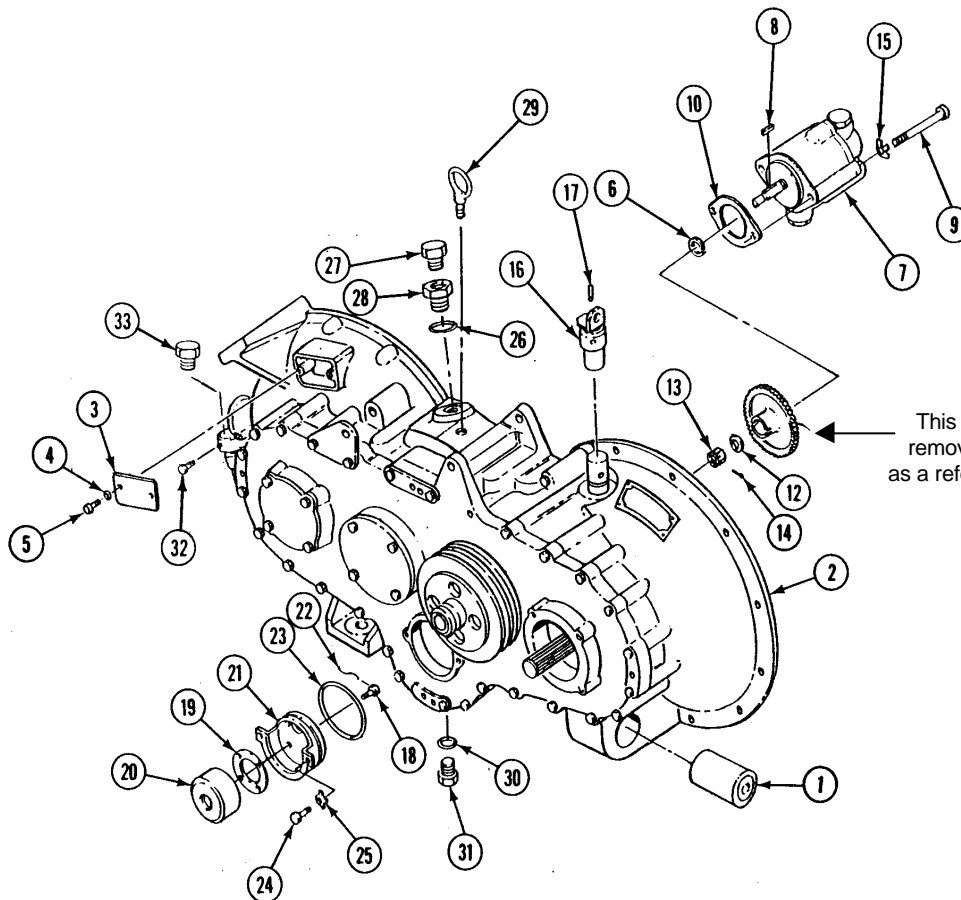


Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

49. Lift transfer gearcase using suitable lifting device and sling through eye bolt (29). Place gearcase on test stand for run-in test.



NOTE

This is an internal gear and is not removed here. This is only shown as a reference for the pump installation.

RUN-IN TEST

NOTE

Conduct run-in test in accordance with local standard procedures.

1. Mount gearcase on test stand in the same position as when installed in the carrier.
2. Fill gearcase with 5 pints of oil (WP 0014 00). Oil level is to be between the ADD and FULL marks on liquid level gauge rod.
3. Provide suitable external lubricating oil supply for the differential oil pump and the ramp hydraulic pump (if installed).
4. Before run-in operation. Provide artificial heating and cooling, if needed.

NOTE

Do not allow oil temperature to exceed 280 degrees F (138 degrees C) at any time during run-in tests. At each stage, watch for over-heating, undue noise, and vibration. Check all seals and covers for oil leakage.

5. Run gearcase in the following minimum time duration stages.

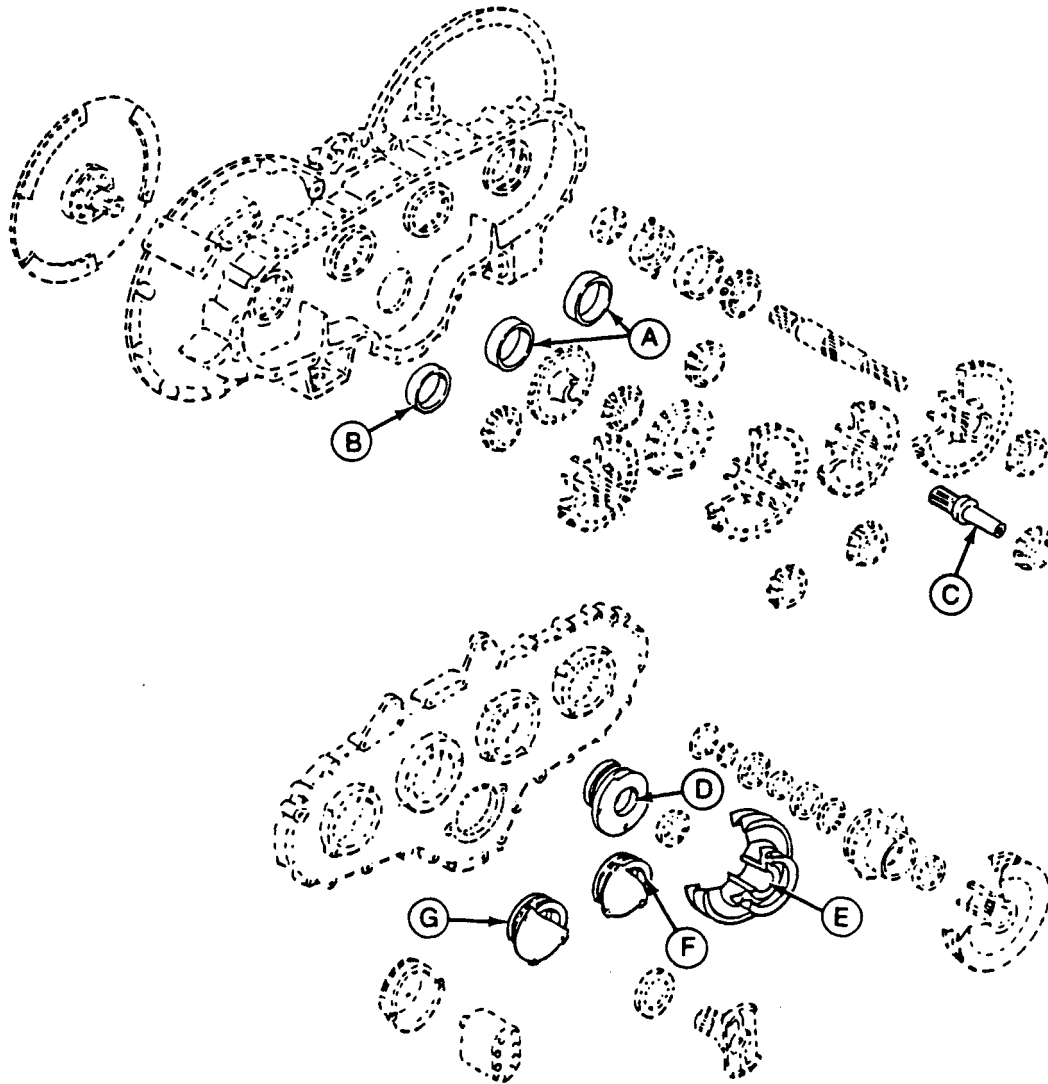
Table 1.

Stage (rpm)	Load (foot-pounds)	Stage Time (minutes)
1100 to 1300	No load	5
1900 to 2100	No load	5
2800 to 3000	No load	5

6. Remove drain plug and drain oil for at least 15 minutes into a suitable container and then install drain plug.
7. Leave oil residue in gearcase for rust prevention.
8. Remove sling and lifting device from transfer gearcase.

WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figures.



3. Check the parts dimensions with chart below to determine replacement.

Table 2. TRANSFER GEARCASE F WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Outside diameter of first and second intermediate bearing cup	3.5425 to 3.5435	(*)(***)
B	Outside diameter of output bearing cup	3.5425 to 3.5435	(*)(***)
C	Fan drive pulley shaft	1.0000 to 1.0010	(*)(**)
D	Inside diameter of bore in first intermediate retainer at bearing surface	3.5410 to 3.5420	(*)(***)
E	Inside diameter of fan pulley hub	1.0000 to 1.0020	(*)(**)
E-C	Fit of fan pulley hub on shaft	0.0010T to 0.0020L	(*)
F	Inside diameter of bore in second intermediate retainer at bearing surface	3.5410 to 3.5420	(*)(***)
F-A	Fit of first and second intermediate bearing cup to retainer bores	0.0005T to 0.0025T	(*)
G	Inside diameter of bore in output retainer	3.3449 to 3.3459	(*)(***)
G-B	Fit of output bearing cup to retainer bore	0.0005T to 0.0025T	(*)
<p>* Must be within new parts dimensions. ** Measure only if there are visual signs of wear or damage. *** Measure only if there is visual indication of bearing turning.</p>			

END OF TASK

CHAPTER 6

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS
FOR REPAIR FINAL DRIVE ASSEMBLIES

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
REPAIR FINAL DRIVE ASSEMBLIES A AND B.....	0020 00

REPAIR FINAL DRIVE ASSEMBLIES A AND B

0020 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0020 00-2).
 - Cleaning (page 0020 00-6).
 - Assembly (page 0020 00-7).
 - Run-in Test (page 0020 00-13).
 - Wear Limits (page 0020 00-14).
-

INITIAL SETUP:

Maintenance Level

Direct Support

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Arbor press (WP 0033 00, Item 16)
- Jack screw (2) (WP 0033 00, Item 30)
- Puller kit (WP 0033 00, Item 17)
- Remover/Replacer (WP 0033 00, Item 25)
- Straight pin (WP 0033 00, Item 14)
- Torque wrench (WP 0033 00, Item 41)
- Torque wrench (WP 0033 00, Item 44)
- Vernier height gage (WP 0033 00, Item 8)
- Sling (WP 0033 00, Item 32)

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Engine lubricating oil (WP 0035 00, Item 5)
- Grease automotive (WP 0035 00, Item 6)
- Petrolatum (WP 0035 00, Item 10)
- Sealing compound (WP 0035 00, Item 12)
- Sealing compound (WP 0035 00, Item 13)
- Sealing compound (WP 0035 00, Item 14)
- Sealing compound (WP 0035 00, Item 16)
- Wiping rag (WP 0035 00, Item 17)
- Gasket
- Gasket
- Gasket
- Gasket
- Gasket
- Key washer
- Key washer (4)
- Key washer (6)
- Key washer (8)
- Preformed packing
- Seal
- Seal
- Self-locking bolt (3)
- Self-locking bolt (4)
- Self-locking bolt (14)

Personnel Required

Track Vehicle Repairer

References

- See your -10
- See your -20
- TM 9-214

Equipment Condition

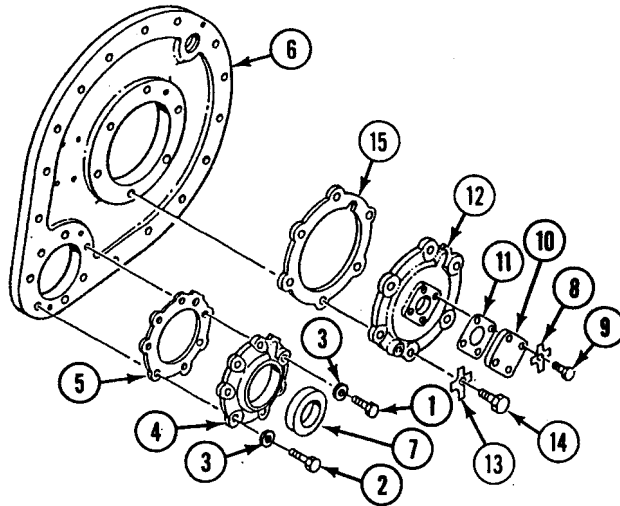
Final drive removed from carrier (see your -20)

DISASSEMBLY

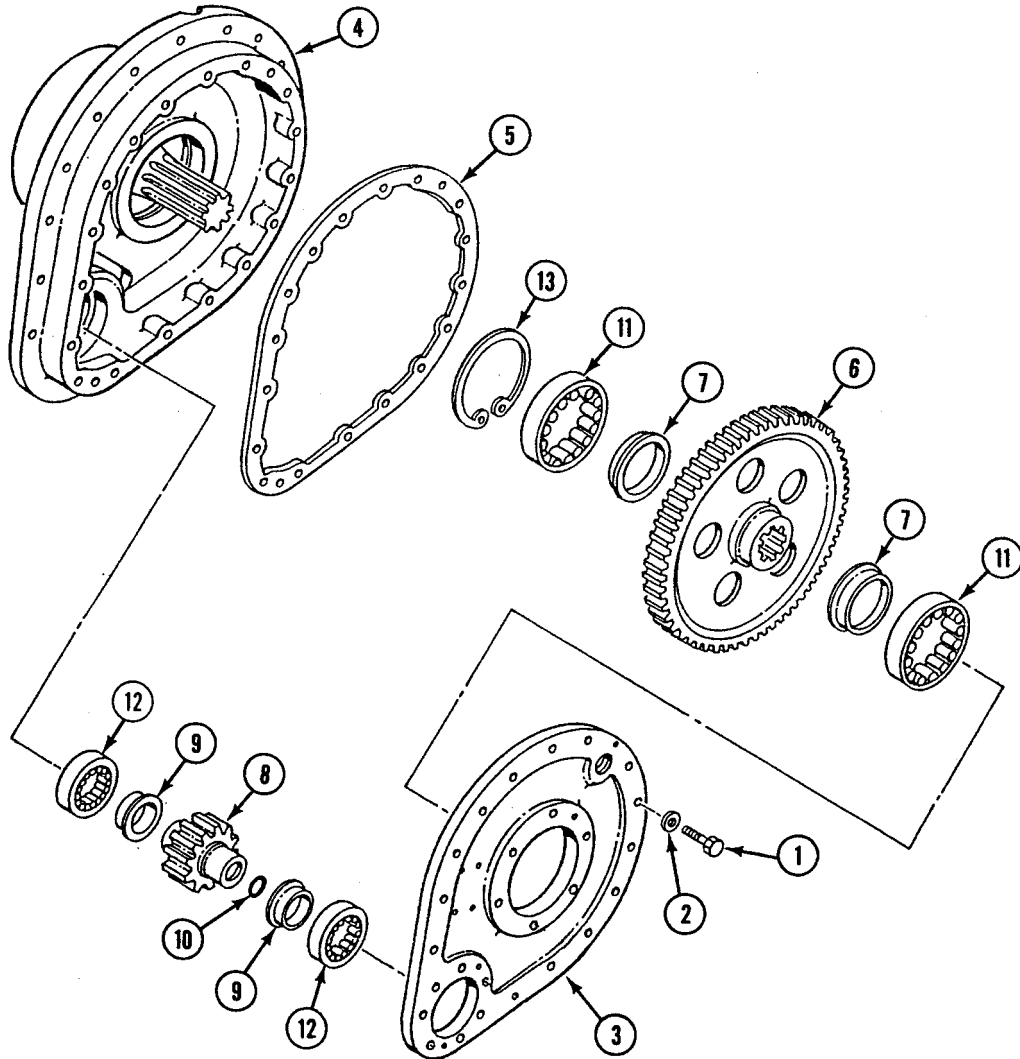
CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during disassembly, cleaning, inspection, and assembly.

1. Remove four lock bolts (1), three lock bolts (2), seven washers (3), seal retaining cover (4), and gasket (5) from housing cover (6). Discard lock bolts and gasket.
2. Remove metal ring oil seal (7) from cover (4). Discard seal.
3. Straighten tabs on four key washers (8). Remove four cap screws (9), key washers (8), access cover (10), and gasket (11) from bearing retaining plate (12). Discard key washers and gasket.
4. Straighten tabs on six key washers (13). Remove six cap screws (14), key washers (13), bearing retaining plate (12), and gasket (15) from housing cover (6). Discard key washers and gasket.



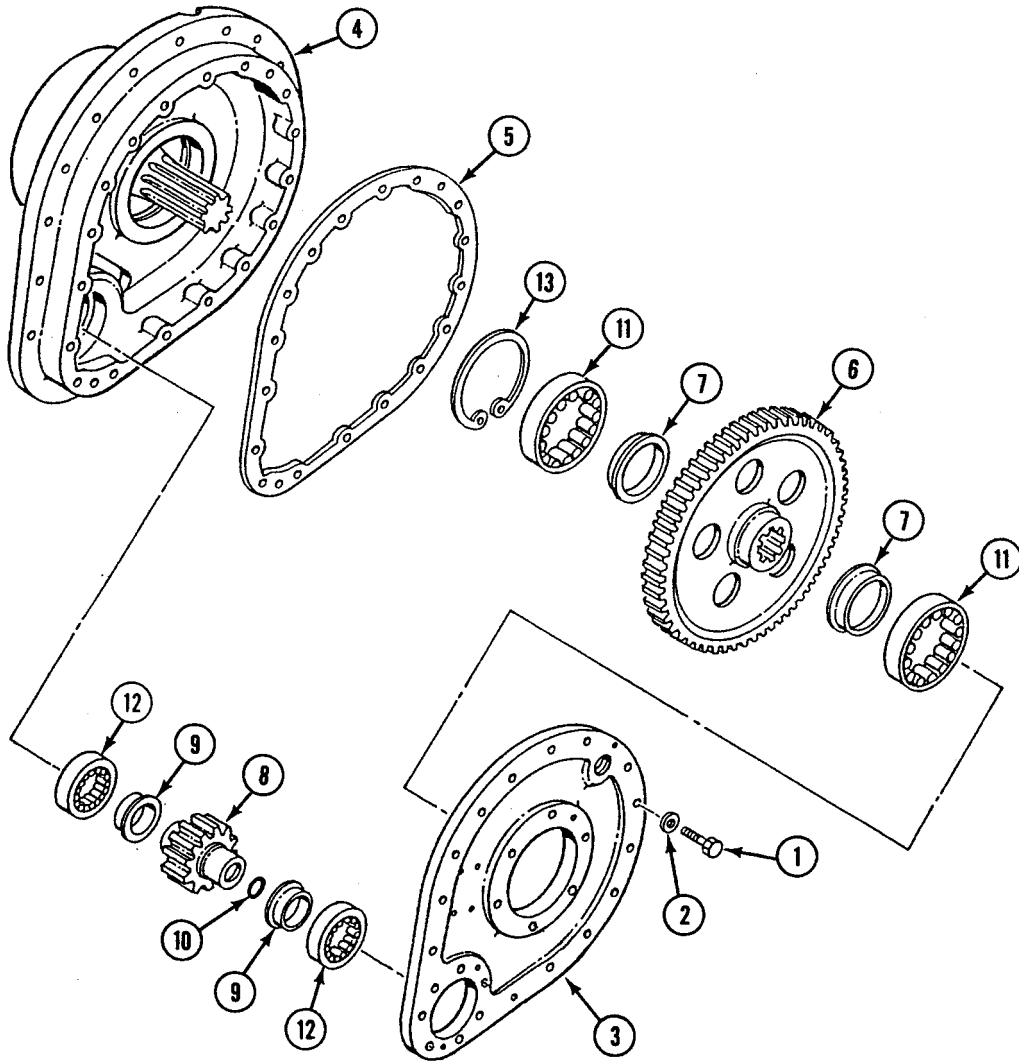
5. Remove 14 lock bolts (1) and washers (2) holding housing cover (3) to housing (4). Install two jack screws evenly into jacking screw holes in housing cover (3) and remove cover and gasket (5). Discard gasket and lock bolts.
6. Remove spur gear (6) with two attached inner races (7) from housing (4).
7. Remove spur gear (8) with two attached inner races (9) from housing (4).
8. Remove packing (10) from gear (8). Discard packing.



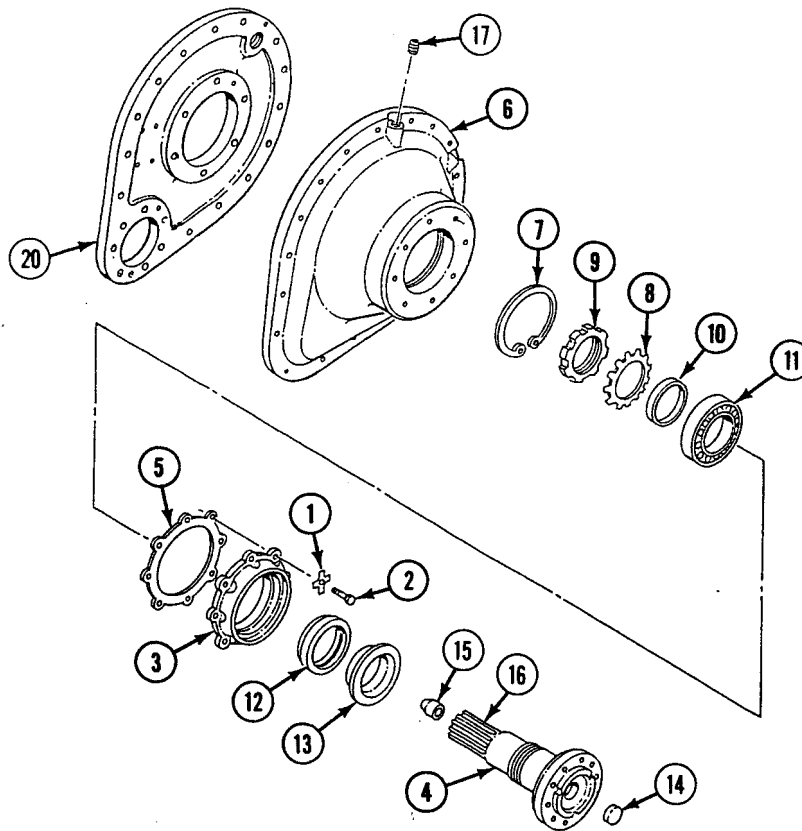
NOTE

Both inner race and outer race of roller bearings are matched sets and must be replaced if either is defective.

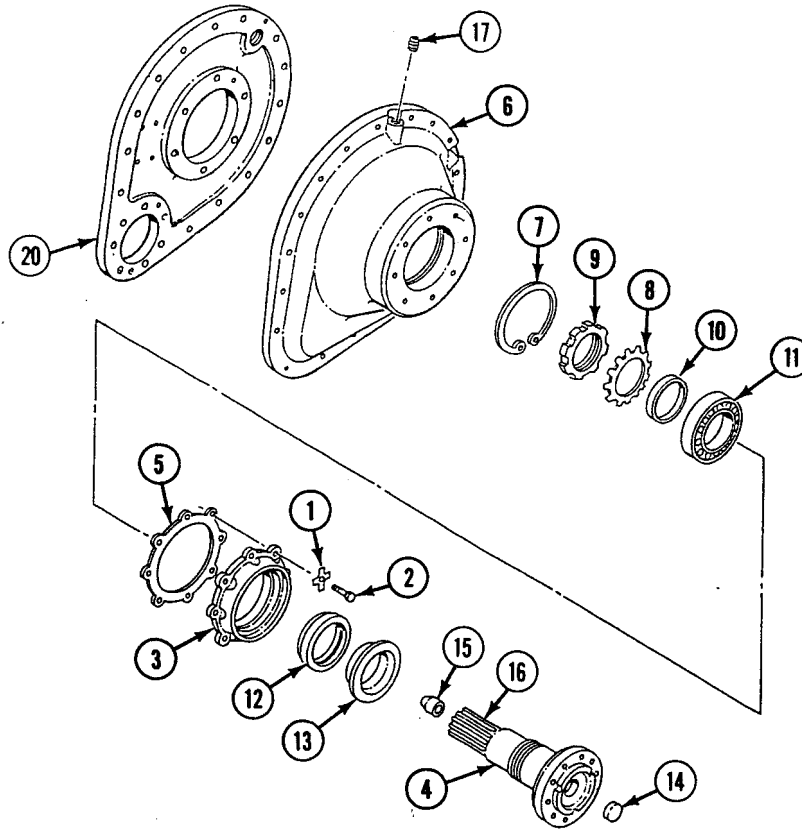
9. If inspection indicates that inner race (7) or inner race (9) or outer race (11) or outer race (12) requires replacement, remove applicable outer race(s) from bore(s) of housing cover (3) or from bore(s) of housing (4). Remove applicable inner race(s) from spur gear (6) or spur gear (8). Discard both outer race(s) and inner race(s).
10. Remove retaining ring (13) from housing (4).



11. Straighten tabs on eight key washers (1). Remove eight cap screws (2), key washers (1), bearing and oil seal retainer (3) with output shaft assembly (4) and attached parts, and gasket (5) from housing (6). Discard key washers and gasket.
12. Remove retaining ring (7) from housing (6).
13. Straighten tabs on key washer (8). Remove round nut (9), key washer (8) and bearing washer (10) from shaft assembly (4). Discard key washer.
14. Remove parts from shaft assembly (4). Position three straight pins on remover and replacer with pins in unthreaded holes in flange of shaft assembly. Use an arbor press to press roller bearing (11), retainer (3) with encased oil seal (12), and seal spacer (13) from shaft assembly. Remove oil seal from retainer. Discard seal.



15. If needed, remove protective plug (14) and speedometer adapter (15) from final drive shaft (16).
16. Remove two pipe plugs (17) from housing (6).



CLEANING

CLEAN, INSPECT, AND REPAIR

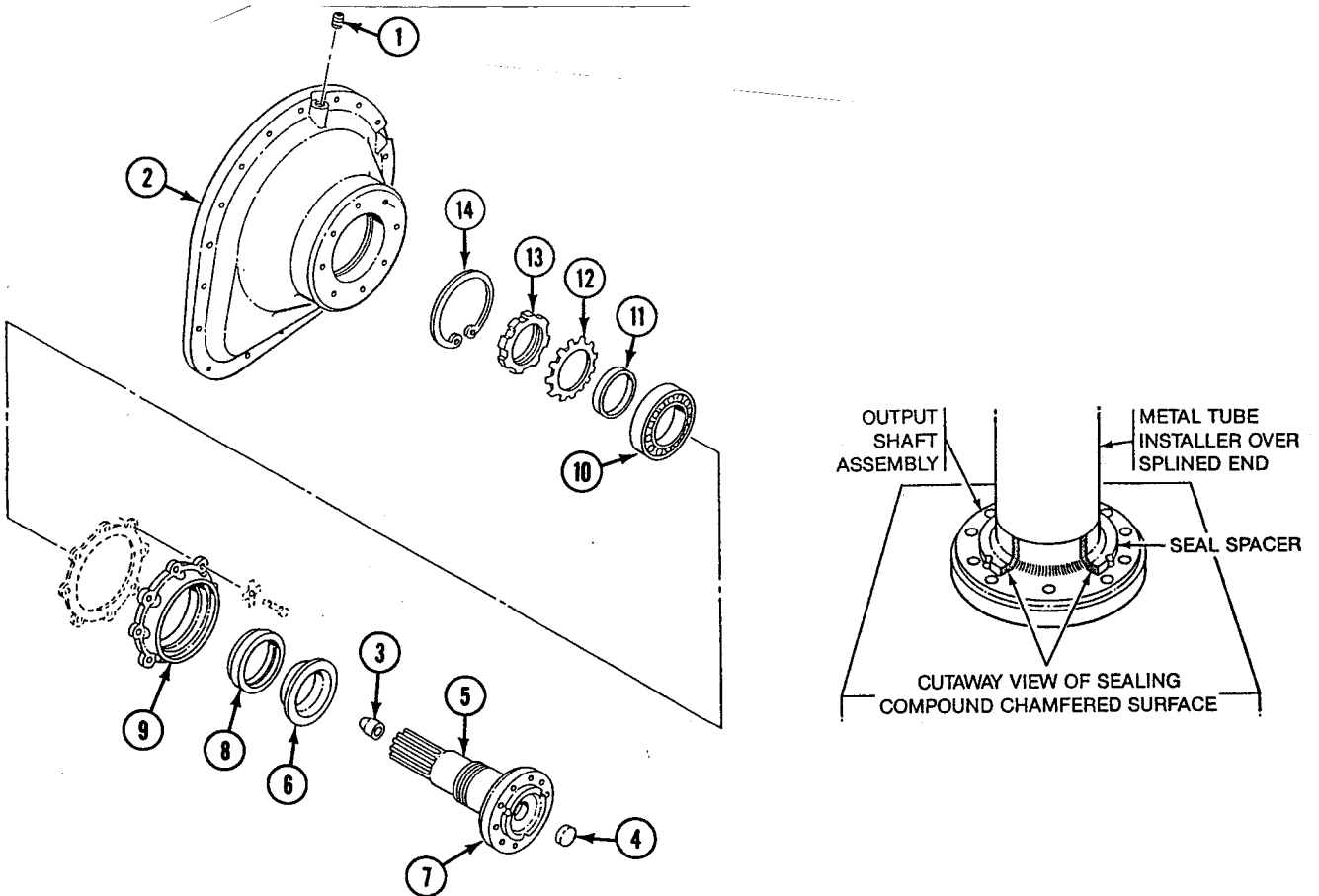
1. Before inspection, repair, or assembly of final drive assemblies, clean all parts as described in General Maintenance section of (WP 0014 00).
2. Inspect all parts. See (WP 0014 00) for general inspection and repair procedures. To measure parts for wear, see final drive assemblies wear limits (page 0020 00-14). Repair or replace defective parts.

ASSEMBLY

NOTE

The final drive housing and cover are machined as a unit and must be retained or replaced as a matched set.

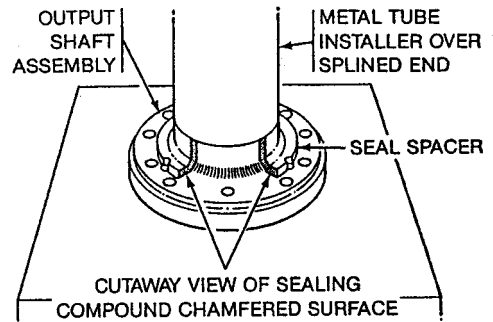
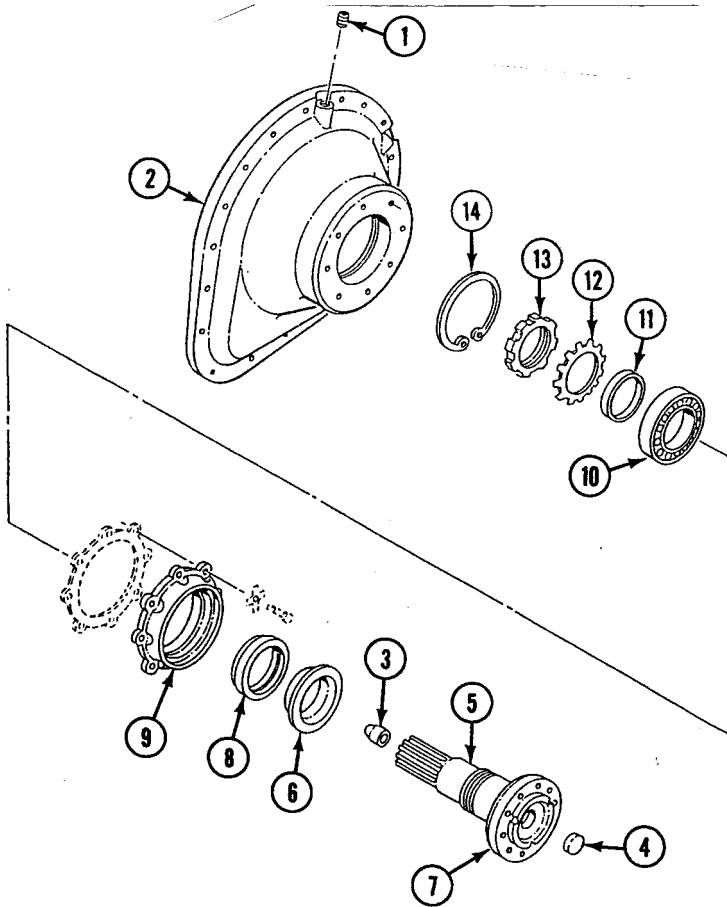
1. Apply sealing compound (WP 0035 00, Item 14) to small end of pipe threads. Do not apply sealant beyond small end of pipe threads. Do not fill leading thread. Install two pipe plugs (1) in housing (2).
2. If removed during disassembly, install new speedometer adapter (3) and protective plug (4) in final drive shaft (5).
3. Position shaft assembly on level surface on arbor press with splined end up. On chamfered surface of seal spacer (6) nearest output shaft assembly (7), apply a coat of sealing compound (WP 0035 00, Item 16). Place spacer (6) on shaft assembly so spacer holes are between the 3/8 inch diameter holes in shaft assembly. Using a metal tube with same diameter as spacer (6) and arbor press, press spacer on output shaft assembly.



CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation seal must flush with outer surface. Keep replacer clear of three steel pins in oil seal.

4. Install new encased oil seal (8) in bearing and oil seal retainer (9). Clean mating surface of oil seal. Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to outer edge of oil seal. Use remover/replacer and hammer.
5. Install retainer (9) on shaft assembly (7) with three gasket steel pins of seal (8) in three holes in retainer.
6. Press roller bearing (10) on shaft assembly (7) so that inner race fits tightly against spacer (6). Secure with bearing washer (11), new key washer (12), and round nut (13) with chamfered side toward washer. Bend tabs on key washer. Use arbor press and remover/replacer.
7. Install retaining ring (14) in housing (2).
8. Install retainer (9) with attached parts on housing (2).

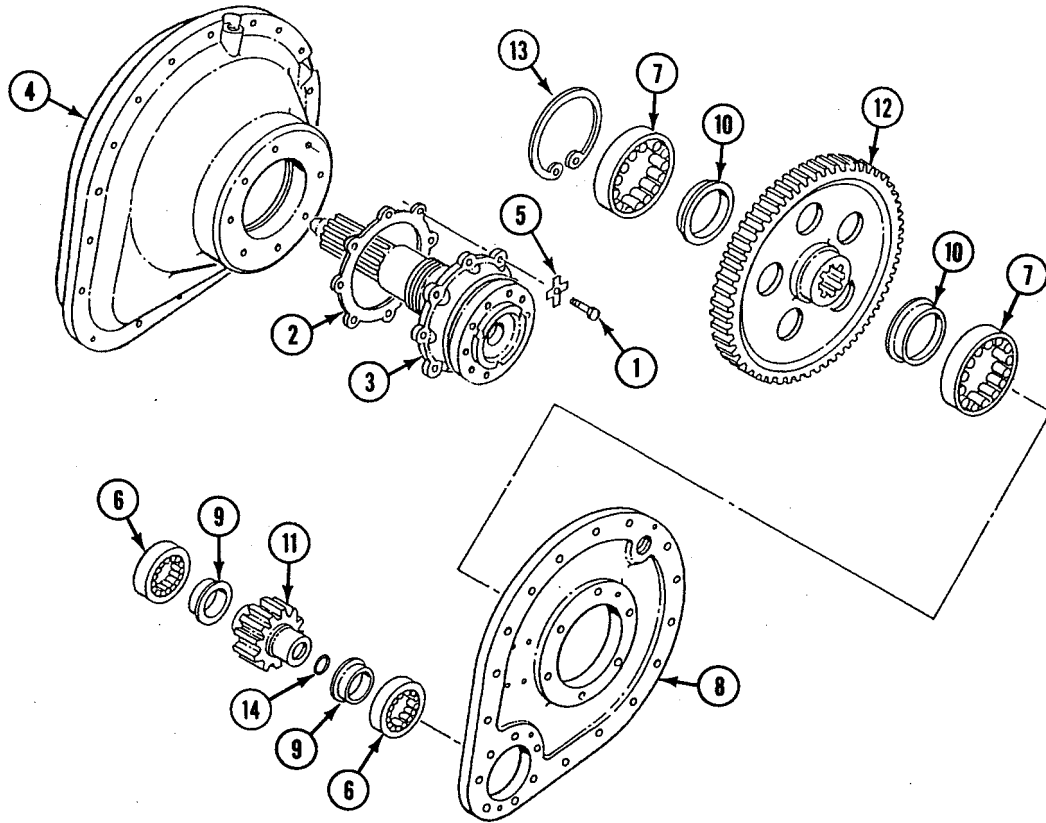


9. Apply a light coat of antiseize compound to clean threads of eight cap screws (1). Place new gasket (2) and retainer (3) on housing (4). Secure with eight new key washers (5) and cap screws (1). Torque screws to 264-288 lb-in (30-32 N•m). Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.

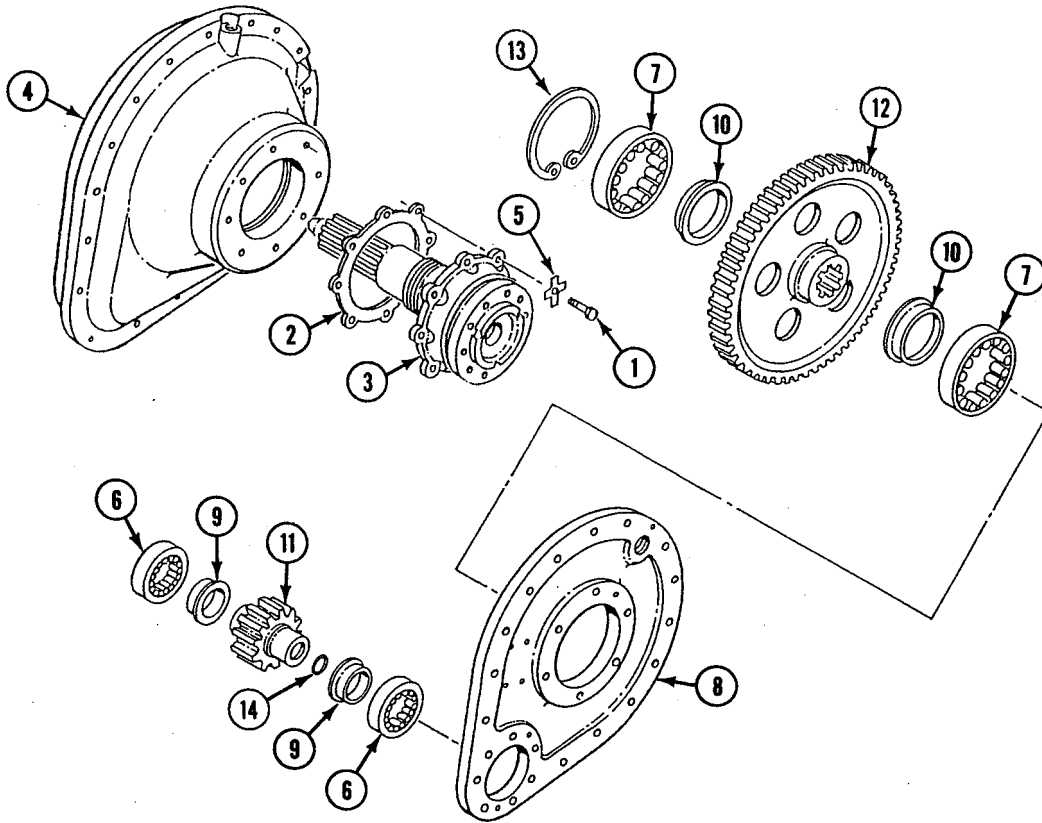
NOTE

Both inner race and outer race of roller bearings are matched sets and must be replaced if either is defective.

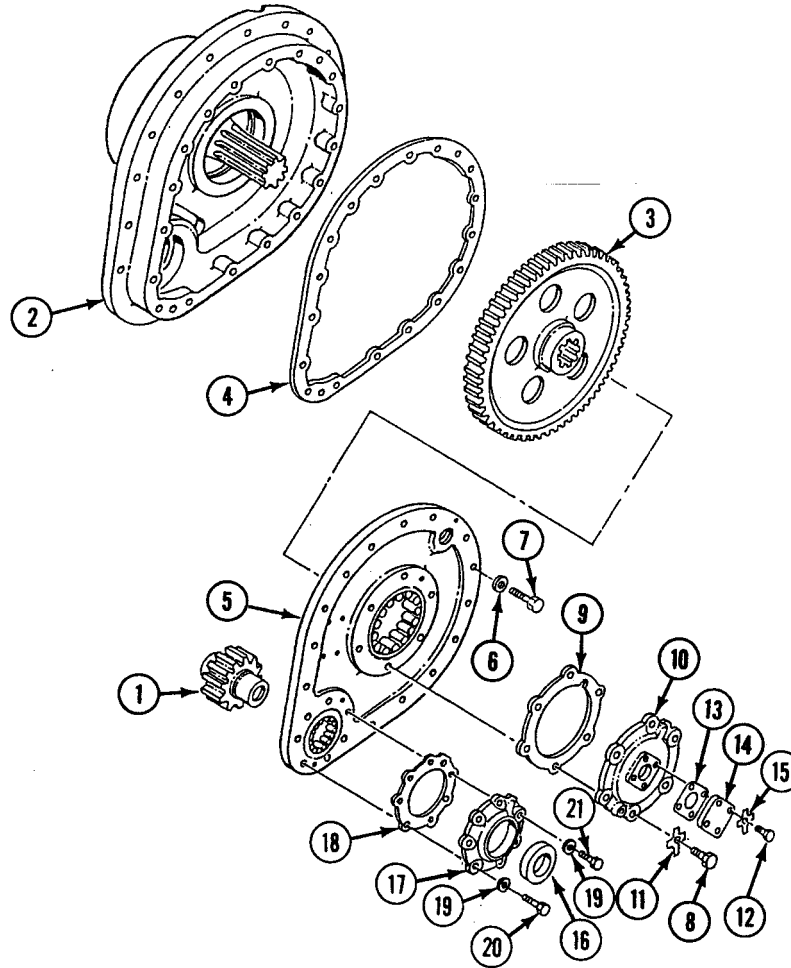
10. If removed during disassembly, press new outer race (6) or outer race (7) in bore(s) in housing cover (8). Press applicable new inner race (9) or inner race (10) on hub(s) of spur gear (11) or spur gear (12). Use arbor press and remover/replacer.



11. Install retaining ring (13) in housing (4).
12. If removed during disassembly, press new outer race (6) or new outer race (7) in bore(s) in housing (4). Press applicable new inner race (9) or new inner race (10) on hub(s) of spur gear (11) or spur gear (12). Use arbor press and remover/replacer.
13. Lubricate new packing (14) with grease or petrolatum and install packing in spur gear (11).



14. Install spur gear (1) in housing (2).
15. Install spur gear (3) in housing (2).
16. Install new gasket (4) and housing cover (5) on housing (2) with 14 washers (6) and new lock bolts (7). Torque bolts to 34-36 lb-ft (46-49 N.m). Use torque wrench (WP 0033 00, Item 44).
17. Apply a light coat of antiseize compound to clean threads of six cap screws (8). Place new gasket (9) and retaining plate (10) on cover (5). Secure with six new key washers (11) and cap screws (8). Torque screws to 264-288 lb-in (30-33 N.m). Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.



NOTE

Do not bend two lower key washers that mount loop clamps for final drive left or right filler tube and liquid gage rod installed in Step 20.

18. Apply a light coat of antiseize compound to clean threads of four cap screws (12). Place new gasket (13) and access cover (14) on retaining plate (10). Secure with four new key washers (15) and cap screws (12). Bend tabs on two upper key washers.

CAUTION

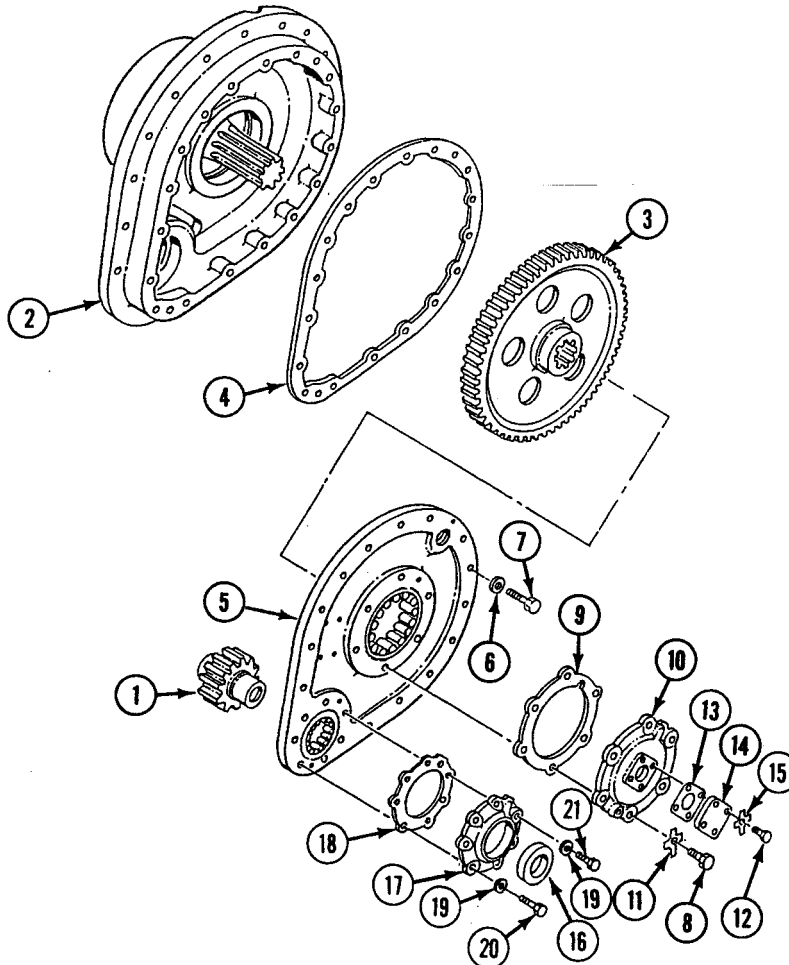
To prevent damage to metal ring oil seal, do not press seal beyond face of bore. After installation seal must be flush with outer surface.

19. Clean mating surface of oil seal. Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to outer edge of oil seal. Install oil seal (16) in retaining cover (17) with sealing lip in towards bearing.

NOTE

Install three longer lock bolts (20) in bottom holes in housing cover (5).

20. Install new gasket (18) and retaining cover (17) on housing cover (5) with seven washers (19), three new lock bolts (20), and four new lock bolts (21). Torque bolts to 34-36 lb-ft (46-49 N•m). Use torque wrench (WP 0033 00, Item 44).



RUN-IN TEST

WARNING



Lifting or moving objects in excess of 70 pounds could injure you. Make sure to get an assistant or use a lifting device to move heavy objects.

CAUTION

Take care to prevent damage to machined surfaces, gears, bearings, and other components during maintenance activities.

NOTE

Conduct run-in test in accordance with local operating procedures.

1. Install sling and suitable lifting device to final drive
2. Mount final drive in same position as in the carrier (line connecting input and output shaft center lines at 15 to 25 degrees from vertical).
3. Install filler tube, liquid level gage rod, vent tube and elbow, and adapter as installed in carrier (see your -20).
4. Fill housing with oil between ADD and FULL marks on liquid level gage rod (about 3-1/2 quarts or 7 pints).
5. Operate final drive according to the following schedule, checking for undue noise level, local heating, leaks, and vibration at each phase:

Table 1. RUN-IN TEST SCHEDULE

Stage (rpm)	Direction	Stage Time (minutes)
900 to 1100	Forward	6 to 8
900 to 1100	Reverse	6 to 8
1900 to 2100	Forward	3 to 5
1900 to 2100	Reverse	3 to 5
2900 to 3100	Forward	1 to 3
2900 to 3100	Reverse	1 to 3

6. Drain oil into a suitable container. Leave residual oil for use as a preservative during shipping and storage.
7. Remove filler tube and vent components installed in Step 2 above (see your -20).
8. Cover filler tube vent and input shaft openings.
9. Remove sling and suitable lifting device from final drive

WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figures.
3. Check the parts dimensions with chart on next page to determine replacement.

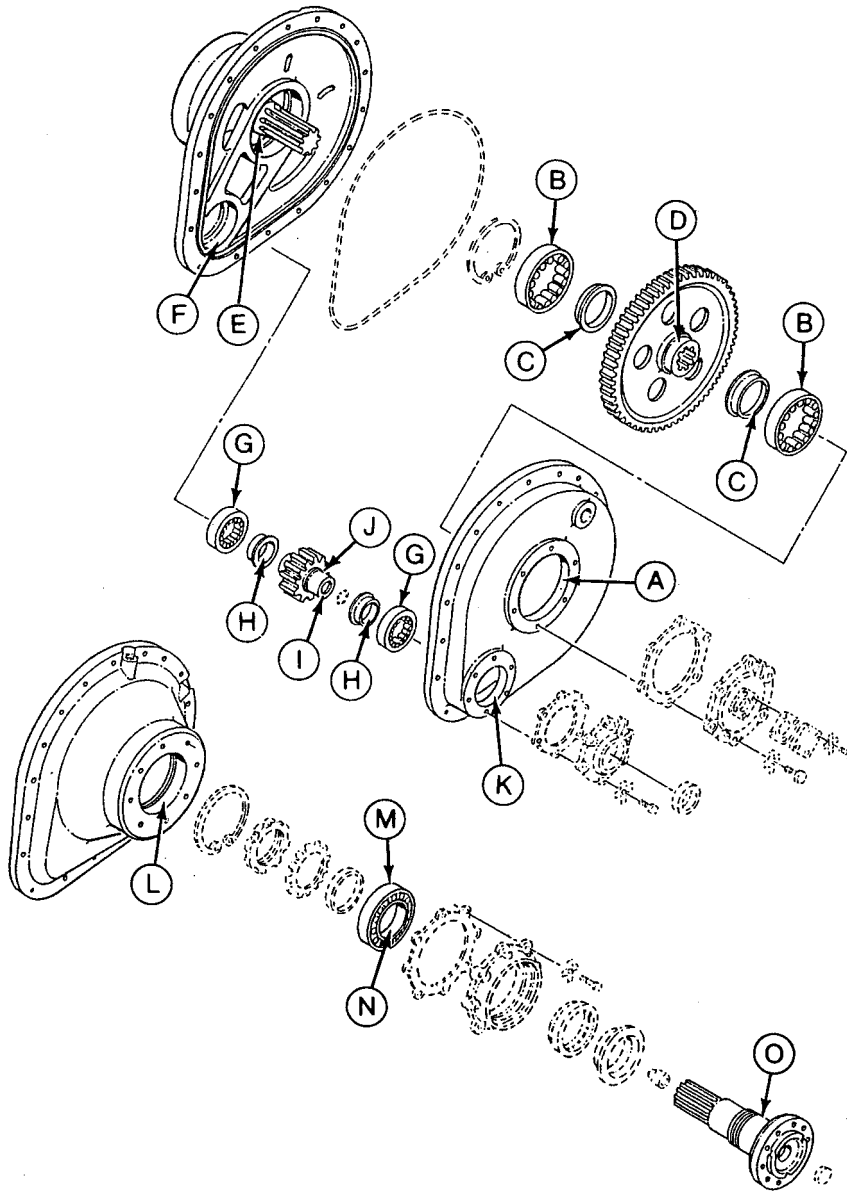


Table 2. FINAL DRIVE A AND B WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Inside diameter of spur gear bearing bore in cover	5.5112 to 5.5128	(***) 5.5132
B	Outside diameter of spur gear bearing	5.5110 to 5.5118	(*)(***)
B-A	Fit of bearing in cover bore	0.0006T to 0.0018L	
C	Inside diameter of spur gear bearing	3.1490 to 3.1496	(*)(***)
D	Outside diameter of spur gear hub bearing surface	3.1504 to 3.1511	(*)(***)
D-C	Fit of bearing to spur gear hub	0.0008T to 0.0021T	
E	Inside diameter of spur gear bearing bore in housing	5.5112 to 5.5128	5.5132
E-B	Fit of bearing in housing bore	0.0006T to 0.0018T	
F	Inside diameter of gear bearing bore in housing	3.9370 to 3.9380	3.9384
G	Outside diameter of gear bearing	3.9364 to 3.9370	(*)(***)
G-F	Fit of bearing in housing bore	0.0000 to 0.0016L	
H	Inside diameter of gear bearing	2.1648 to 2.1654	(*)(***)
I	Outside diameter at gear bearing surface of gear hub	2.1230 to 2.1270	(*)(***)
I-H	Fit of bearing on gear	0.0008T to 0.0021T	
J	Outside diameter at seal surface of gear hub	2.1662 to 2.1670	(**) 2.1210
K	Inside diameter of gear bearing bore in cover	3.9370 to 3.9380	(***) 3.9384
K-G	Fit of bearing in cover bore	0.0000 to 0.0016T	
L	Inside diameter of housing output bearing bore	5.5112 to 5.5128	(***) 5.5132
M	Outside diameter of output bearing	5.5110 to 5.5118	(*)(***)
M-L	Fit of bearing in housing bore	0.0006T to 0.0028L	
N	Inside diameter of output bearing	3.1490 to 3.1496	(*)(***)
O	Outside diameter at output bearing surface of output shaft	3.1504 to 3.1511	(*)(***)
O-N	Fit of bearing on output shaft	0.0008T to 0.0021T	
<p>* Must be within new parts dimensions. ** Measure only if there is visual indication of bearing turning. *** Measure only if there is visual indication of wear or damage.</p>			

END OF TASK

CHAPTER 7

DIRECT/GENERAL SUPPORT MAINTENANCE INSTRUCTIONS
FOR STEERING CONTROL DIFFERENTIAL

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
DIRECT SUPPORT	
REPLACE STRAIGHT ADAPTER AND BRAKE SHOE ASSEMBLIES.....	.0021 00
REPAIR BRAKE SHOE ASSEMBLIES.....	.0022 00
REPLACE OUTPUT SHAFT ASSEMBLIES.....	.0023 00
GENERAL SUPPORT	
REPAIR OUTPUT SHAFT ASSEMBLIES.....	.0024 00
REPLACE DIFFERENTIAL STEERING CONTROL ASSEMBLY.....	.0025 00
REPAIR DIFFERENTIAL STEERING CONTROL ASSEMBLY.....	.0026 00
REPLACE DIFFERENTIAL RIGHT ANGLE GEARBOX.....	.0027 00
REPAIR DIFFERENTIAL RIGHT ANGLE GEARBOX.....	.0028 00
REPAIR STEERING CONTROL DIFFERENTIAL HOUSING.....	.0029 00

REPLACE STRAIGHT ADAPTER AND BRAKE SHOE ASSEMBLIES

0021 00

THIS WORK PACKAGE COVERS:

- Removal (page 0021 00-2).
- Cleaning (page 0021 00-4).
- Installation (page 0021 00-5).

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Torque wrench (WP 0033 00, Item 41)
- Socket wrench set (WP 0033 00, Item 34)

References

- See your -20
- See your PMCS

Materials/Parts

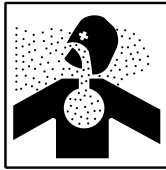
- Antiseize compound (WP 0035 00, Item 1)
- Cleaning compound (WP 0035 00, Item 4)
- Sealing compound (WP 0035 00, Item 15)
- Wiping rags (WP 0035 00, Item 17)
- Gasket
- Gasket
- Key washers (4)
- Key washers (13)
- Self-locking nut (3)

Equipment Condition

Steering control differential removed from carrier (see your -20)

REMOVAL

WARNING

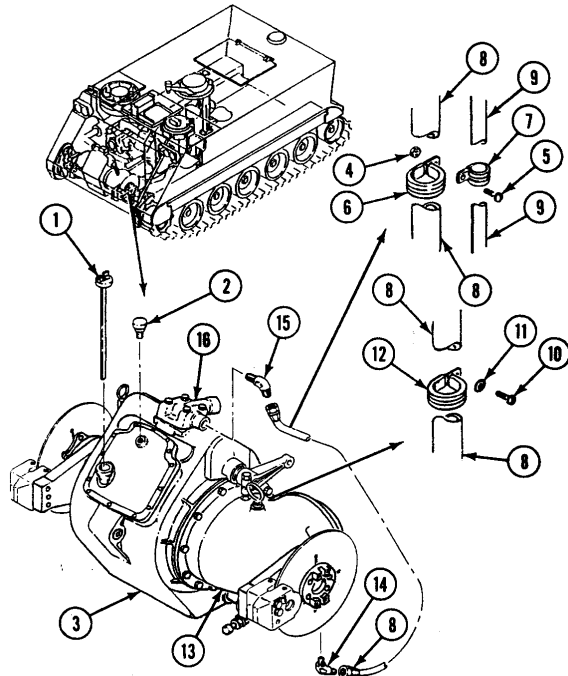


Parts of the brake assembly may be coated with asbestos dust. Breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

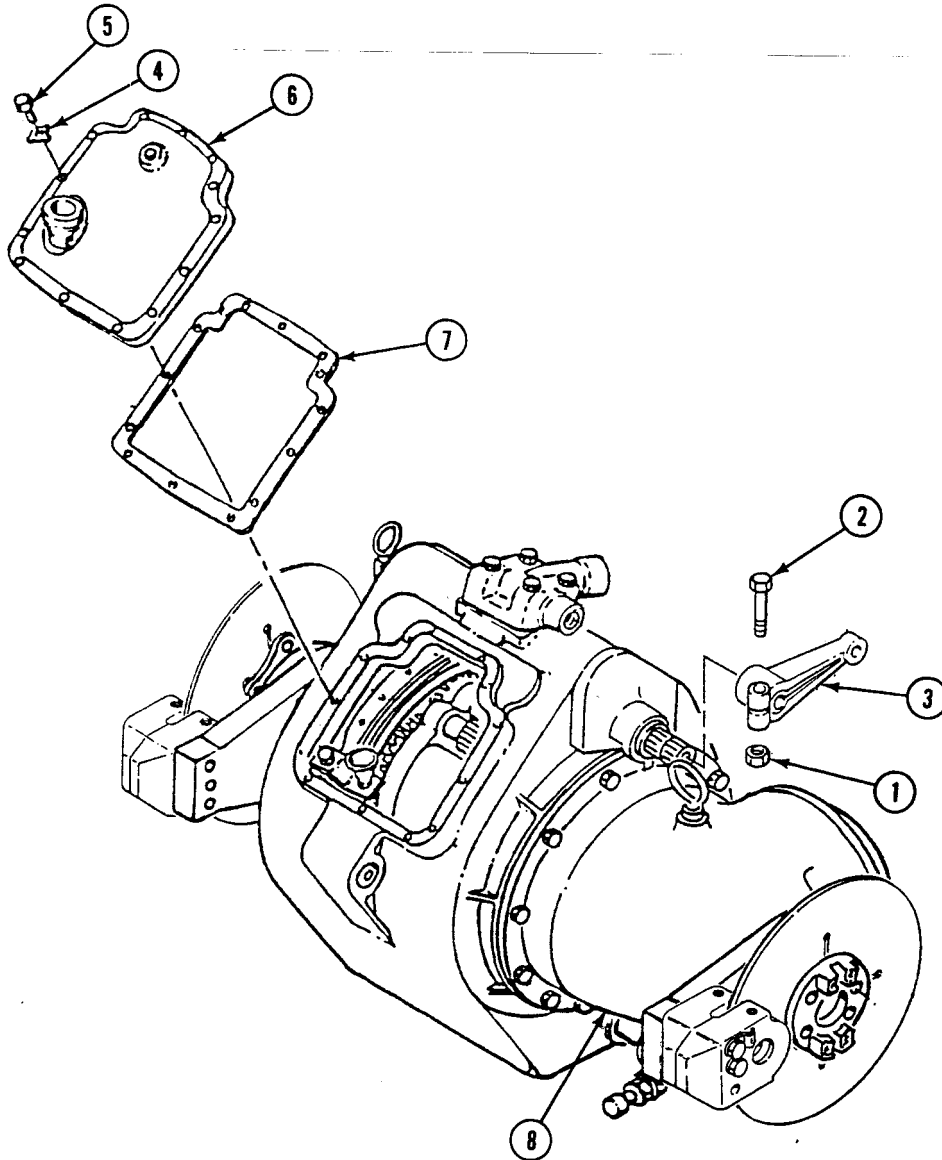
CAUTION

Take care during handling and disassembly to protect machined surfaces, gears, bearings, and components from damage. Provide safe blockage arrangement.

1. Drain differential oil into suitable container (see your PMCS).
2. Remove dipstick (1) and breather (2) from differential (3).
3. Remove locknut (4), screw (5), clamp (6), and clamp (7). Separate differential oil hose (8) from circuit 328 lead (9). Discard locknut.
4. Remove screw (10), washer (11), clamp (12) and oil hose (8) from differential gearbox (13).
5. Disconnect oil hose (8) from elbow (14) and elbow (15).
6. Remove elbow (15) from adapter (16).
7. Remove elbow (14) from differential gearbox (13).



8. Remove two locknuts (1), screws (2), and two brake levers (3) from differential brake lever shafts. Discard locknuts.
9. Straighten tabs on 13 key washers (4). Remove 13 cap screws (5), key washers, housing cover (6) and gasket (7) from differential gearbox (8). Discard key washers and gasket.

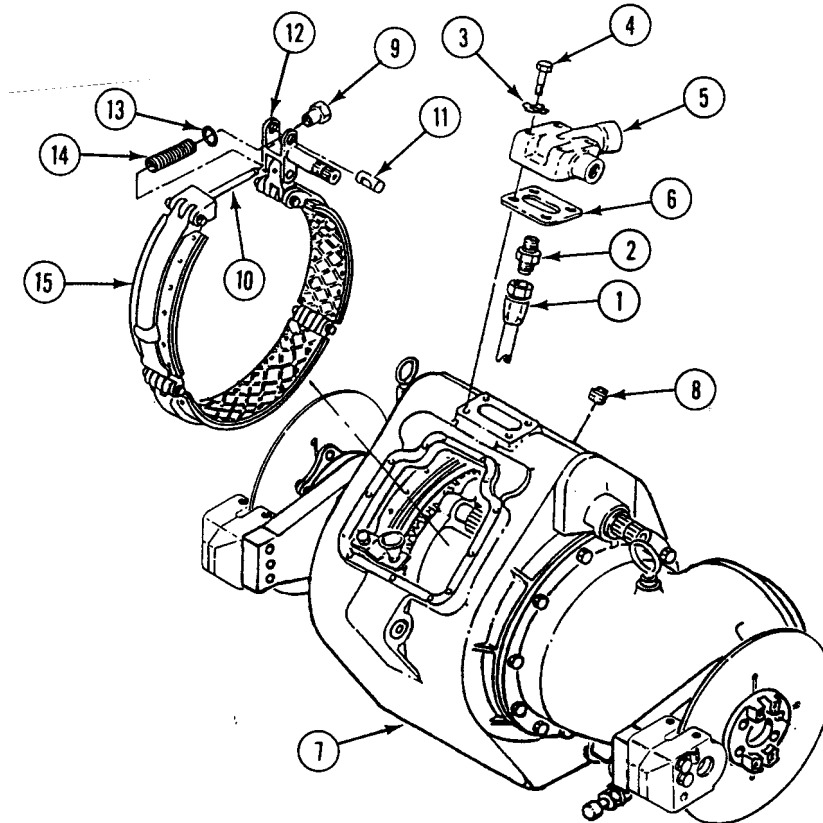


10. Disconnect two nonmetallic hoses (1) from straight adapters (2).
11. Straighten tabs on four key washers (3). Remove four cap screws (4), key washers, adapter (5), and gasket (6) from differential housing (7). Discard key washers and gasket.
12. Remove two adapters (2) from adapter (5).
13. Remove brake access plug (8) from differential housing (7).

NOTE

Procedures are the same for left and right brake shoe assemblies.

14. Remove brake shoe assemblies as follows. Remove steering brake adjusting nut (9) securing rod end and clevis (10) to pin (11) in steering brake shaft (12). Remove pin (11) from brake shaft (12). Separate washer (13) and helical spring (14) from clevis (10). Remove brake shoe assembly (15) from differential housing (7). Install helical spring (14) and washer (13) on clevis (10). Install pin (11) in brake shaft (12). Install clevis (10) in pin (11). Secure clevis (10) with adjusting nut (9) until repair of brake shoe assembly is complete. Use socket wrench set.



CLEANING

CLEAN, INSPECT, AND REPLACE

1. Refer to (WP 0014 00) for inspection before and after disassembly and for cleaning during maintenance and after disassembly. Visually inspect gears, brake linings, hoses, and linkages for excessive wear and damage during disassembly.

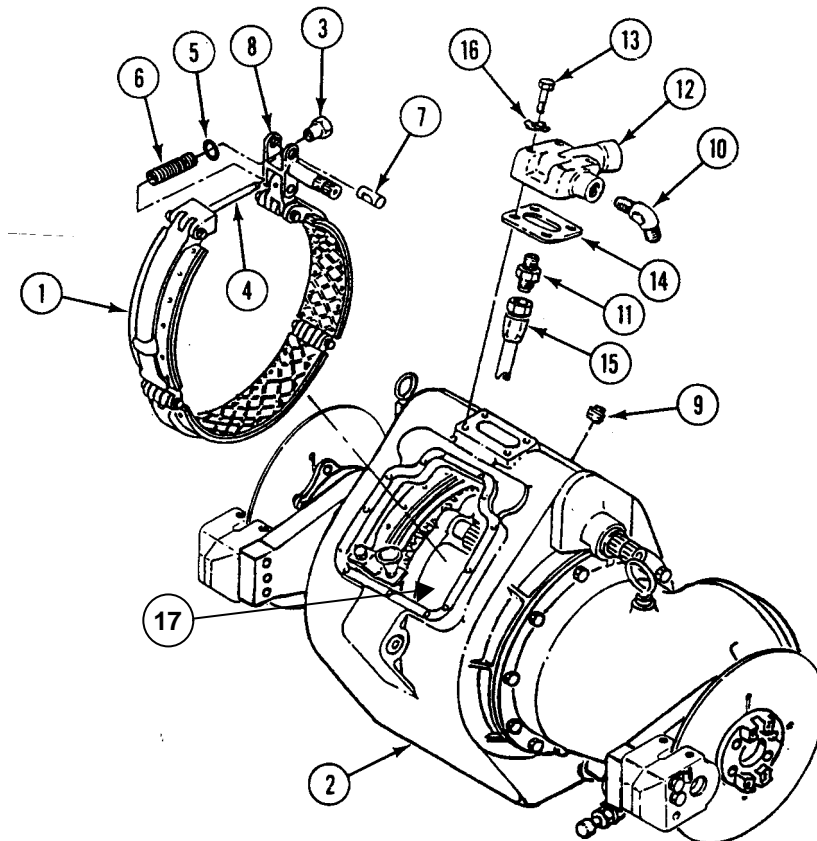
INSTALLATION

NOTE

Procedures are the same for left and right brake shoe assemblies.

Make sure hose and elbow are positioned properly on brake shoe when it is installed in differential housing.

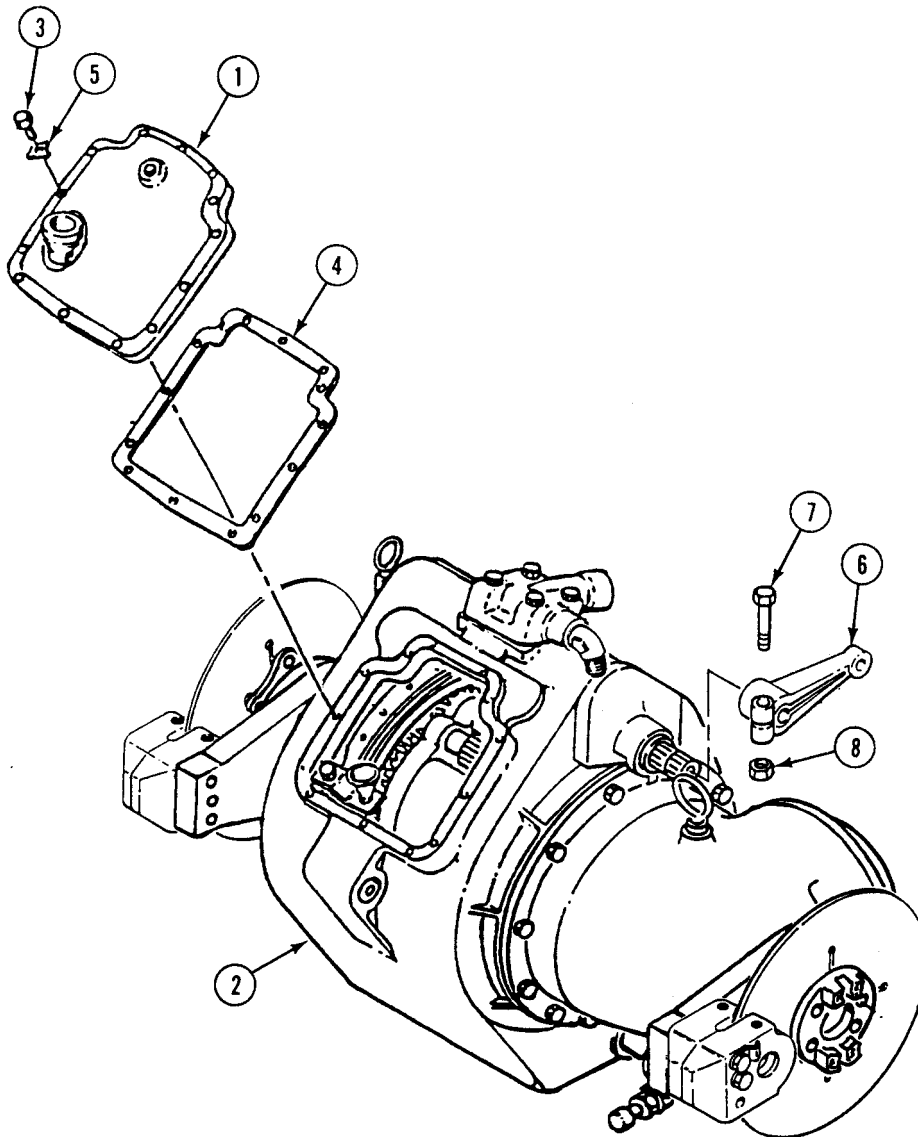
1. Install two brake shoe assemblies (1) in differential housing (2). Remove steering brake adjusting nut (3), rod end clevis (4), washer (5), and helical spring (6) from brake shoe assembly. Position brake shoe assembly (1) around brake drum (17), and install pin (7) through steering brake shaft (8). Install spring and washer over clevis. Insert clevis through pin and secure with adjusting nut (3). Repeat steps above for other brake shoe assembly.
2. Install brake access plug (9) in differential housing (2) as follows. Apply a light coat of antiseize compound to clean threads of plugs. Install plugs in housing.
3. Install pipe to tube elbow (10) and two adapters (11) in adapter (12). Clean male tapered pipe threads thoroughly. Apply sealing compound to small end of pipe threads. Do not fill leading thread. Install elbow at a 30° angle from the horizontal toward base of adapter.
4. Install adapter (12) on differential housing (2). Clean threads of cap screws (13) thoroughly. Apply a light coat of antiseize compound to threads at installation. Place new gasket (14) on housing. Connect two nonmetallic hoses (15) to adapters. Place adapter on housing (2). Secure with four new key washers (16) and screws (13). Tighten screws to 252-300 lb-in (29-34 N•m) torque. Use torque wrench and socket set. Bend tabs on key washers.



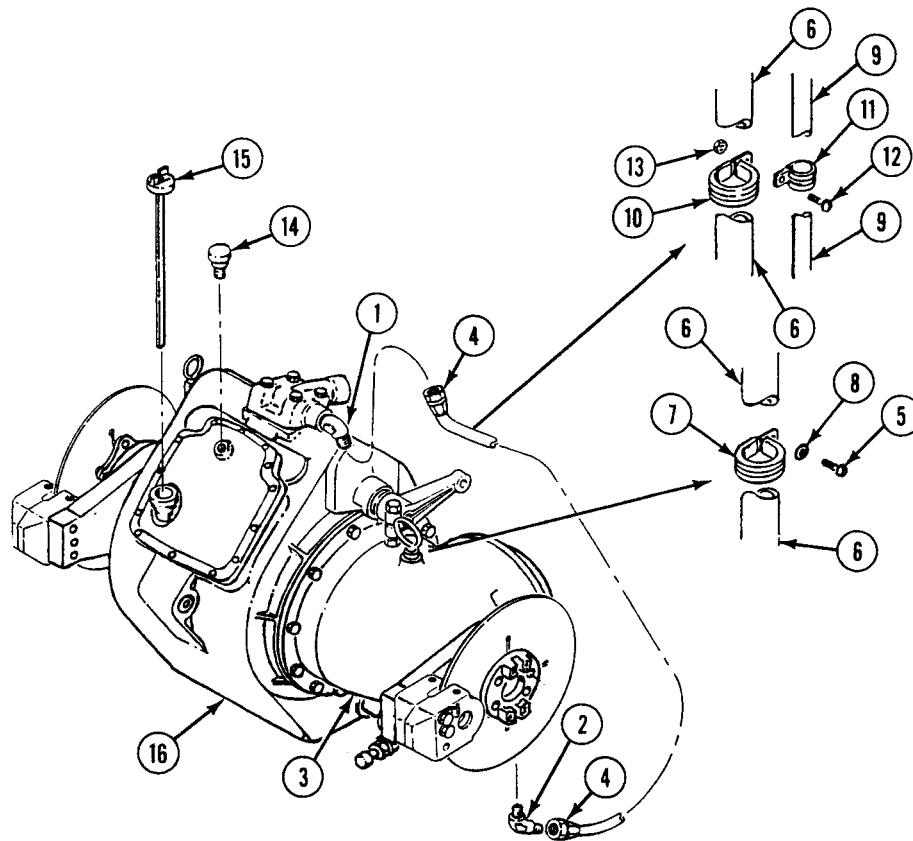
REPLACE STRAIGHT ADAPTER AND BRAKE SHOE ASSEMBLIES — Continued

0021 00

5. Install housing cover (1) on differential housing (2) as follows. Apply a light coat of antiseize compound to clean threads of 13 cap screws (3). Place new gasket (4) and housing cover on housing. Secure with 13 new key washers (5) and cap screws. Tighten screws to 252-300 lb-in (29-34 N•m) torque. Use torque wrench and socket set. Bend tabs on key washers.
6. Install two levers (6) on differential brake shafts. Secure with two screws (7) and new locknuts (8).
7. Tighten locknuts (8) to 360-420 lb-in (41-47 N•m) torque. Use torque wrench.



8. Apply a thin even coat of sealing compound to cleaned external threads of elbow (1) and elbow (2).
9. Install elbow (2) in differential gearbox (3).
10. Connect differential oil hose (4) to elbow (1) and elbow (2).
11. Apply antiseize compound to external threads of screw (5).
12. Install oil hose (6) on differential gear box (3) with clamp (7) and washer (8). Secure with screw (5). Tighten screw (5) to 252-300 lb-in (28-34 N•m) torque. Use torque wrench.
13. Install circuit 328 lead (9) and oil hose (6) together with clamp (10), clamp (11), and secure with screw (12) and new locknut (13).
14. Fill differential oil (see your PMCS).
15. Install breather (14) and dipstick (15) on differential (16).



END OF TASK

REPAIR BRAKE SHOE ASSEMBLIES

0022 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0022 00-2).
- Cleaning (page 0022 00-4).
- Assembly (page 0022 00-5).
- Wear Limits (page 0022 00-8).

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Brake and clutch reliner (WP 0033 00, Item 19)
- Portable electric drill, 1/2 inch (WP 0033 00, Item 4)
- Twist drill set (WP 0033 00, Item 6)
- Vernier height gage (WP 0033 00, Item 8)

References

TM 9-214

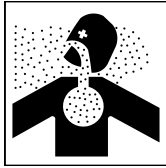
Equipment Condition

Brake shoe assembly removed (WP 0021 00)

Materials/Parts

- Cleaning compound (WP 0035 00, Item 4)
 - Sealing compound (WP 0035 00, Item 14)
 - Cotter pin (2)
 - Cotter pin (6)
 - Rivet
 - Straight pin (3)
 - Straight pin
-

DISASSEMBLY

WARNING

Parts of the brake assembly may be coated with asbestos dust. Breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

CAUTION

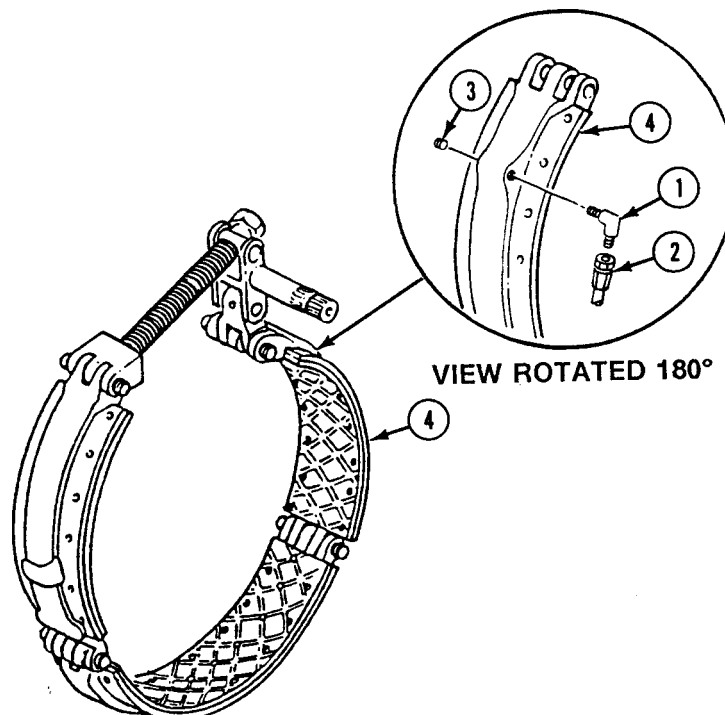
Take care during handling and disassembly to protect machined surfaces, gears, bearings, and components from damage. Provide safe blockage arrangement and place differential into subassemblies.

NOTE

All brake shoe assemblies are disassembled the same way.

Remember position of pipe to tube elbow (1) for proper installation later.

1. Remove hose (2), pipe to tube elbow (1), and pipe plug (3) from brake shoe (4).

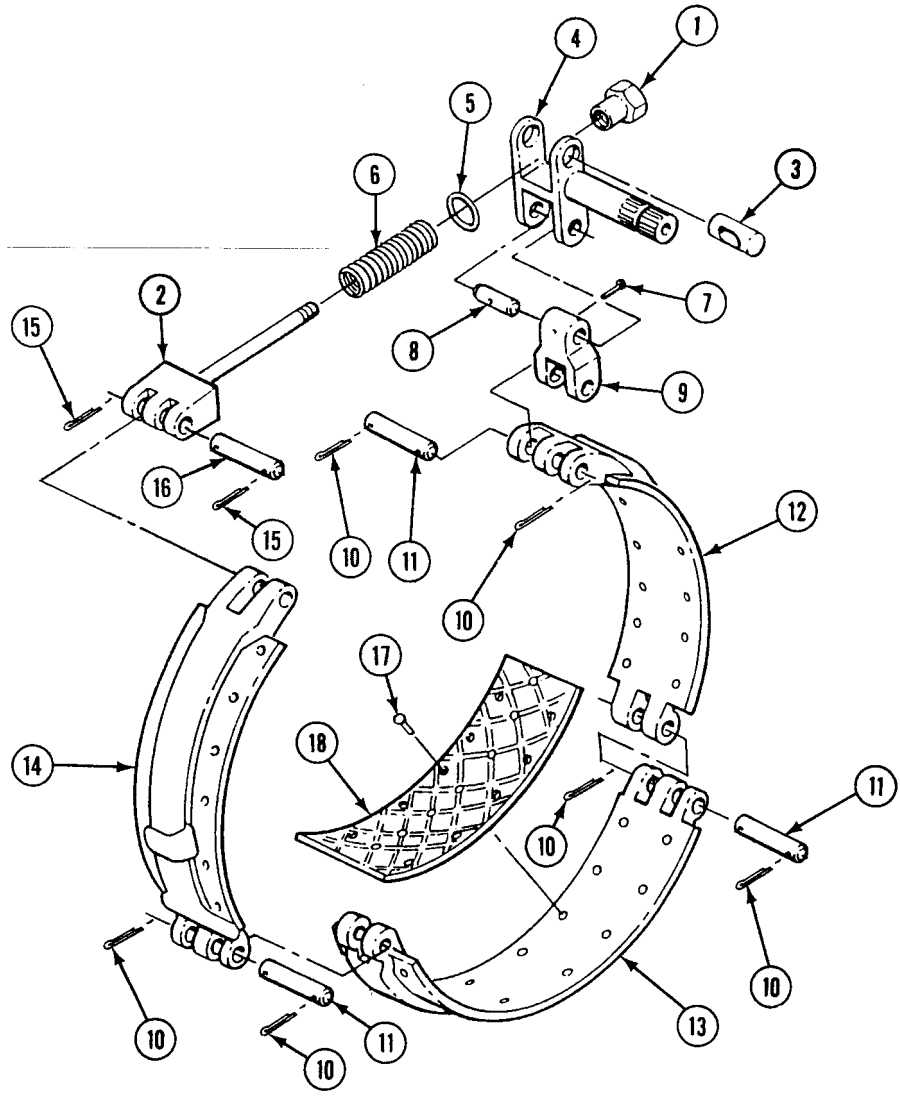


2. Remove steering brake adjusting nut (1) from rod end clevis (2). Remove clevis and pin (3) from steering brake shaft (4). Remove washer (5) and helical spring (6) from clevis (2).
3. Remove solid rivet (7) and pin (8) holding steering brake shaft (4) to link (9). Separate pin and brake shaft from link. Discard rivet.
4. Remove six cotter pins (10) and three straight headless pins (11). Separate brake shoe (12), brake shoe (13), and brake shoe (14). Discard cotter pins and straight pins.
5. Remove two cotter pins (15) and straight headless pin (16). Separate rod end clevis (2) from shoe (14). Discard cotter pins and straight pin.

NOTE

If inspection indicates brake friction linings must be replaced, do (page 0022 00-8).

6. Remove 12 tubular rivets (17) from each friction lining (18) on brake shoe (12), brake shoe (13), and brake shoe (14). Discard friction linings and rivets. Use drill and twist drill set.



CLEANING**CLEAN, INSPECT, AND REPAIR**

1. Before inspection, repair, or assembly, clean all parts of each output shaft assembly as described in (WP 0014 00).
2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures. Check wear limits and clearances of parts (page 0022 00-8). Repair or replace defective parts.
3. Measure springs for free (no tension or compression) length of 3-3/8 to 3-5/8 inches (8.6 to 9.2 cm). Replace any springs not within these dimensions.

ASSEMBLY

NOTE

All brake shoe assemblies are assembled the same way.

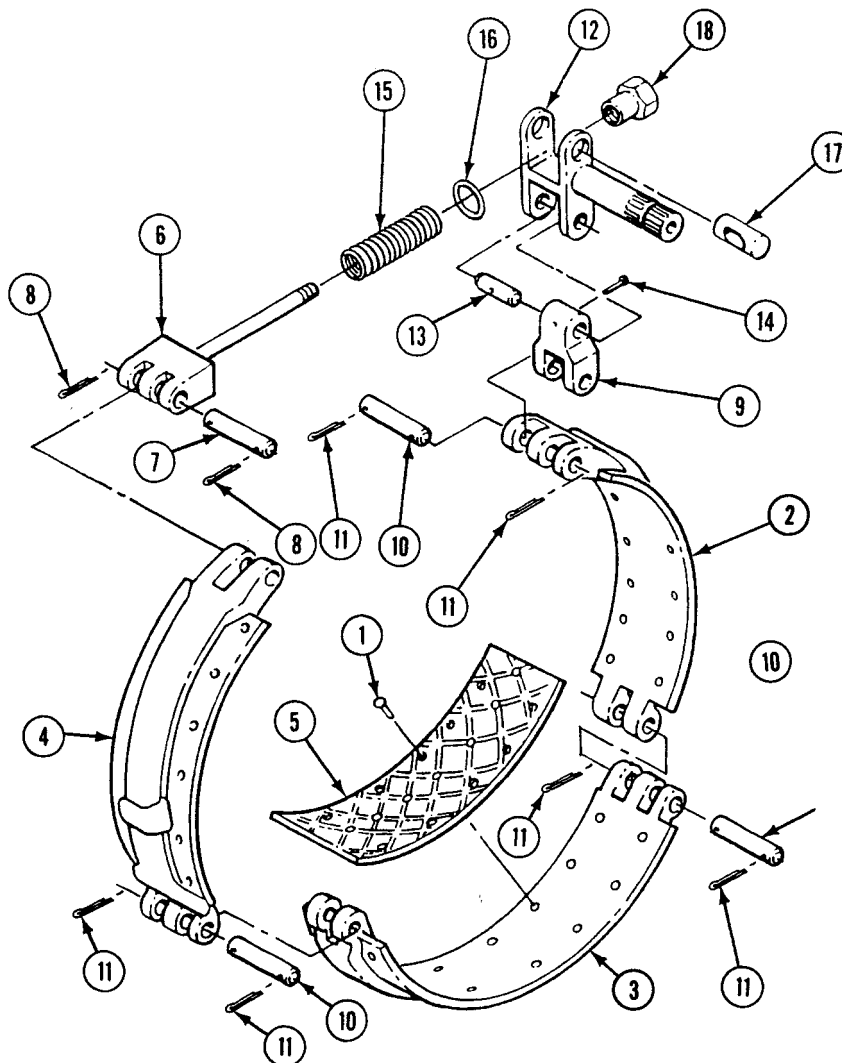
If brake friction linings were removed in (page 0022 00-2), do Step 3.

Friction linings must be riveted tightly against the shoe so that a 0.020 inch (0.51 mm) shim cannot be inserted beyond the lengthwise centerline of rivets.

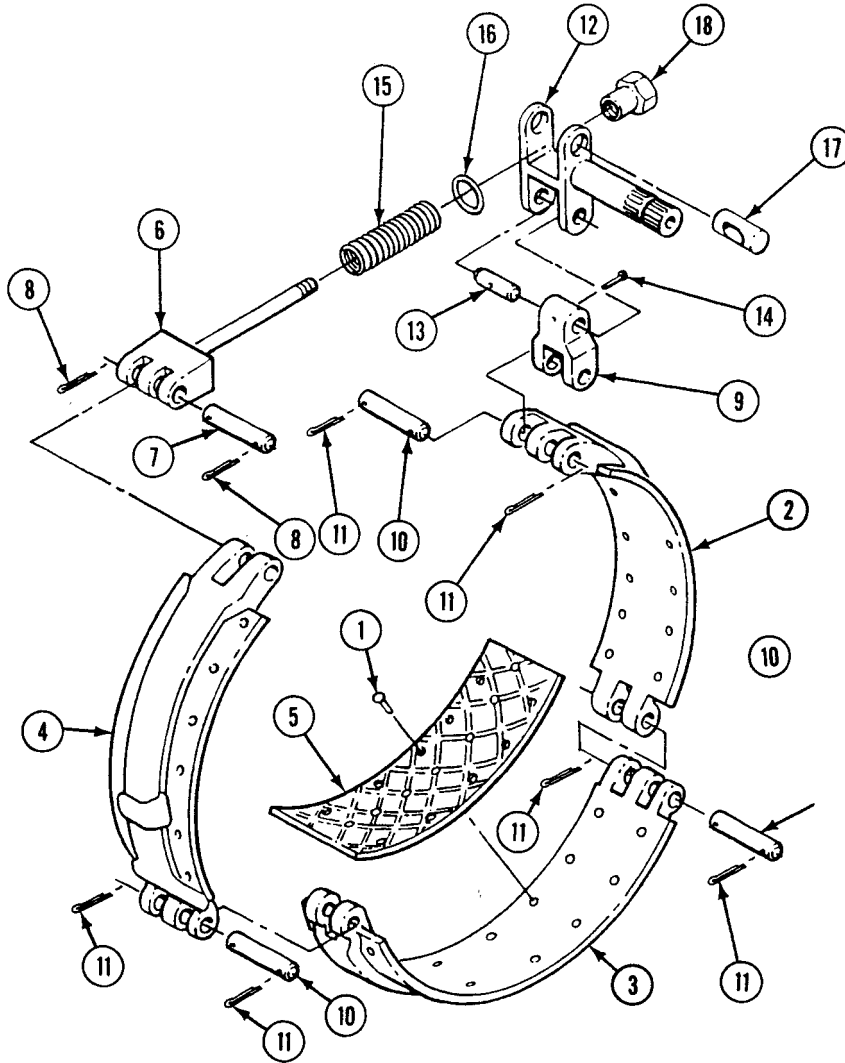
Check the color code (stripes) on the side of all three friction linings. All three brake linings must have the same number and color of stripes when installed. Do not mix different types of brake linings.

Install a complete new set of three linings each time any lining is changed.

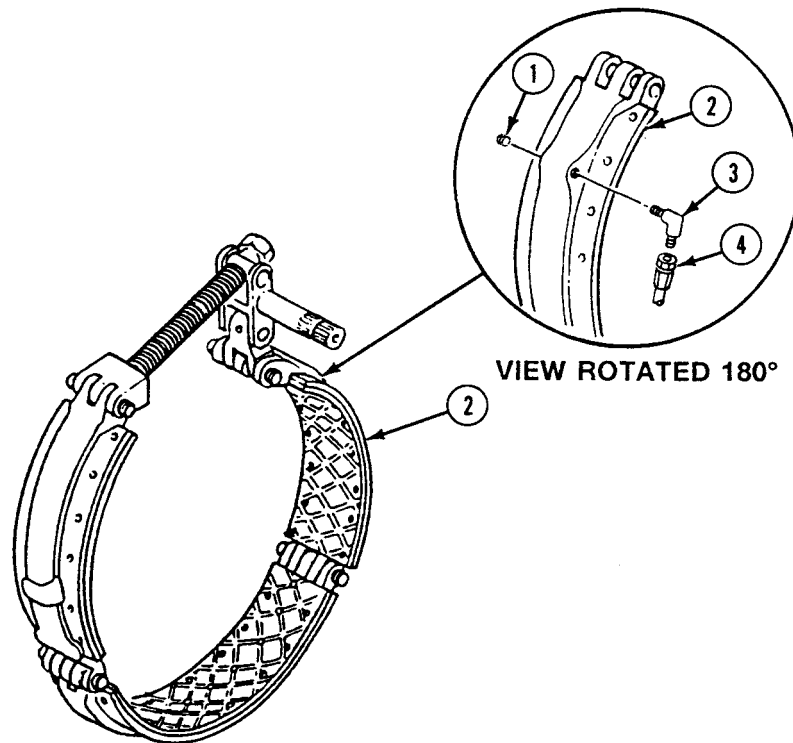
1. Place three new friction linings (1) on shoe (2), shoe (3), and shoe (4). Secure each lining to its respective shoe with 12 new tubular rivets (5). Use brake and clutch reliner.



2. Install brake shoe (4) on rod and clevis (6) with new straight headless pin (7). Secure with two new cotter pins (8). Use brake and clutch reliner.
3. Interlock brake shoe (2), brake shoe (3), brake shoe (4), rod and clevis (6), and link (9). Secure with three new straight headless pins (10) and six new cotter pins (11).
4. Place brake shaft (12) on link (9). Secure with pin (13) and new solid rivet (14).
5. Assemble helical spring (15), washer (16), and pin (17) on rod and clevis (6). Secure to steering brake shaft (12) with steering brake adjusting nut (18).

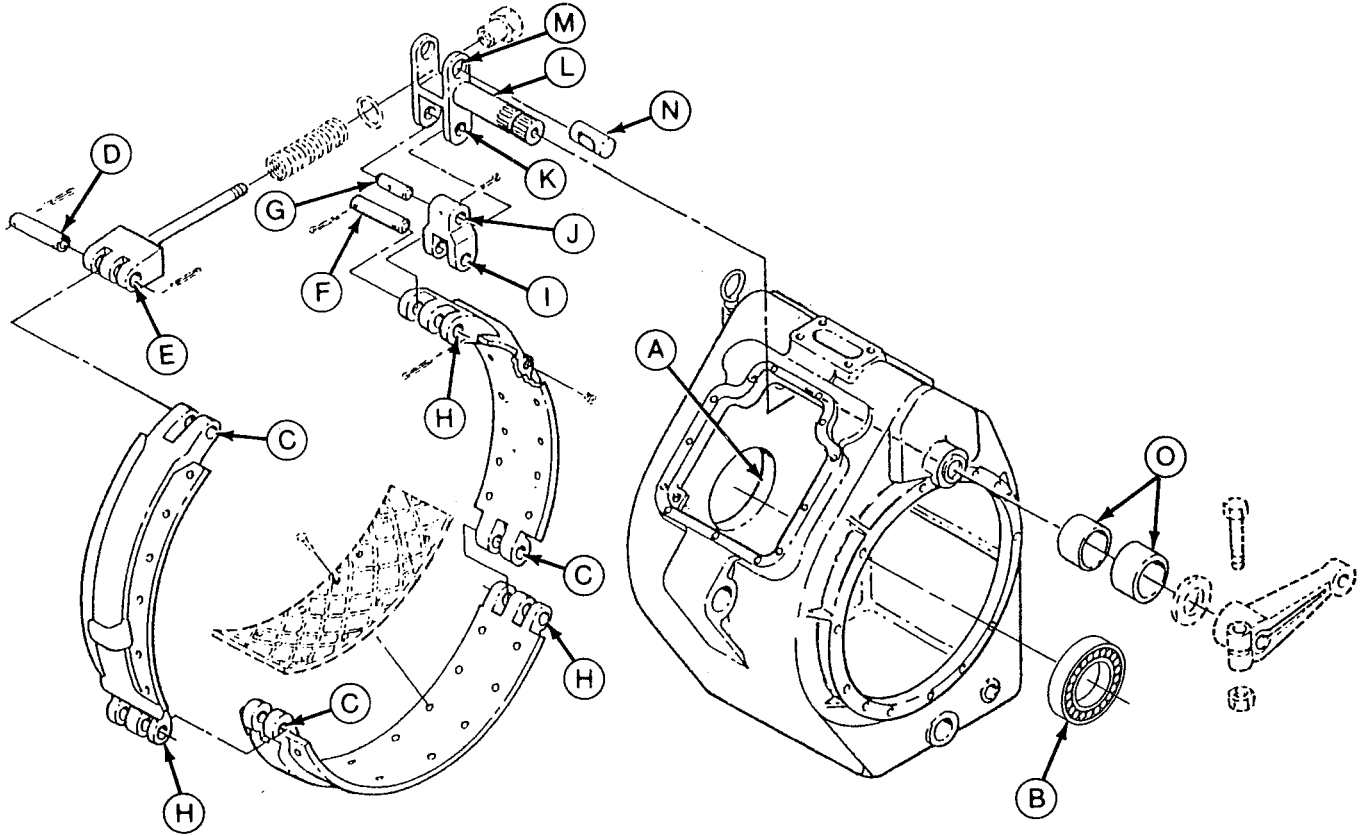


6. Clean male tapered pipe threads thoroughly with cleaning compound.
7. Apply sealing compound to small end of pipe threads. Do not apply sealant beyond small end of pipe threads. Do not fill leading thread.
8. Install pipe plug (1) on brake shoe (2).
9. Install pipe to tube elbow (3) and hose (4) on brake shoe (2).



WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figure.



3. Check the parts dimensions with chart below to determine replacement.

Table 1. BRAKE SHOE ASSEMBLIES WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Inside diameter of hole in shoe	0.5120 to 0.5200	0.5300
B	Outside diameter of pin	0.4980 to 0.5000	0.4930
B-A	Fit of pin in shoe	0.0120L to 0.0220L	0.0370L
C	Inside diameter of hole in clevis	0.5120 to 0.5200	0.5300
C-B	Fit of pin to clevis	0.0120L to 0.0220L	0.0370L
D	Outside diameter of pin	0.4980 to 0.5000	0.4930
E	Outside diameter of pin	0.6240 to 0.6250	0.6190
F	Inside diameter of bore hole in shoe	0.5120 to 0.5200	0.5300
F-D	Fit of pin in shoe	0.0120L to 0.0220L	0.0370L
G	Inside diameter of hole in link	0.5130 to 0.5190	0.5290
G-D	Fit in pin in link	0.0130L to 0.0210L	0.0360L
H	Inside diameter of hole in link	0.6260 to 0.6270	0.6370
H-E	Fit of pin in link	0.0010L to 0.0030L	0.0180L
I	Inside diameter of hole in brake shaft	0.6270 to 0.6280	0.6380
I-E	Fit of pin in brake shaft	0.0020L to 0.0040L	0.0190L
J	Outside diameter at bearing surface of shaft	1.2505 to 1.2480	1.2480
K	Inside diameter of hole in brake shaft	1.0630 to 1.0650	1.0750
L	Outside diameter of pin	1.0570 to 1.0590	1.0520
L-K	Fit of pin in shaft	0.0040L to 0.0080L	0.0230L
M	Inside diameter of needle bearing	1.2505 to 1.2500	(*)
M-J	Fit of bearings on shaft	0.0005L to 0.0005T	0.0020L

* Must be within new parts dimensions.

END OF TASK

REPLACE OUTPUT SHAFT ASSEMBLIES

0023 00

THIS WORK PACKAGE COVERS:

- Removal (page 0023 00-2).
- Cleaning (page 0023 00-3)
- Installation (page 0023 00-4).

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Torque wrench (WP 0033 00, Item 42)

References

See your -20

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Sealing compound (WP 0035 00, Item 12)
- Gasket
- Key washer (12)
- Locknut (4)
- Shim

Equipment Condition

- Steering control differential removed from carrier (see your -20)
 - Pivot steer brakes removed (see your -20)
-

REMOVAL

WARNING

Parts of the brake assembly may be coated with asbestos dust. Breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

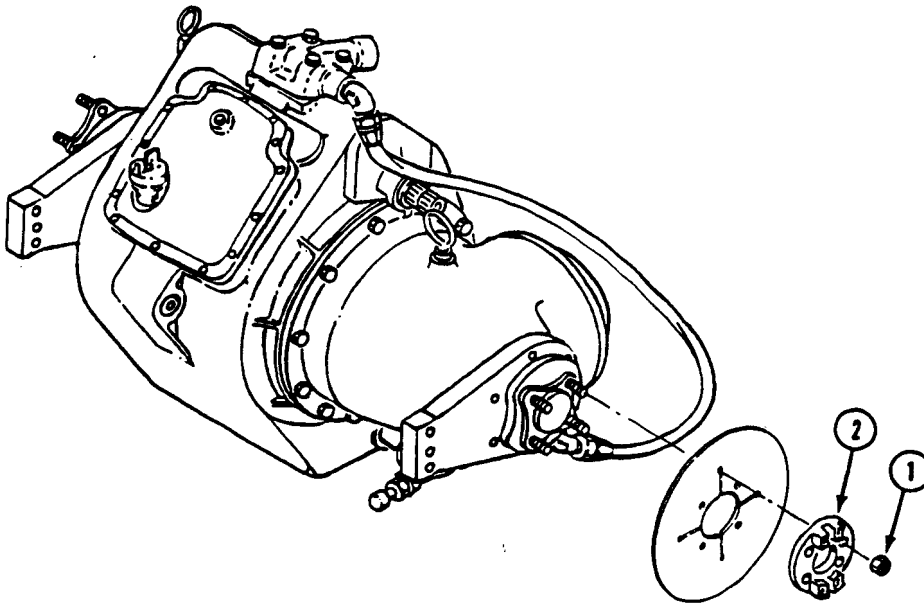
CAUTION

Use care in handling and disassembly to protect machined surfaces and bearings. Provide safe blockage arrangement at work station and place output shaft assemblies in convenient position for disassembly.

NOTE

Left and right brake adapter are removed and installed in the same manner.

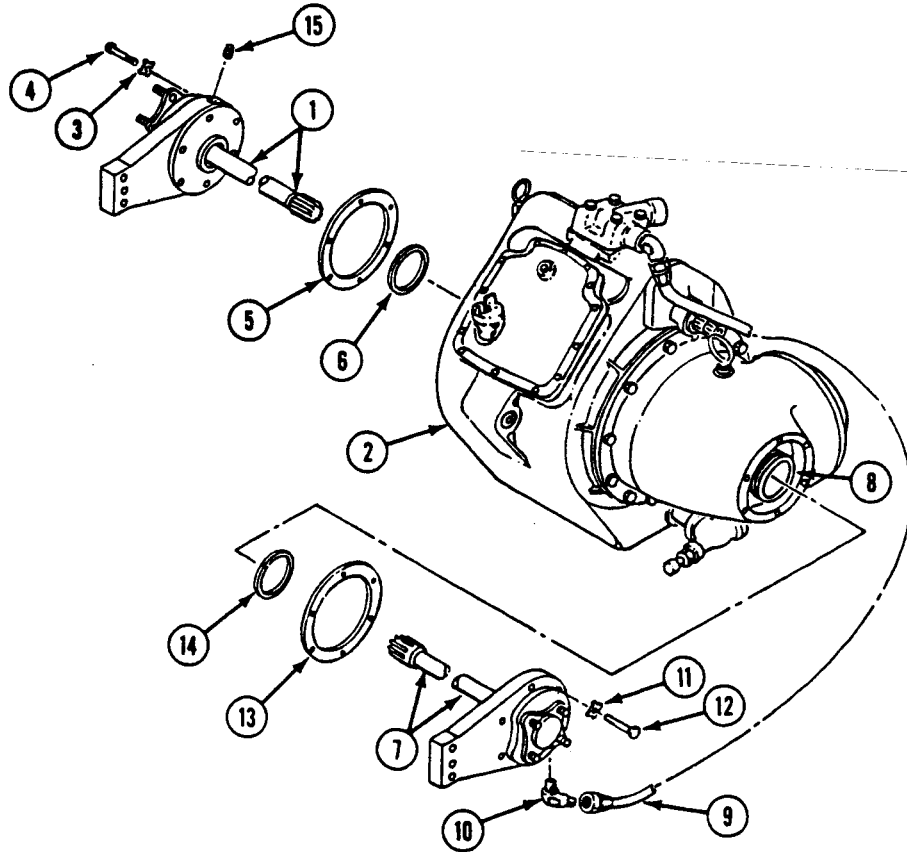
1. Remove four locknuts (1) and adapter (2) from differential output shaft. Discard locknuts.



REPLACE OUTPUT SHAFT ASSEMBLIES — Continued

0023 00

2. Remove right output shaft assembly (1) from differential (2) as follows. Straighten tabs on six key washers (3) . Remove six cap screws (4) , key washers (3) , right output shaft (1) , and laminated shim (5) from differential (2) . Discard key washers (3) and shim (5) . Remove piston ring (6) from steering unit assembly in differential (2) .
3. Remove left output shaft (7) from right angle gearbox (8) as follows. Detach nonmetallic hose (9) from pipe to tube elbow (10) . Straighten tabs on six key washers (11) . Remove six cap screws (12) , key washers (11) , left output shaft (7) , and gasket (13) from right angle gearbox (8) . Discard key washers (11) and gasket (13) . Remove piston ring (14) from left output shaft (7) .
4. Remove pipe to tube elbow (10) from left output shaft assembly (7) .
5. Remove pipe plug (15) from right output shaft (1) .



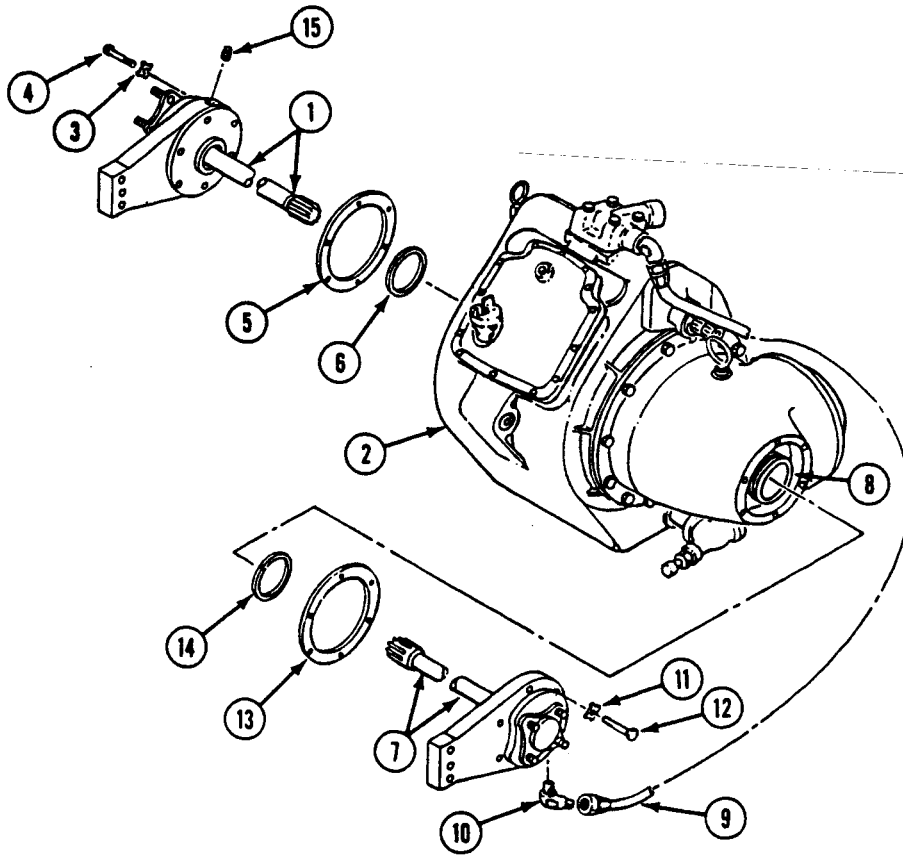
CLEANING

CLEAN, INSPECT, AND REPLACE

1. Clean all parts and check for cracks, wear, and damage. Replace if needed.

INSTALLATION

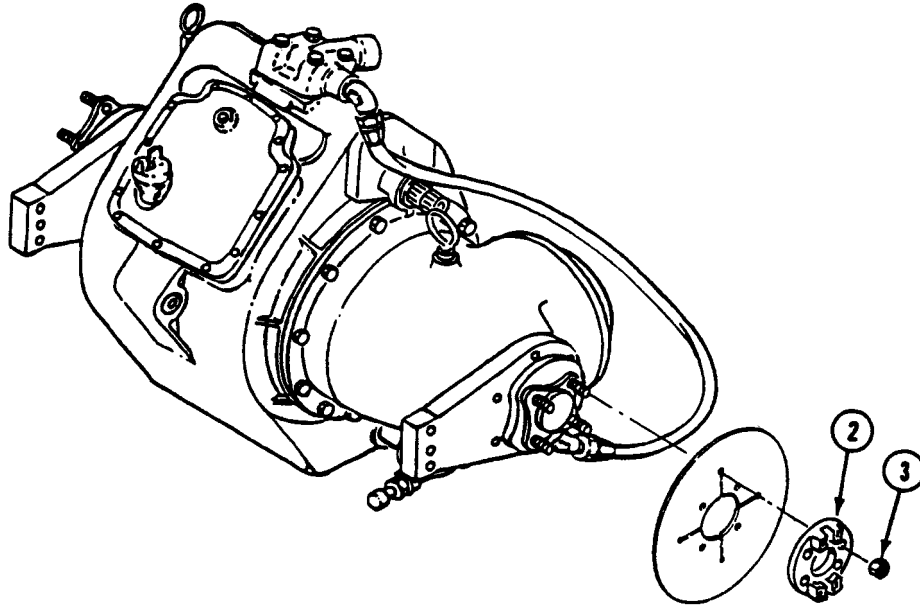
1. Install pipe to tube elbow (10) in left output shaft assembly (7) . Clean threads of elbow thoroughly. Apply a light coat of sealing compound to threads at installation.
2. Install left output shaft assembly (7) on right angle gearbox differential (2) . Apply a light coat of antiseize compound to clean threads of six cap screws (12) . Install piston ring (14) on output shaft of right angle gearbox. Install new gasket (13) and left output shaft assembly (7) on right angle gearbox with six new key washers (11) and cap screws (12) . Tighten screws to 55-60 lb-ft (75-81 N•m) torque. Use torque wrench. Bend tabs on key washers.
3. Install pipe plug (15) in right output shaft assembly (1) . Apply a light coat of antiseize compound to clean threads of plug. Install plug in right output shaft.
4. Install right output shaft assembly (1) on differential (2) . Apply a light coat of antiseize compound to clean threads of six cap screws (4) . Install piston ring (6) on output shaft of differential. Install new laminated shim (5) and right output shaft assembly (1) on differential with six new key washers (3) and cap screws (4) . Tighten screws to 55-60 lb-ft (75-81 N•m) torque. Use torque wrench. Bend tabs on key washers.



REPLACE OUTPUT SHAFT ASSEMBLIES — Continued

0023 00

5. Install adapter (2) on differential output shaft. Secure with four new locknuts (3). Tighten nuts to 75-80 lb-ft (102-108 N•m) torque. Use torque wrench.

**END OF TASK**

REPAIR OUTPUT SHAFT ASSEMBLIES

0024 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0024 00-6).
- Cleaning (page 0024 00-6).
- Assembly (page 0024 00-7).
- Wear Limits (page 0024 00-13).

INITIAL SETUP:

Maintenance Level

General Support

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Arbor press (WP 0033 00, Item 16)
- Drill portable, electric (WP 0033 00, Item 4)
- Drill set twist (WP 0033 00, Item 5)
- Remover/Replacer (WP 0033 00, Item 20)
- Remover/Replacer (WP 0033 00, Item 24)
- Socket wrench set, 3/8 inch drive (WP 0033 00, Item 34)
- Torque wrench (WP 0033 00, Item 41)
- Vernier height gage (WP 0033 00, Item 8)

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Cleaning compound (WP 0035 00, Item 4)
- Sealing compound (WP 0035 00, Item 12)
- Gasket
- Key washer (4)
- Key washer
- Oil seal
- Piston ring

Personnel Required

- Track Vehicle Repairer

Equipment Condition

- Output shafts removed from differential (WP 0023 00)
-

DISASSEMBLY

CAUTION

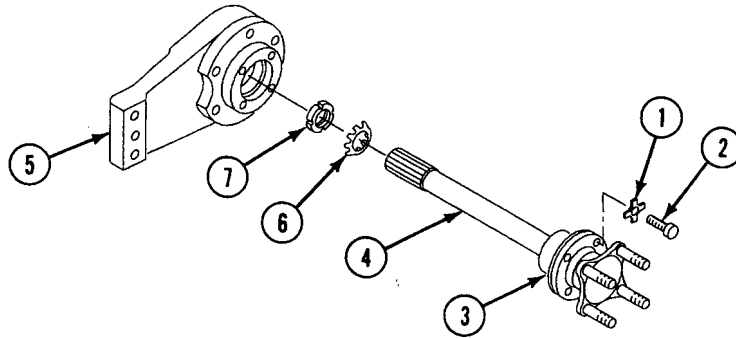
Use care in handling and disassembly to protect machined surfaces and bearings from damage. Provide safe blockage arrangement at work station and place output shaft assemblies in convenient position for disassembly.

NOTE

The right output shaft assembly contains a short output shaft, and its housing support has a pipe plug. The left output shaft assembly contains a long output shaft, and its housing support has a pipe to tube elbow.

Steps 1 - 7 apply to left output shaft assembly.

1. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers, and oil seal retainer (3) with output shaft (4) from output shaft support (5). Discard key washers.
2. Straighten tabs on key washer (6). Remove round retaining nut (7) and key washer from output shaft (4). Discard key washer.

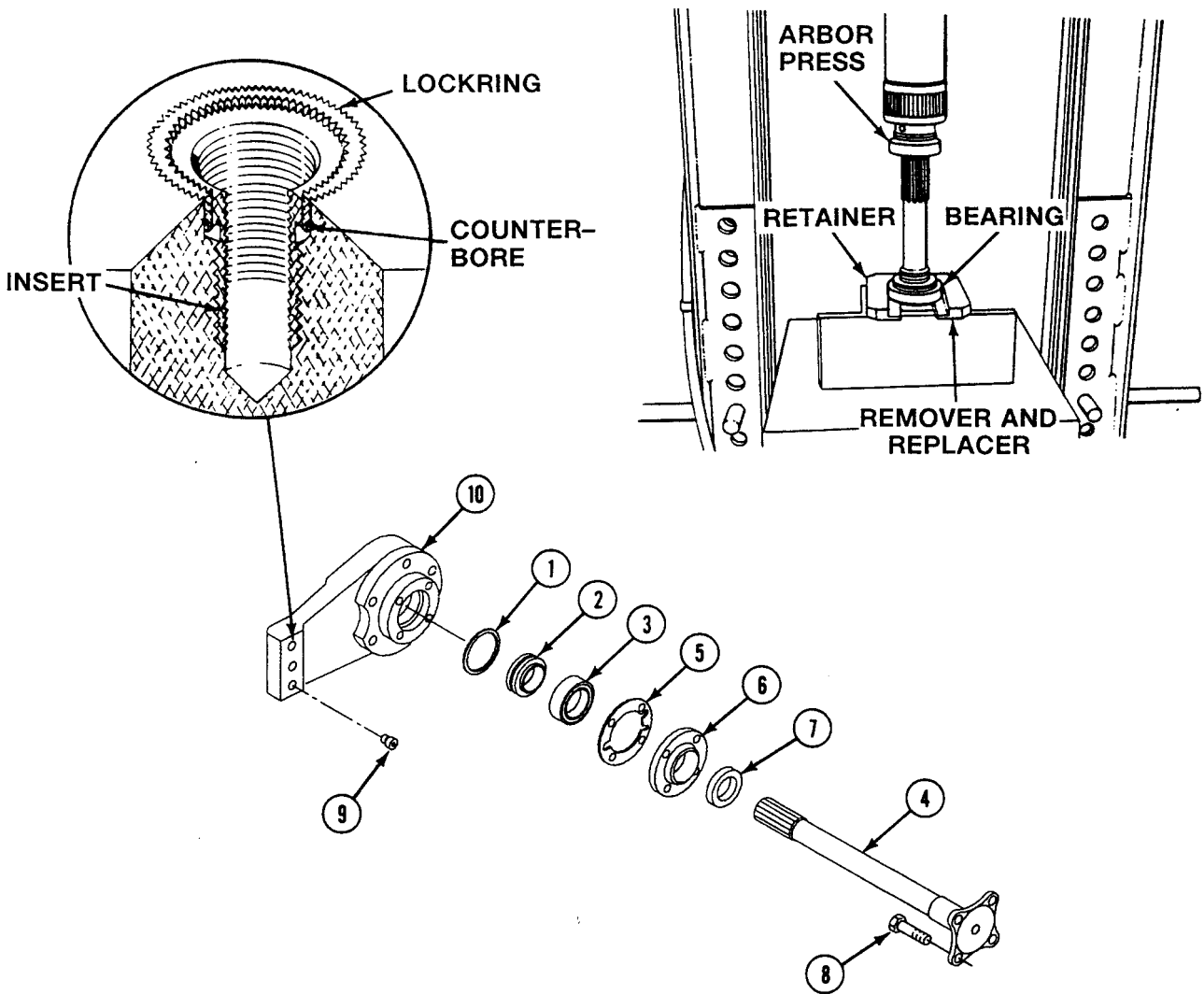


3. Remove piston ring (1), piston ring retainer (2), and ball bearing (3) from output shaft (4). Use remover and replacer (WP 0033 00, Item 20) and arbor press. Remove piston ring (1) from retainer (2). Discard piston ring.
4. Remove gasket (5) and oil seal retainer (6) with encased oil seal (7) from output shaft (4). Discard gasket.
5. Tap out oil seal (7) from retainer (6) with hammer. Discard oil seal.

NOTE

If inspection indicates shoulder bolt(s) is damaged, do Step 6.

6. Remove shoulder bolt(s) (8) from output shaft (4). Use arbor press.

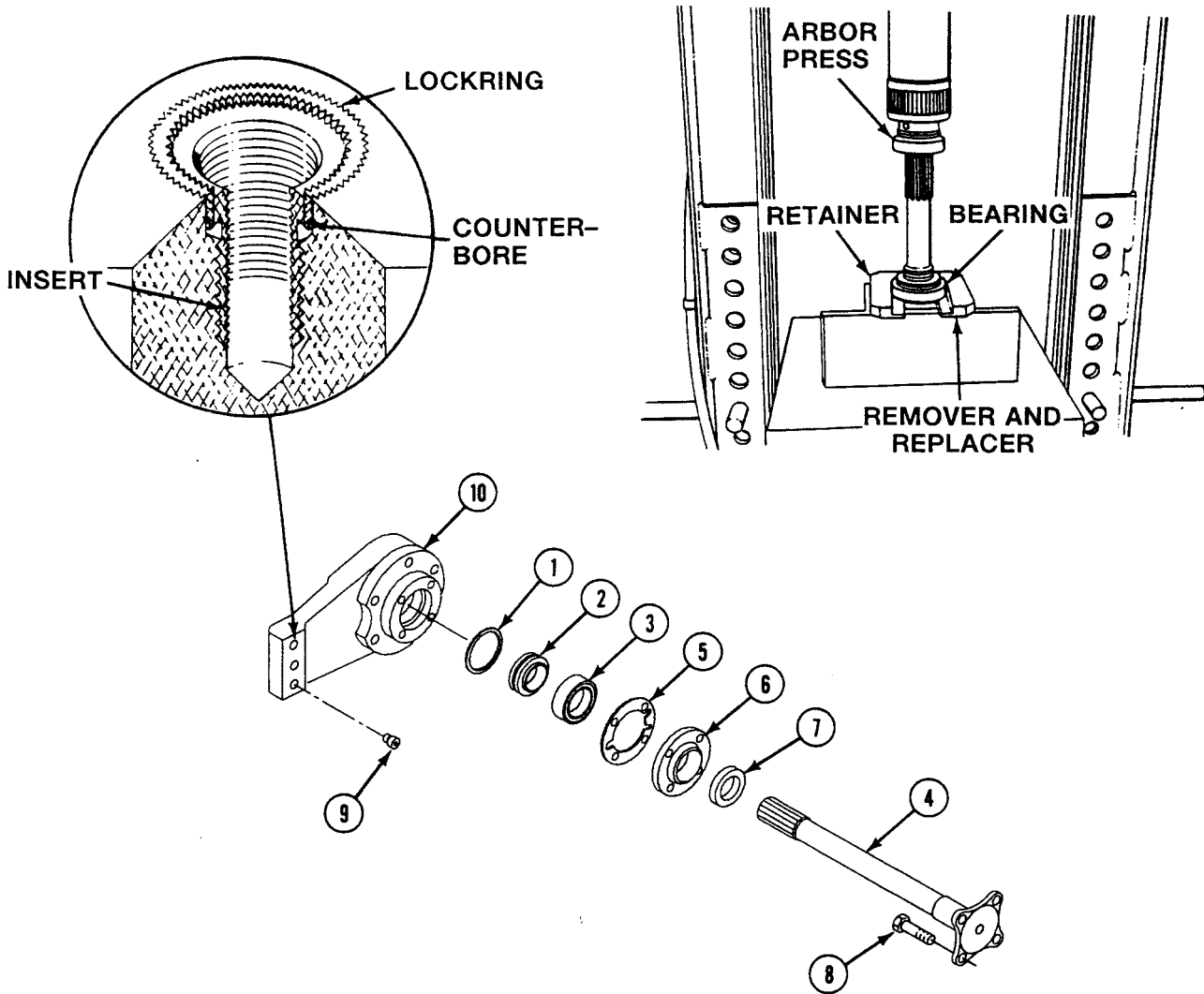


NOTE

If inspection indicates serrated locking screw thread insert is damaged, do Step 7.

Inserts for both left and right output shaft assemblies are removed the same way.

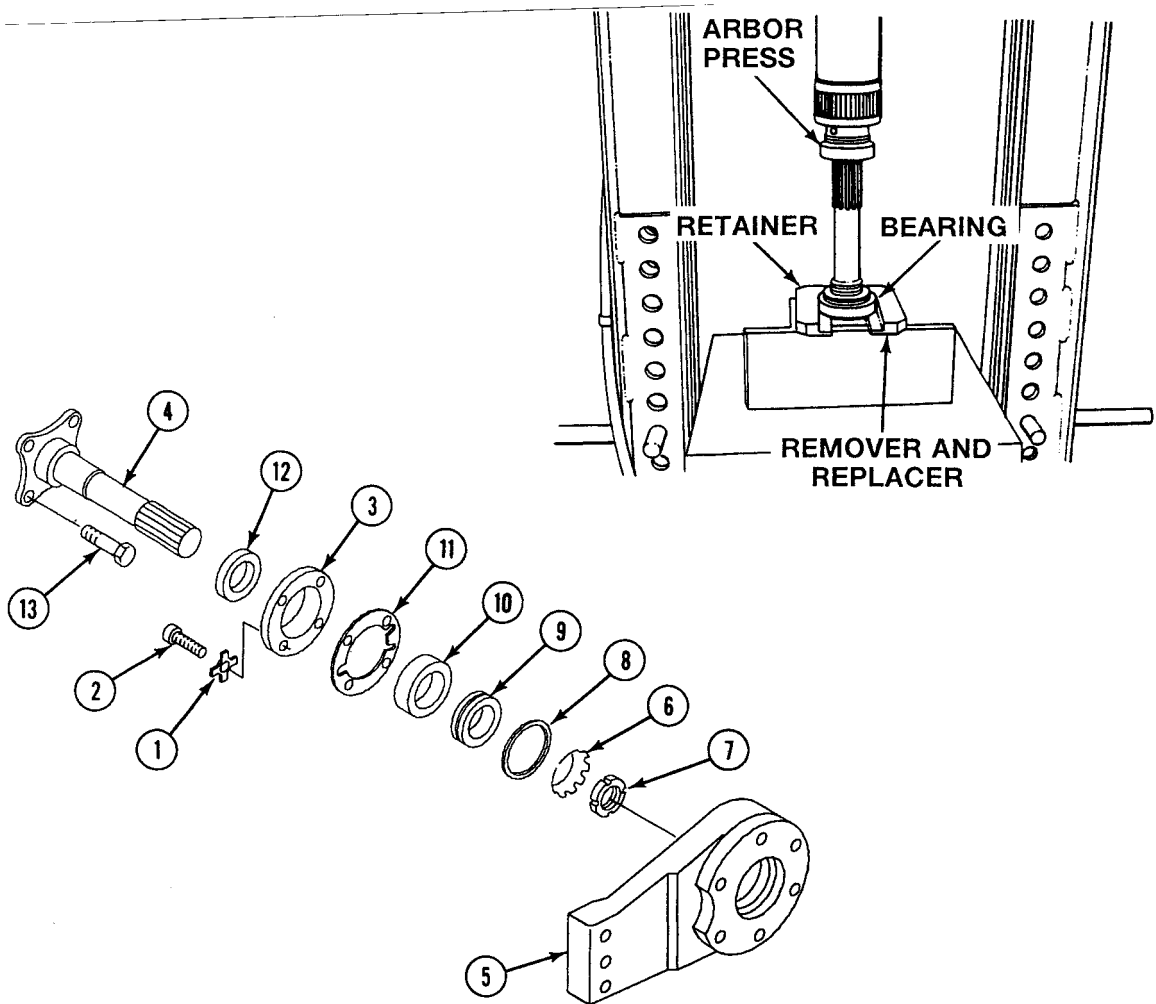
7. Select drill with same diameter as inside serrations of insert (9) and drill to depth of counterbore in output shaft support (10). Drill at high speed. Drive in extractor tool and back out insert, turning to the left. As insert comes out, it will push serrated locking out. If locking fails to come out as insert is removed, collapse locking with punch and hammer. Remove locking from output shaft support (10).



NOTE

Steps 8 - 13 apply to right output shaft assembly.

8. Straighten tabs on four key washers (1). Remove four cap screws (2), key washers, and oil seal retainer (3) with output shaft (4) from output shaft support (5). Discard key washers.
9. Straighten tabs on key washer (6). Remove round retaining nut (7) and key washer from output shaft (4). Discard key washer.
10. Remove piston ring (8), piston ring retainer (9), and ball bearing (10) from output shaft (4). Use remover and replacer (WP 0033 00, Item 20) and arbor press. Remove piston ring (8) from retainer (9). Discard piston ring.



11. Remove gasket (11) and oil seal retainer (3) with encased oil seal (12) from output shaft (4). Discard gasket.
12. Tap out oil seal (12) from retainer (3) with hammer. Discard oil seal.

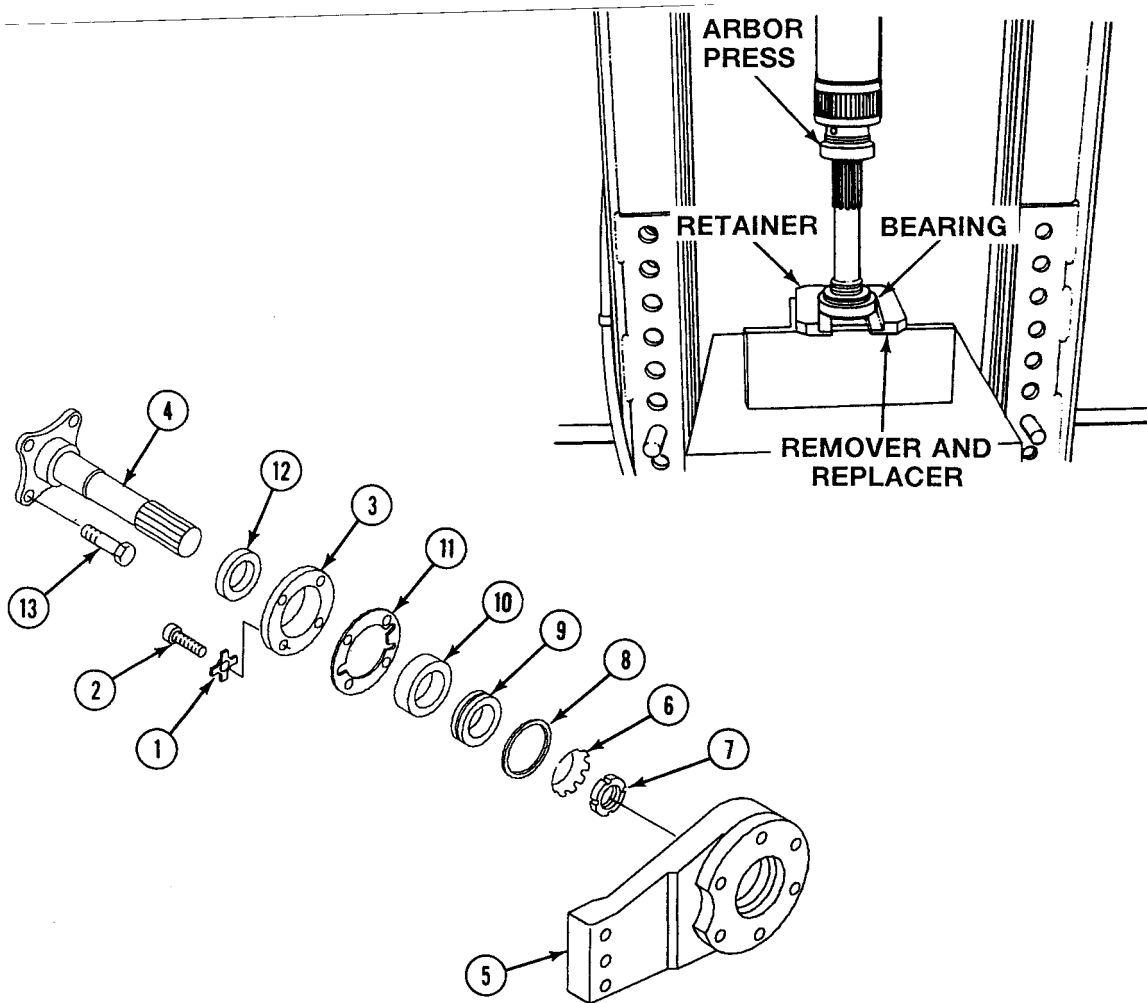
NOTE

If inspection indicates shoulder bolt(s) is damaged, do Step 13.

NOTE

If inspection indicates serrated lockring screw thread insert is damaged, do Step 7.

13. Remove bolt(s) (13) from base of output shaft (4). Use arbor press.



CLEANING

CLEAN, INSPECT, AND REPAIR

1. Before inspection, repair, or assembly, clean all parts of each output shaft assembly as described in (WP 0014 00).
2. Inspect all parts using general procedures described in (WP 0014 00). Check wear limits for minimum, maximum, and important clearances of new or rebuilt parts (page 0023 00-13).

3. Inspect the bore and machine groove in the piston ring retainer for wearing and deformation. Replace defective retainer.
4. Inspect screw thread inserts in output shaft supports for damaged threads and loose fit. Replace inserts that are loose or have damaged threads.

ASSEMBLY

NOTE

Steps 1 - 13 apply to right output shaft assembly.

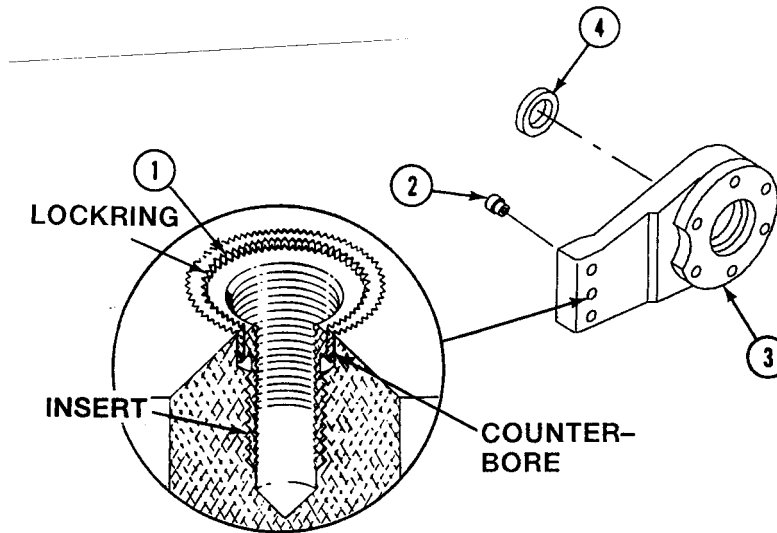
If serrated locking screw thread insert in output shaft support was removed in page 0024 00-2, do Steps 1 - 3.

1. Remove lockring (1) from insert (2).
2. Install insert (2) into tapped hole of output shaft support (3) by turning insert to the right.

CAUTION

Do not drive lockring below top surface of insert. Insert threads may loosen.

3. Drive lockring (1) into tapped hole in output shaft support (3) until inserter tool touches surface. Lockring will be set at proper depth.
4. Thoroughly clean mating surface of new encased oil seal (4) with cleaning compound.
5. Apply a thin film of sealing compound to outer edge of oil seal (4).



CAUTION

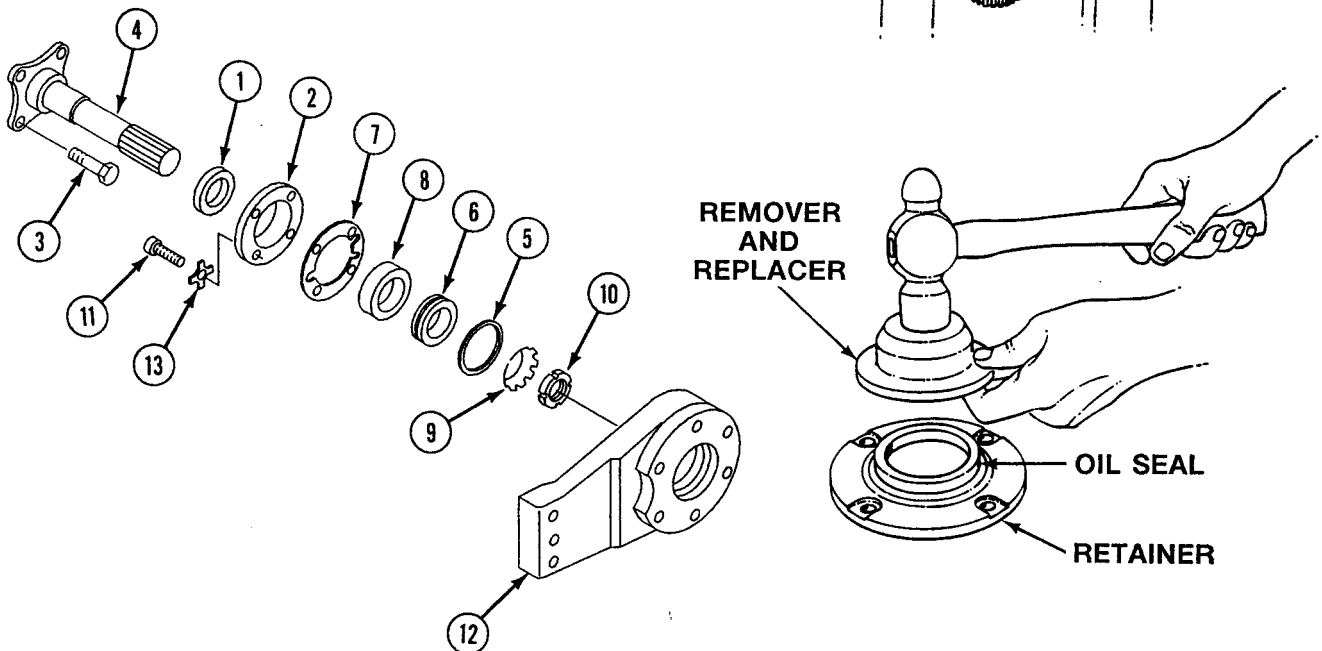
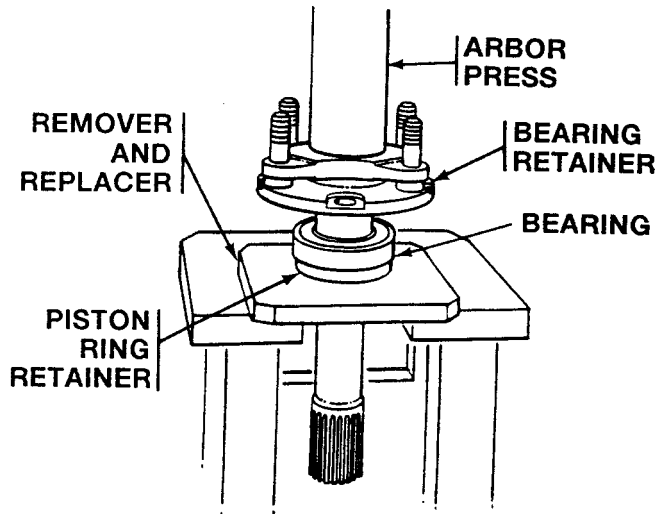
To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation, seal must be flush with outer surface.

6. Install oil seal (1) in oil seal retainer (2). Use remover and replacer (WP 0033 00, Item 24) and hammer.

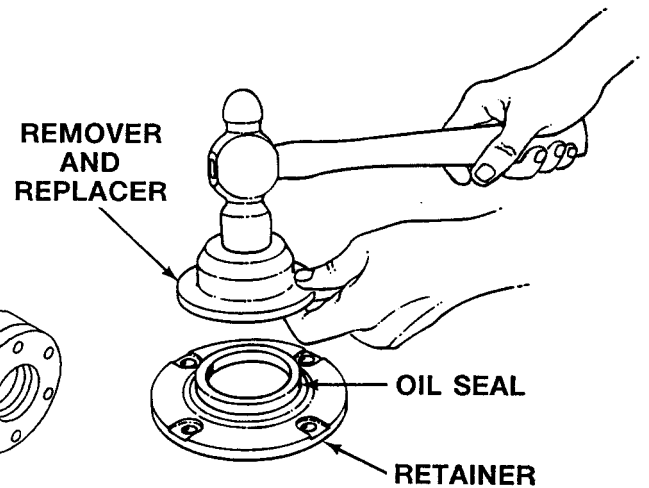
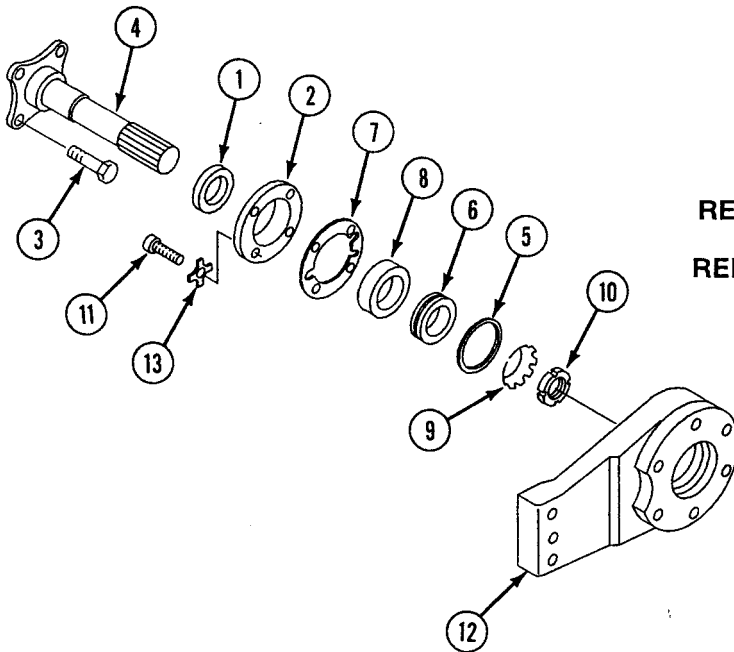
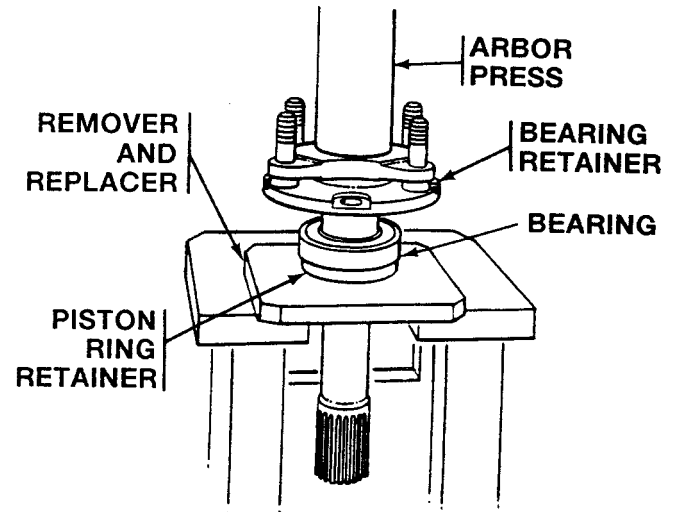
NOTE

If shoulder bolt(s) was removed in page 0024 00-2, do Step 7.

7. Install new bolt(s) (3) in base of shaft (4) with flat side of bolts toward shoulder. Use arbor press.
8. Install new piston ring (5) on piston ring retainer (6).
9. Install oil seal retainer (2) with oil seal (1) installed, new gasket (7), ball bearing (8), and retainer (6) with piston ring (5) on shaft (4). Use remover and replacer (WP 0033 00, Item 20) and arbor press.



10. Install new key washer (9) and retaining nut (10) on shaft (4). Tighten nut. Bend tabs on key washer (9) over nut.
11. Thoroughly clean threads of four cap screws (11).
12. Apply light coat of antiseize compound to threads of cap screws (11).
13. Install retainer (6) with attached parts on output shaft support (12) with four new key washers (13) and cap screws (11). Tighten screws to 252-300 lb-in (28.5-33.9 N•m) torque. Use torque wrench and socket wrench set. Bend tabs on key washers.



NOTE

Steps 14 - 23 apply to left output shaft assembly.

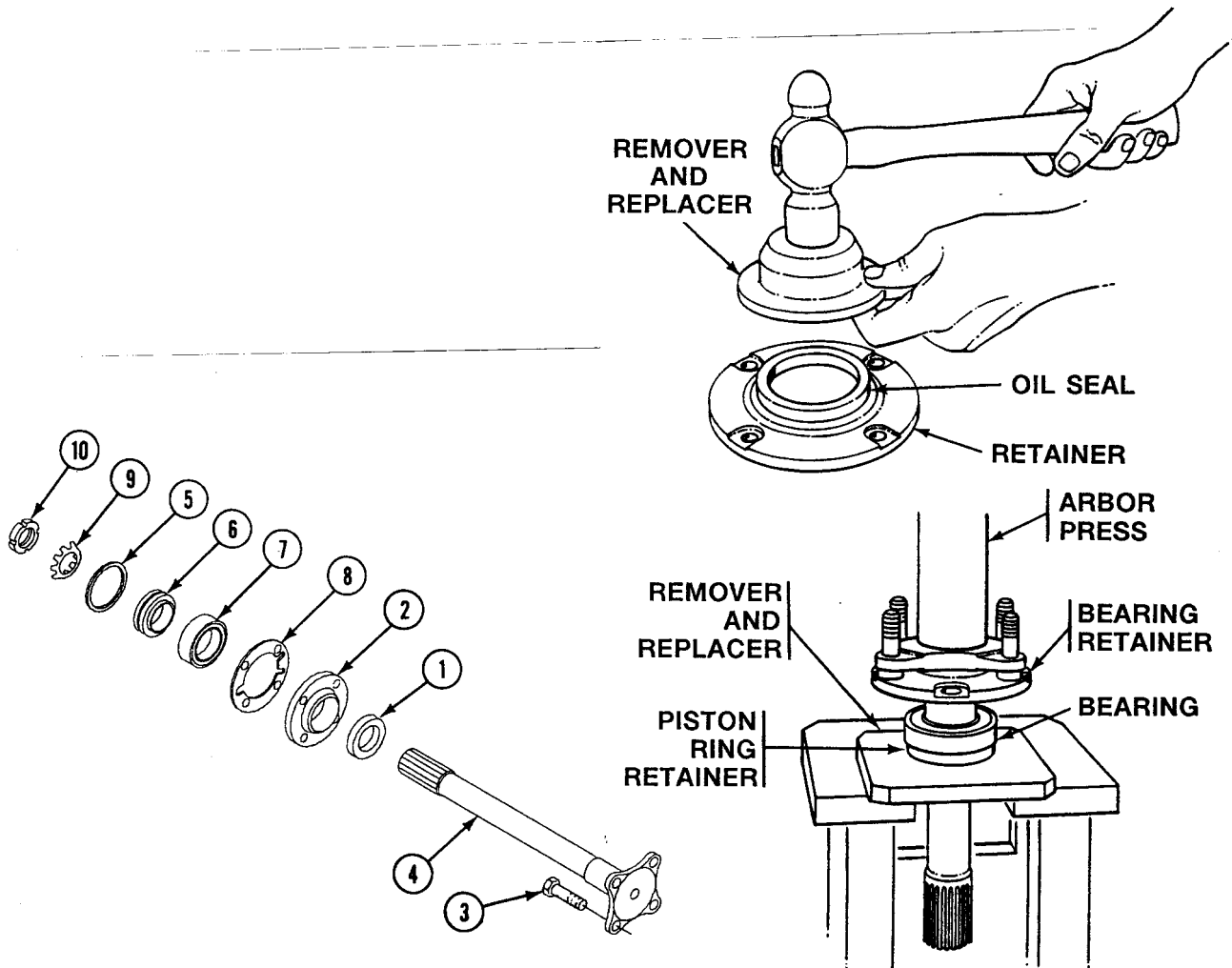
If serrated lockring screw thread insert was removed in page 0024 00-2, do Steps 1 - 3.

- 14. Thoroughly clean mating surface of new encased oil seal (1) with cleaning compound.
- 15. Apply thin film of sealing compound to outer edge of oil seal (1).

CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation, seal must be flush with outer surface.

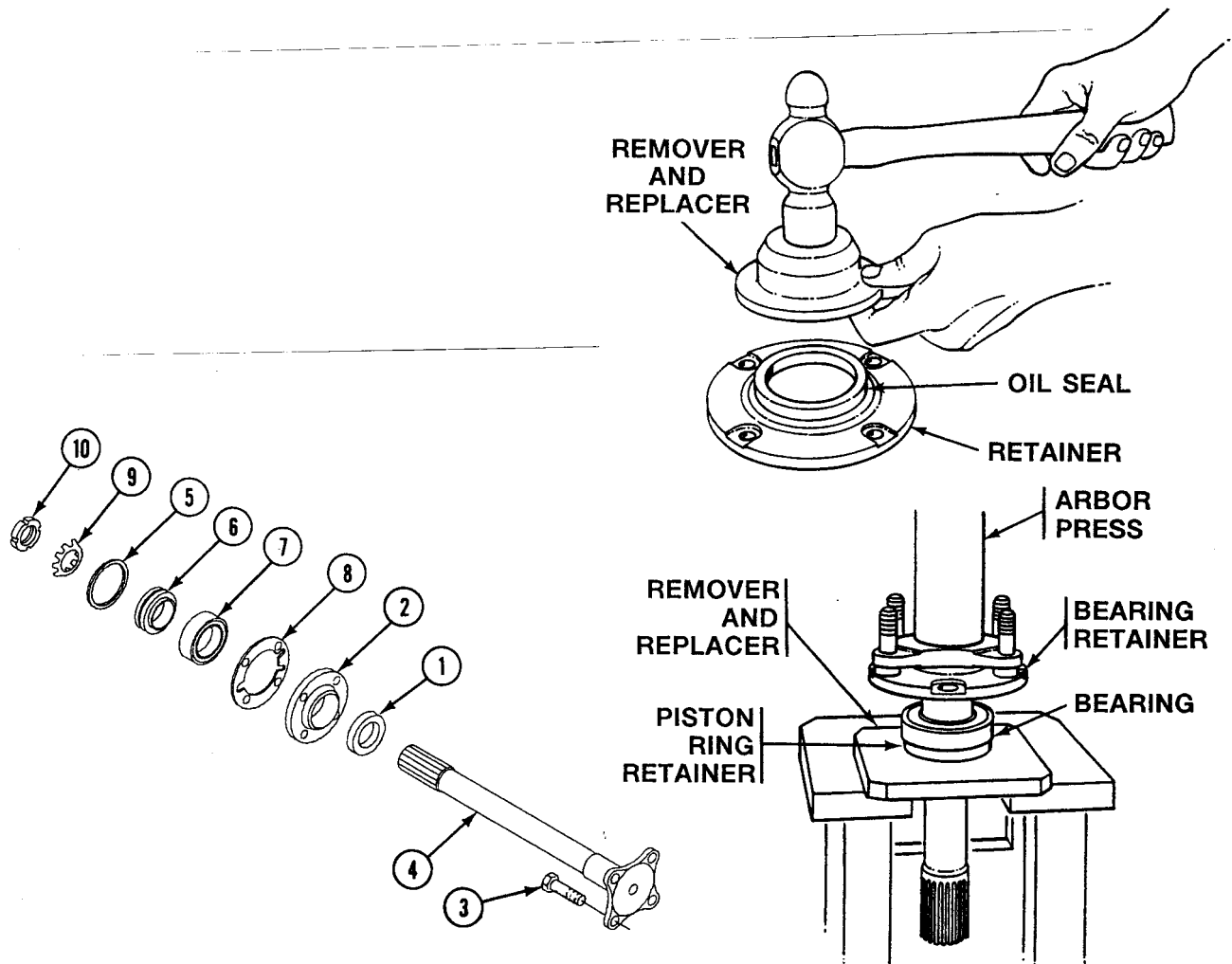
- 16. Install oil seal (1) in oil seal retainer (2). Use remover and replacer (WP 0033 00, Item 24) and hammer.



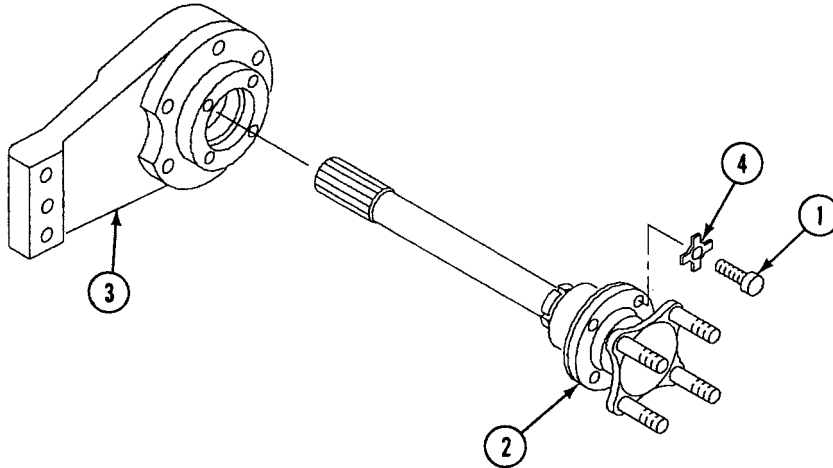
NOTE

If shoulder bolt(s) was removed in page 0024 00-2, do Step 17.

17. Install shoulder bolt(s) (3) in base of shaft (4) with flat side of bolt(s) toward shoulder. Use arbor press.
18. Install new piston ring (5) on piston ring retainer (6).
19. Install retainer (2) with oil seal (1) installed, new gasket (8), ball bearing (7), and retainer (6) with piston ring (5) on shaft (4). Use remover and replacer (WP 0033 00, Item 20) and arbor press.
20. Install new key washer (9) and retaining nut (10) on shaft (4). Tighten nut. Bend key washer tabs on nut.

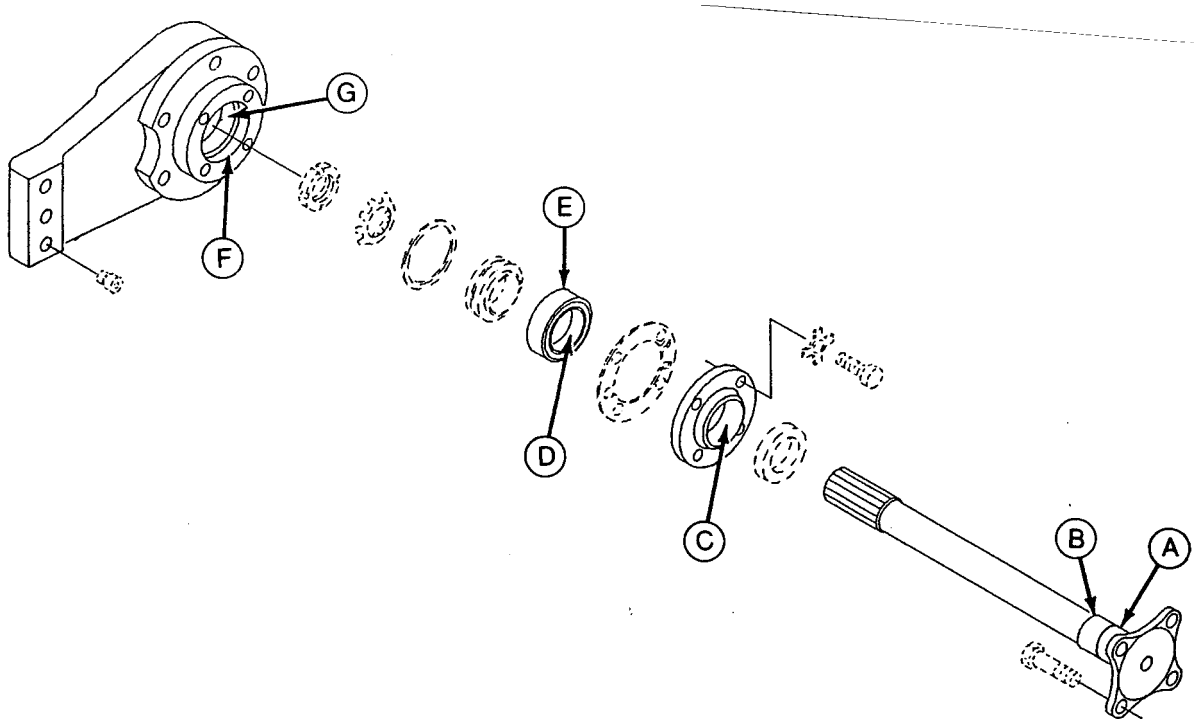


21. Thoroughly clean threads of four cap screws (1).
22. Apply light coat of antiseize compound to threads of cap screws (1).
23. Install retainer (2) on output shaft support (3) with four new key washers (4) and cap screws (1). Tighten screws to 252-300 lb-in (28.5-33.9 N•m) torque. Use torque wrench and socket wrench set. Bend tabs on key washers.



WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figure.



3. Check the parts dimensions with chart below to determine replacement.

Table 1. LEFT AND RIGHT OUTPUT SHAFT ASSEMBLIES WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Outside diameter at oil seal surface of shaft	1.9980 to 2.0020	1.9960
B	Outside diameter at bearing surface of shaft	1.7716 to 1.7720	(*)(**)
C	Inside diameter at seal surface of retainer	2.6850 to 2.6870	(*)(***)
D	Inside diameter of bearing	1.7712 to 1.7717	(*)(**)
D-B	Fit of bearing on shaft	0.0001L to 0.0008T	(*)
E	Outside diameter of bearing	3.3459 to 3.3465	(*)(**)
F	Inside diameter at bearing surface of support	3.3464 to 3.3472	3.3477
F-E	Fit of bearing in support	0.0013L to 0.0001T	0.0018L
G	Inside diameter at piston ring surface of support	2.9370 to 2.9390	(****) 2.9450

* Must be within new parts dimensions.
 ** Measure only if there is visual indication of bearing turning.
 *** Measure only if there is visual indication of seal turning in retainer.
 **** Measure only if support has been reworked to remove grooves caused by sealing ring or to repair other damage.

END OF TASK

REPLACE DIFFERENTIAL STEERING CONTROL ASSEMBLY

0025 00

THIS WORK PACKAGE COVERS:

- Removal (page 0025 00-2).
- Cleaning (page 0025 00-3).
- Installation (page 0025 00-4).

INITIAL SETUP:

Maintenance Level

General Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Socket wrench set, 3/8 inch drive (WP 0033 00, Item 34)
- Torque wrench (WP 0033 00, Item 41)

References

See your -20

Materials/Parts

- Antiseize compound (WP 0034 00, Item 1)
- Gasket
- Key washer

Equipment Condition

- Steering control differential removed from carrier (see your -20)
 - Housing cover removed (WP 0021 00)
 - Output shaft assembly removed (WP 0023 00)
 - Right angle gearbox removed (WP 0027 00)
-

REMOVAL

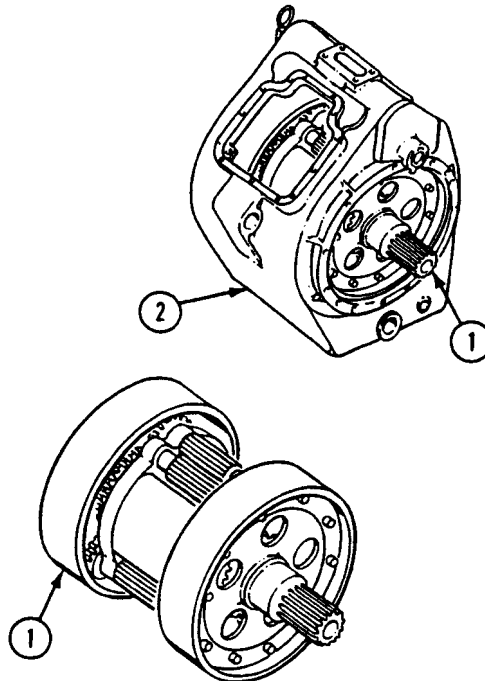
WARNING

Parts of the brake assembly may be coated with asbestos dust. Breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

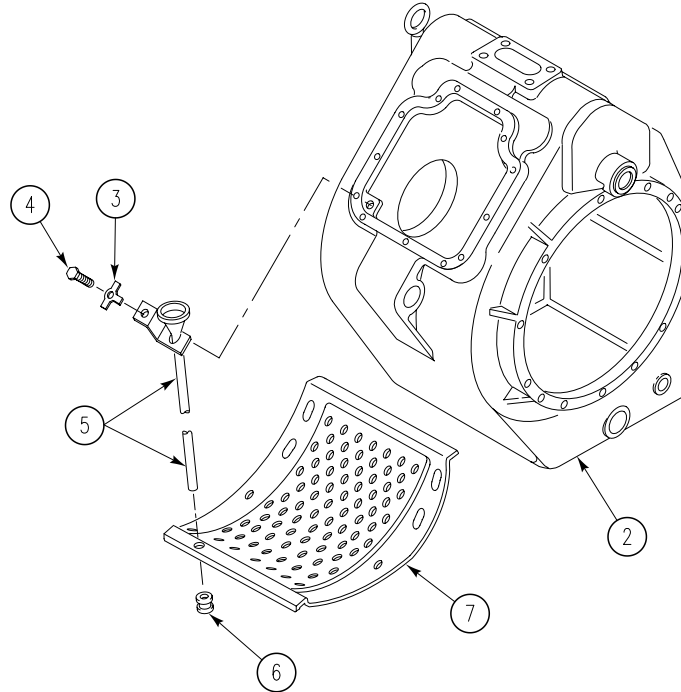
CAUTION

Use care during removal of steering unit assembly to prevent separation of brake hub from splined shaft.

1. Support shaft at each end of control assembly (1) and carefully remove steering control assembly from differential housing (2).



2. Straighten tabs on key washer (3). Remove cap screw (4) and key washer holding gauge rod guide (5) to housing (2). Remove rod guide from nonmetallic grommet (6) in strainer (7). Discard key washer.



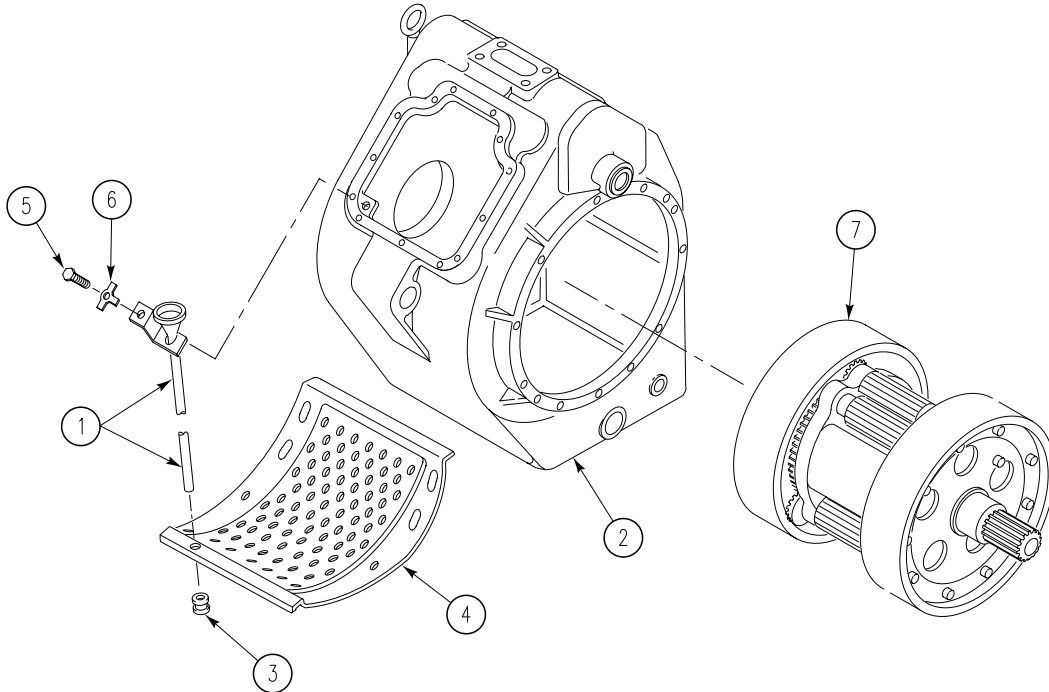
CLEANING

CLEAN, INSPECT, AND REPLACE

1. Check all parts for cracks, wear, and damage. Replace if needed.

INSTALLATION

1. Install gauge rod guide (1) in housing (2). Install end of guide through grommet (3) in strainer (4) at bottom of housing. Apply a light coat of antiseize compound to clean threads of cap screw (5). Secure guide to housing bracket with new key washer (6) and cap screw (5). Tighten screw to 252-300 lb-in (29-34 N•m). Use torque wrench and socket set.
2. Support shaft at each end of control assembly (7) and carefully install steering control assembly on differential housing (2).

**END OF TASK**

REPAIR DIFFERENTIAL STEERING CONTROL ASSEMBLY

0026 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0027 00-2)
- Cleaning (page 0027 00-5).
- Assembly (page 0027 00-6).
- Wear Limits (page 0027 00-12).

INITIAL SETUP:

Maintenance Level

General Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Hammer, soft plastic (WP 0033 00, Item 10)
- Arbor press (WP 0033 00, Item 16)
- Mechanical puller kit (WP 0033 00, Item 17)
- Socket wrench set, 3/8 inch drive (WP 0033 00, Item 34)
- Torque wrench (WP 0033 00, Item 41)
- Torque wrench (WP 0033 00, Item 43)
- Vernier height gage (WP 0033 00, Item 8)

References

- See your -10
- See your -20
- TM 9-214

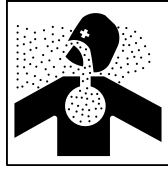
Materials/Parts

- Cotter pin (26)
- Cotter pin (6)
- Woodruff key (6)

Equipment Condition

Differential steering control assembly removed from differential (WP 0025 00).

DISASSEMBLY

WARNING

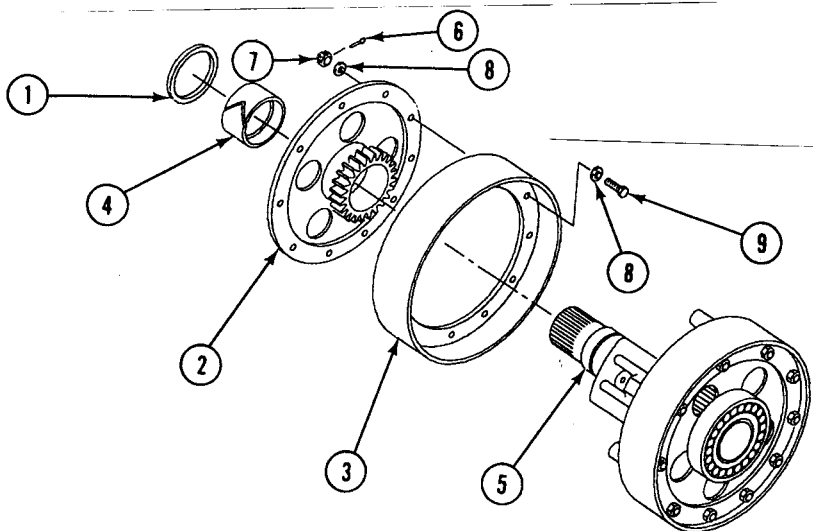
Parts of the brake assembly may be coated with asbestos dust. Breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

1. Remove bearing thrust washer (1), brake drum hub (2) with brake drum (3) attached, and sleeve bearing (4) from splined drive shaft on control flange assembly (5).

NOTE

If inspection indicates that brake drum hub or brake drum require replacement, do Step 2.

2. Remove 10 cotter pins (6), slotted nuts (7), 20 washers (8), and 10 cap screws (9) securing brake drum hub (2) to brake drum (3). Separate hub and drum. Discard cotter pins.
3. Inspect 10 cap screws (9) to determine grade type. If screws are not grade 8 (six radial marks on screw heads), discard screws.

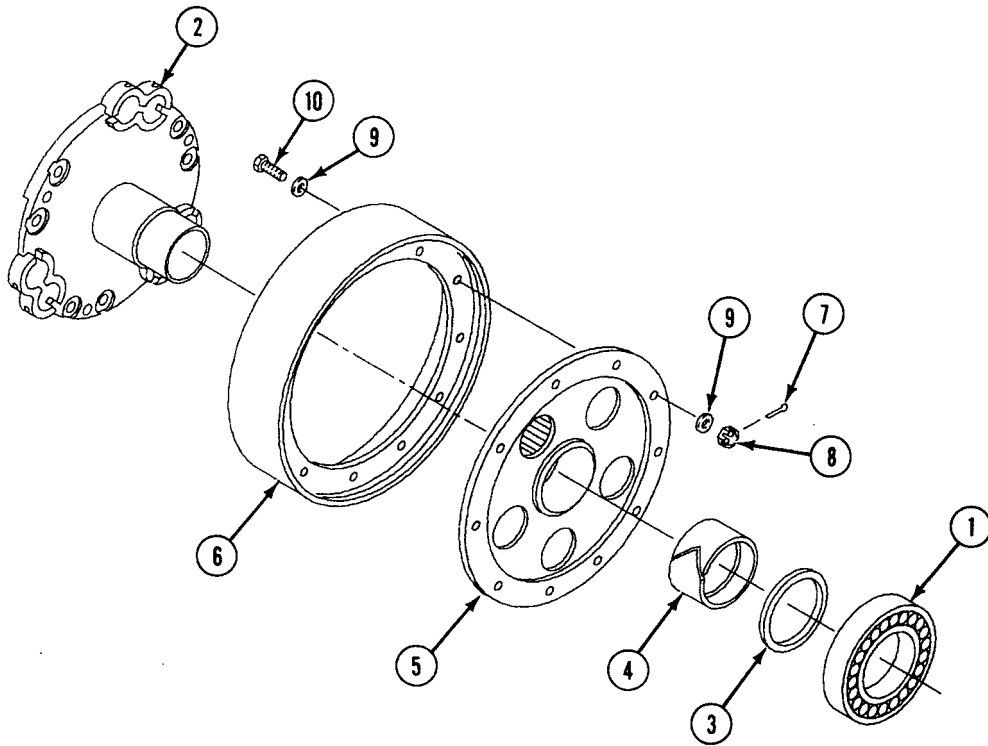


4. Remove ball bearing (1) from brake flange (2). Use mechanical puller.
5. Remove bearing thrust washer (3), sleeve bearing (4), and brake drum hub (5) with attached brake drum (6) from brake flange assembly (2).

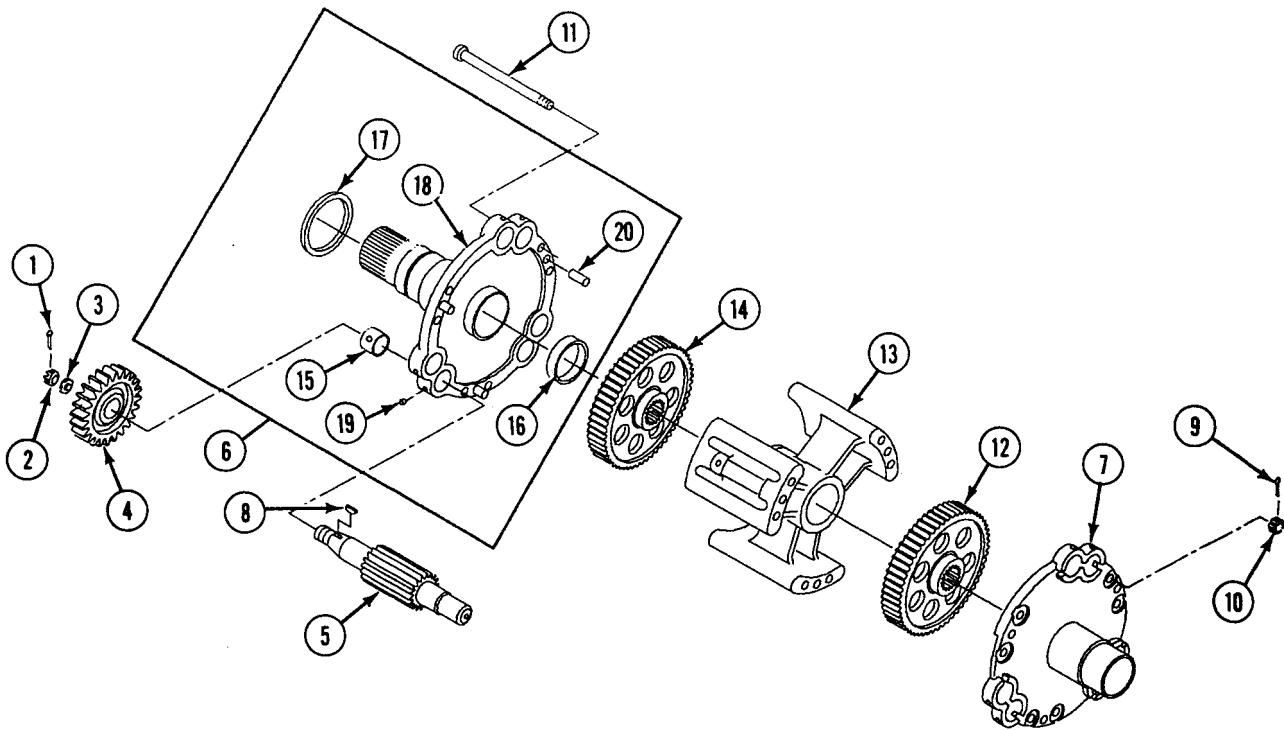
NOTE

If inspection indicates that brake drum hub or brake drum require replacement, do Step 6.

6. Remove 10 cotter pins (7), slotted nuts (8), 20 washers (9), and 10 cap screws (10) securing brake drum hub (5) to brake drum (6). Separate hub and drum. Discard cotter pins.



7. Remove six cotter pins (1), slotted nuts (2), and washers (3) holding external spur gears (4) to gear shafts (5) between control flange assembly (6) and brake flange assembly (7). Discard cotter pins.
8. Remove six spur gears (4) from gear shafts (5). Use mechanical puller. Remove six woodruff keys (8) from gear shafts. Discard keys.
9. Remove six cotter pins (9), slotted nuts (10), and machine bolts (11) holding control flange assembly (6) to brake flange assembly (7). Separate control flange and brake flange assemblies. Use soft hammer. Discard cotter pins.
10. Remove spur gear (12) and six gear shafts (5) from differential spider (13).
11. Separate spur gear (14) and spider (13) from control flange assembly (6). Use soft hammer.



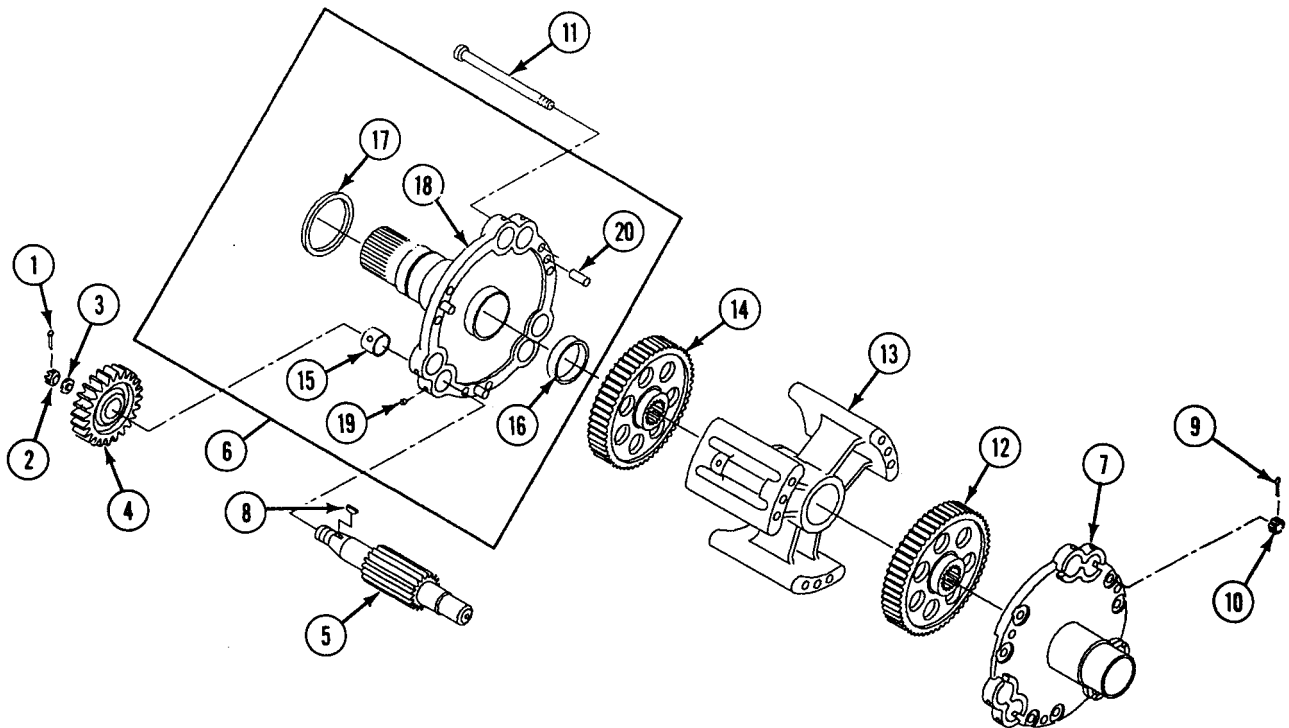
CLEANING**CLEAN, INSPECT, AND REPAIR**

1. Before inspection, repair, or assembly, clean all parts of differential steering control assembly as described in (WP 0014 00).
2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures. Check wear limits and part clearances on differential steering control assembly page 0026 00-12. Repair or replace defective parts.
3. Inspect six sleeve bearings (15), sleeve bearing (16), and ring spacer (17) in differential flange (18). Remove and discard damaged part(s). Use arbor press.

NOTE

If inspection of six expansion plugs and three straight pins indicates replacement is required, do Step 4.

4. Remove expansion plug(s) (19) and pin(s) (20) from differential flange (18). Discard plug(s) and pin(s).



5. Inspect ring spacer (1), six sleeve bearings (2), and sleeve bearing (3) in differential flange (4). Remove and discard damaged part(s). Use arbor press.

NOTE

If inspection of six expansion plugs and three straight pins indicates replacement is required, do Step 6.

6. Remove expansion plug(s) (5) and pin(s) (6) from differential flange (4). Discard plug(s) and/or pin(s).

ASSEMBLY**NOTE**

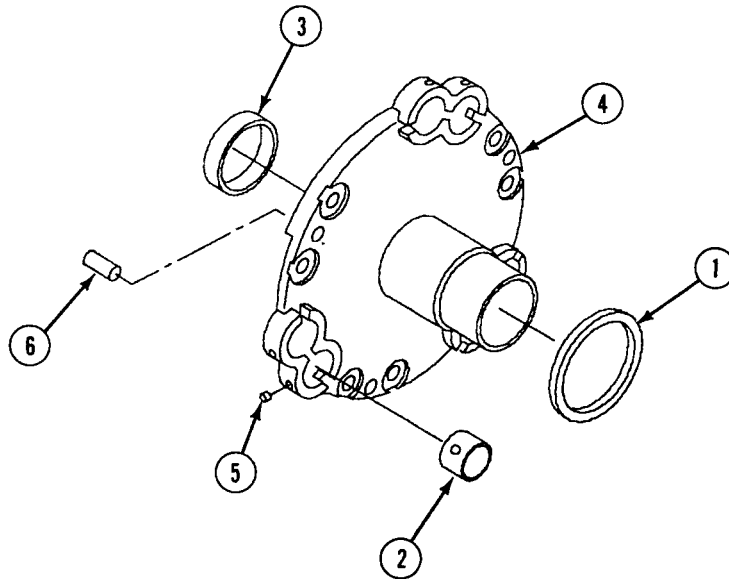
If any of the three straight pins or six expansion plugs were removed from differential flange in page 0027 00-5 above, do Step 1.

1. Install new pin(s) (6) and/or new expansion plug(s) (5) in differential flange (4). Stake each pin(s) four places. Stake each plug(s) two places.

NOTE

If sleeve bearings or ring spacer were removed from differential flange in page 0026 00-5 above, do Step 2.

2. Install new sleeve bearing (3), sleeve bearing(s) (2), and/or ring spacer (1) in differential flange (4). Use arbor press.



NOTE

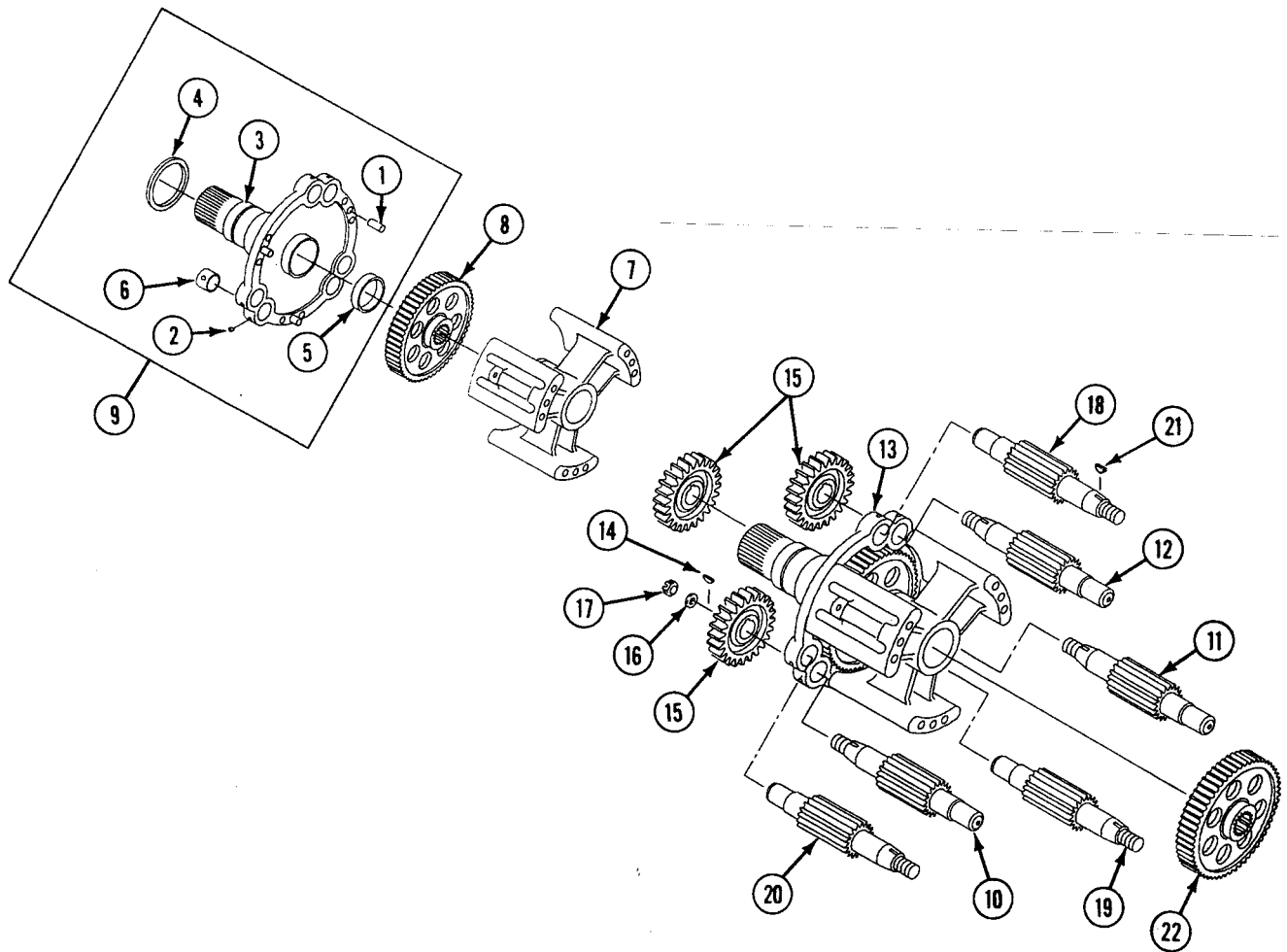
If any of three straight pins or six expansion plugs were removed from differential flange in page 0026 00-5 above, do Step 3.

3. Install new straight pin(s) (1) and/or new expansion plug(s) (2) in differential flange (3). Stake each plug(s) two places.

NOTE

If ring spacer, or sleeve bearings were removed from differential flange in page 0026 00-5 above, do Step 4.

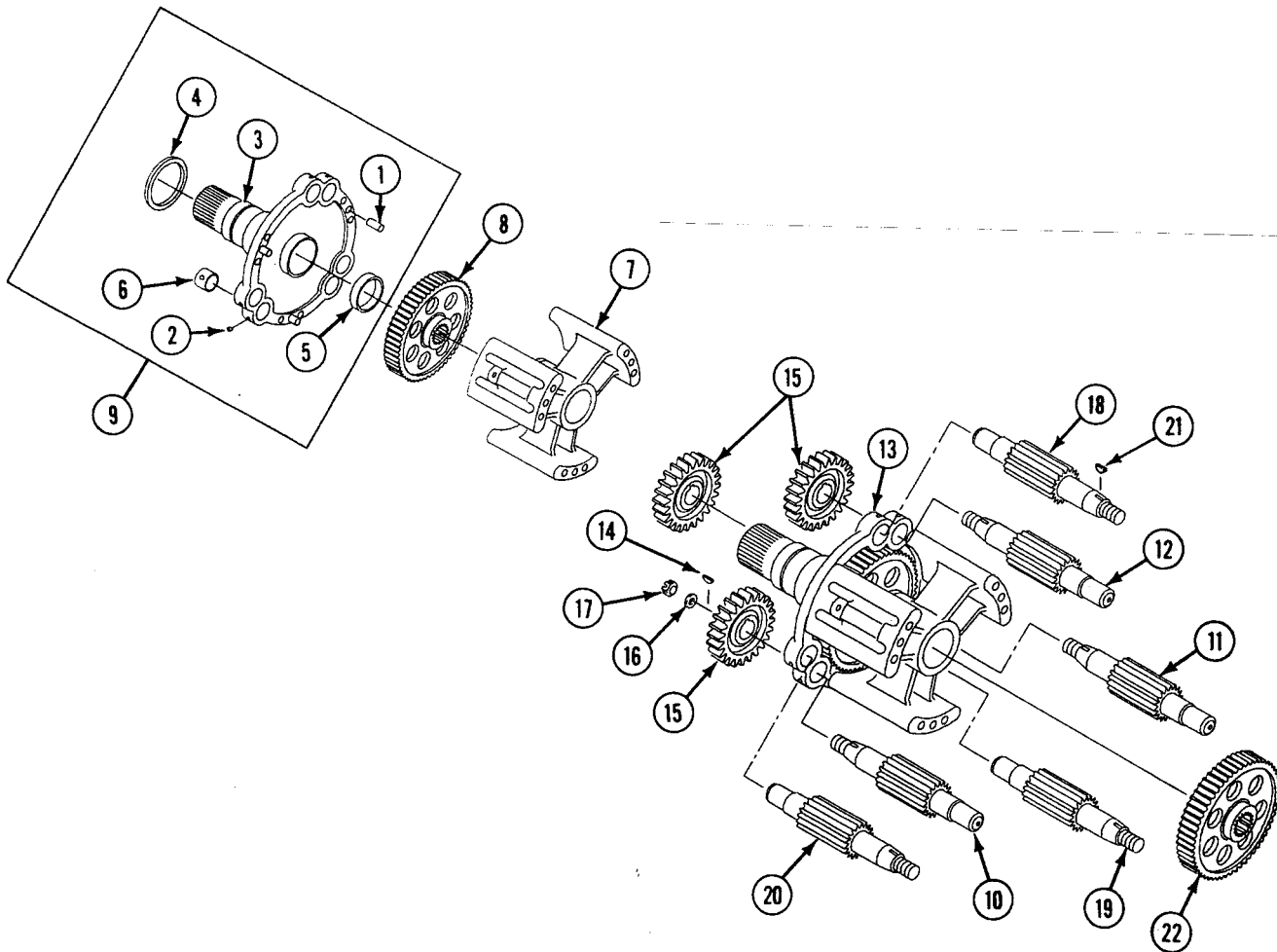
4. Install new ring spacer (4), sleeve bearing (5), and/or sleeve bearing(s) (6) in differential flange (3). Use arbor press.
5. Install differential spider (7) and spur gear (8) on control flange assembly (9).



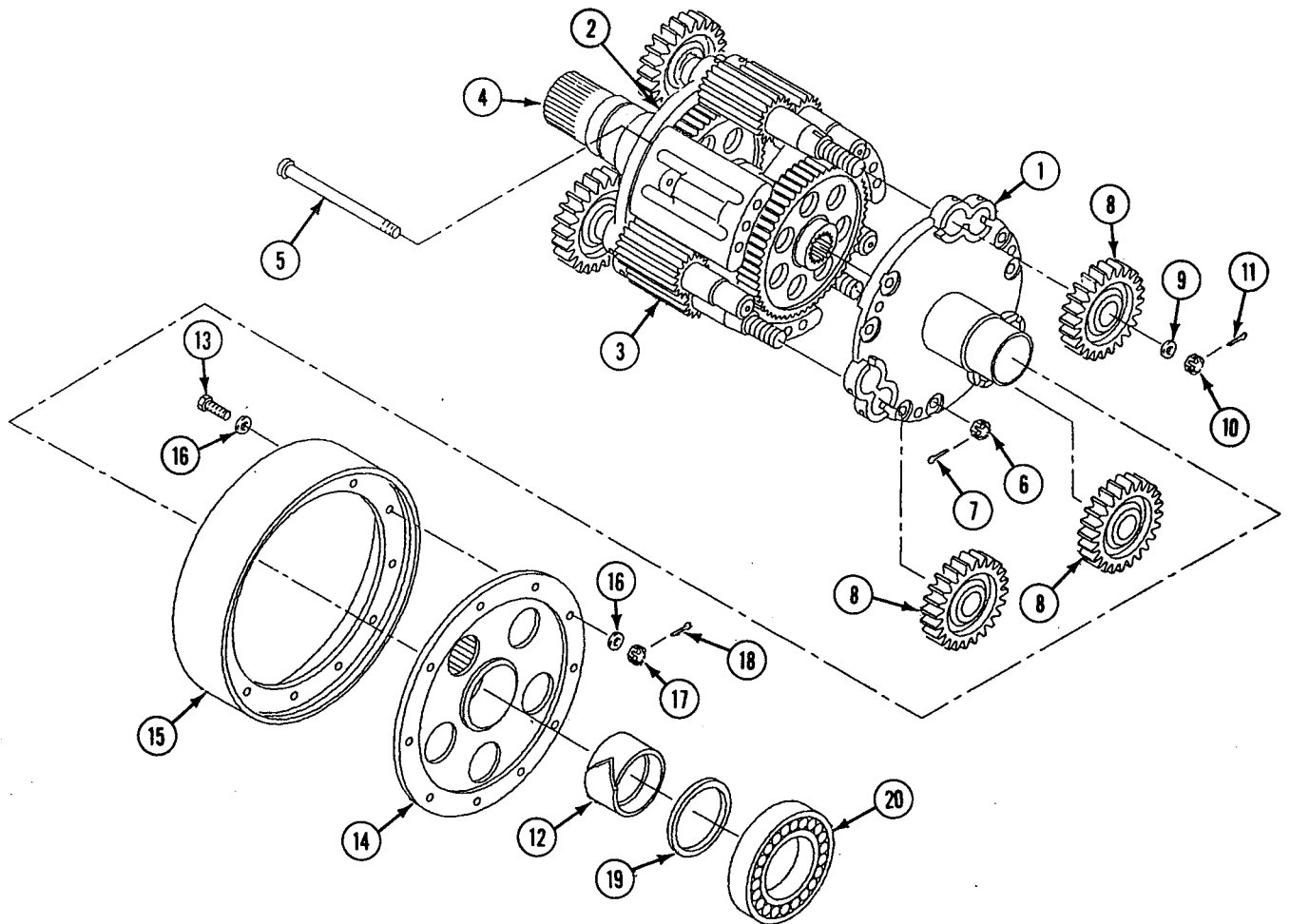
NOTE

Threads and taper on gear shafts and bores in mating spur gears and slotted nuts must be dry and free from grease and oil when being assembled.

6. Insert spur gear shaft (10), spur gear shaft (11), and spur gear shaft (12) in control flange assembly (13) with threaded ends through bores in flange with keyways oriented toward center of flange.
7. Install three new woodruff keys (14) in keyways of gear shaft (10), spur gear shaft (11), and spur gear shaft (12). Install three spur gears (15) on gear shafts. Use soft hammer. Secure with three washers (16) and slotted nuts (17). Do not tighten nuts at this time.
8. Insert spur gear shaft (18), spur gear shaft (19), and spur gear shaft (20) in control flange assembly (13) with machined ends through bores in flange with keyways at the threaded ends oriented toward center of flange.
9. Install three new woodruff keys (21) in keyways of gear shaft (18), spur gear shaft (19), and spur gear shaft (20).
10. Install spur gear (22) on control flange assembly (13).



11. Install brake flange assembly (1) on control flange assembly (2) with six gear shafts (3) inserted through bores in differential flange (4). Secure flange (1) and flange (2) together with six machine bolts (5) and slotted nuts (6). Tighten nuts to 65-70 lb-ft (88-95 N•m) torque. Use torque wrench (WP 0033 00, Item 43). Install six new cotter pins (7).
12. Install three external spur gears (8) on gear shafts (3). Use soft hammer. Secure with three washers (9) and slotted nuts (10).
13. Tighten six slotted nuts (10) to 140-160 lb-ft (190-217 N•m) torque. Use torque wrench (WP 0033 00, Item 43). Install six new cotter pins (11).
14. Install sleeve bearing (12) on brake flange assembly (1) with grooves pointing to the left.

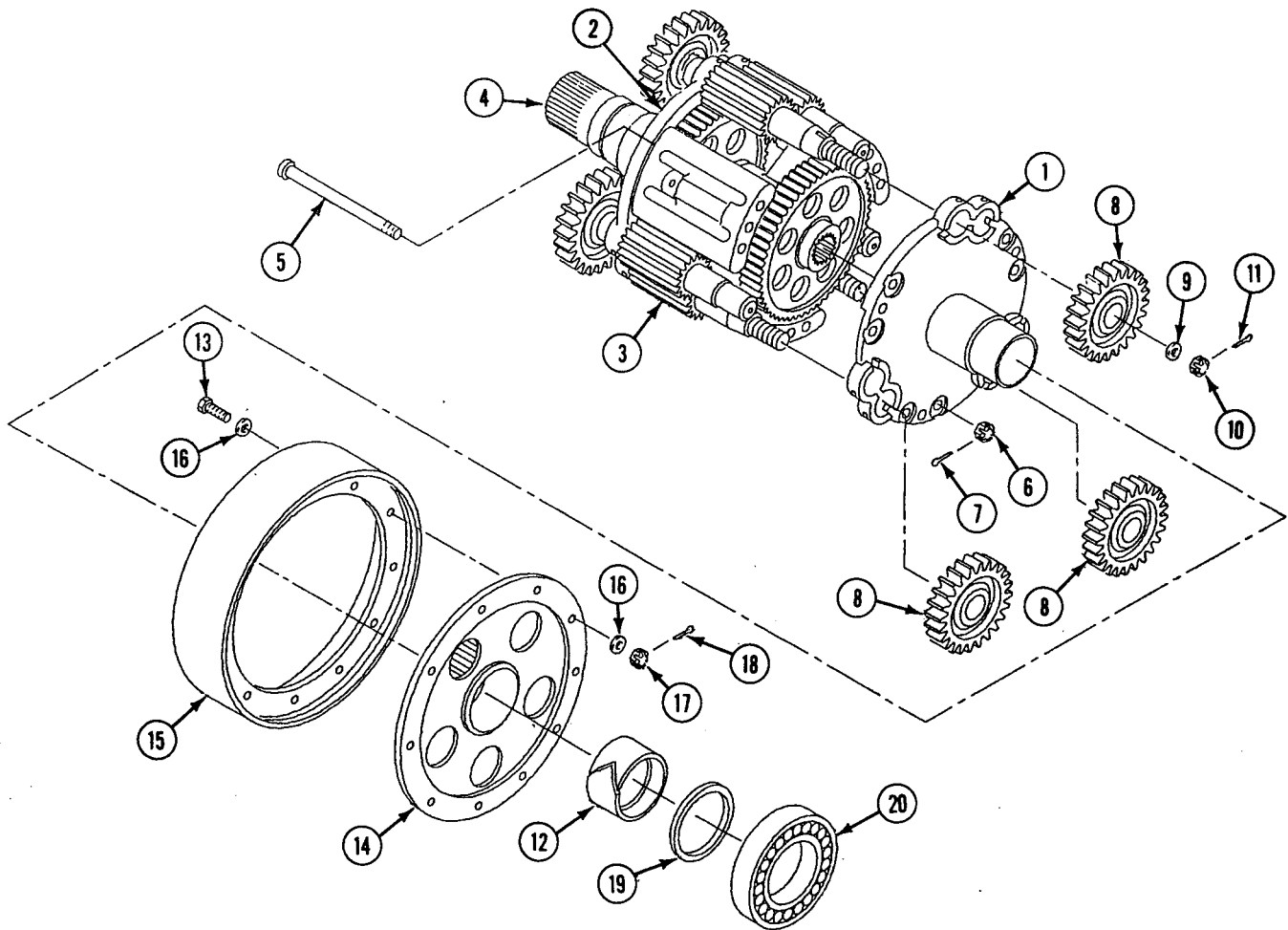


NOTE

Check that 10 cap screws (13) being installed are grade 8 screws (six radial marks on screw heads).

If brake drum hub was removed from brake drum in page 0026 00-2 above, do Step 15.

15. Install brake drum hub (14) on brake drum (15). Secure with 10 cap screws (13), 20 washers (16), and 10 slotted nuts (17). Tighten nuts to 35-40 lb-ft (47-54 N•m) torque. Use torque wrench (WP 0033 00, Item 43). Install 10 new cotter pins (18).
16. Install brake drum hub (14) with brake drum (15) on brake flange assembly (1).
17. Install bearing thrust washer (19) and ball bearing (20) on brake flange assembly (1). Use soft hammer.



18. Install sleeve bearing (1) on control flange assembly (2) with grooves pointing to the right.

NOTE

Check that 10 cap screws being installed are grade 8 screws (six radial marks on screw heads).
If brake drum hub was removed from brake drum in page 0026 00-2 above, do Step 19.

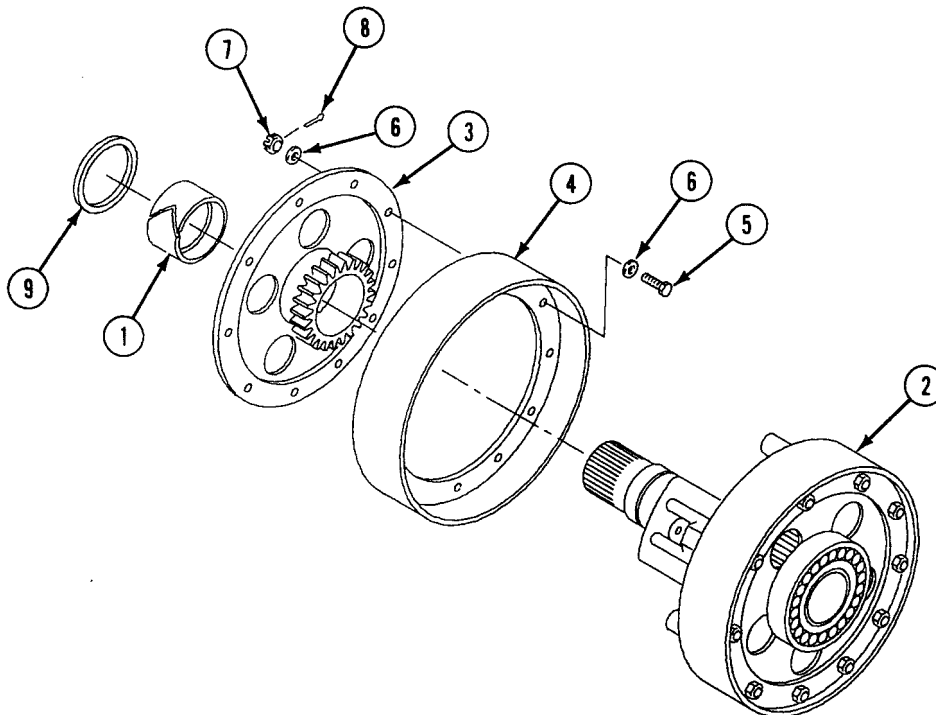
NOTE

If sleeve bearing (3120-00-782-4191, 8756536) is installed on differential spider, inside diameter of spider will be 2.249 to 2.251 inches (5.71 cm).

NOTE

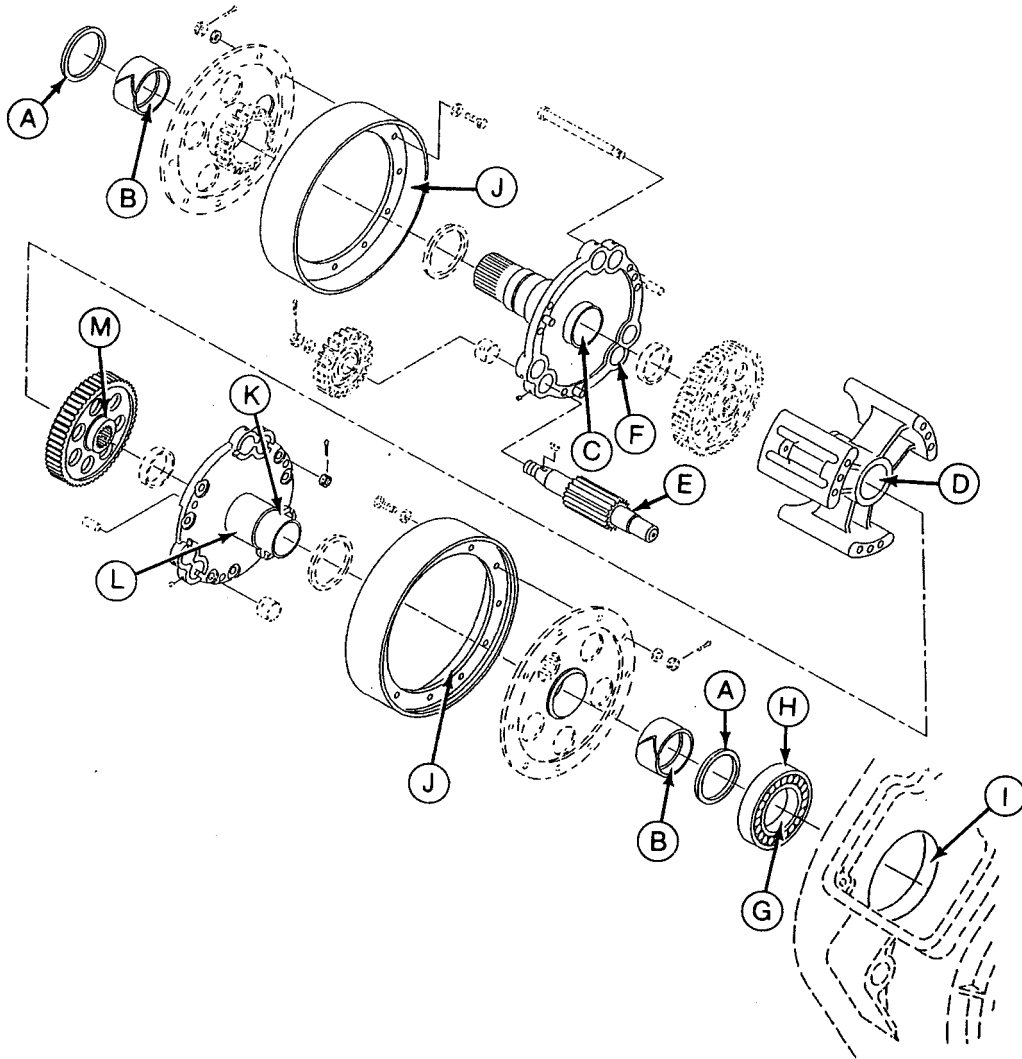
If spider is equipped with sleeve bearing (3120-00-782-4191, 8756536), the fit of spider on gear hub will be 0.0010L to 0.00040L.

19. Install brake drum hub (3) on brake drum (4). Secure with 10 cap screws (5), 20 washers (6), and 10 slotted nuts (7). Tighten nuts to 420-480 lb-in (47-54 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Install 10 new cotter pins (8).
20. Install brake drum hub (3) with attached brake drum (4) on control flange assembly (2).
21. Install bearing thrust washer (9) on drive shaft of control flange assembly (2).



WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figure.



3. Check the parts dimensions with chart below to determine replacement.

Table 1. DIFFERENTIAL STEERING CONTROL ASSEMBLY WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Thickness of thrust washer	0.2180 to 0.2220	(*)
B	Inside diameter of brake drum sleeve bearing	3.2590 to 3.2600	(*)
C	Inside diameter of flange bushing	2.2490 to 2.2505	(*)
D	Inside diameter of spider	2.253 to 2.255	(*)(***)
	With sleeve bearing 8756536 installed	2.249 to 2.251	
E	Outside diameter at bearing surface of gear shaft	1.0550 to 1.0560	(*)
F	Inside diameter of flange bushing	1.0600 to 1.0610	(*)
F-E	Fit of bushing on gear shaft	0.0040L to 0.0060L	(**) 0.0080L
G	Inside diameter of bearing	2.9522 to 2.9528	(*)(****)
H	Outside diameter of bearing	5.1173 to 5.1181	(*)(****)
H-I	Fit of bearing in housing	0.0016L to 0.002T	
J	Outside diameter of drum	13.175 to 13.185	(1)
K	Outside diameter of bearing surface of flange hub	2.9527 to 2.9533	(*)
K-G	Fit of bearing on flange hub	0.0001L to 0.0011T	(*)
L	Outside diameter of bearing surface of flange hub	3.2500 to 3.2510	(*)
L-B	Fit of sleeve bearing on flange hub	0.0080L to 0.0100L	(**) 0.0150L
M	Outside diameter of gear hub	2.2470 to 2.2480	(*)(***)
M-C	Fit of bushing on gear hub	0.0010L to 0.0035L	0.0065L
M-D	Fit of spider on gear hub	0.005L to 0.0080L	0.0100L
	With sleeve bearing 8756536 installed in spider	0.0010L to 0.0040L	

(1) Machined drum wall thickness 0.250 inches (0.64 mm).

* Must be within new parts dimensions.

** Wear is allowed on either or both mating parts as long as fit is within specified limit.

*** Measure only if there is visual indication of wear or damage.

**** Measure only if there is visual indication of bearing turning.

END OF TASK

REPLACE DIFFERENTIAL RIGHT ANGLE GEARBOX

0027 00

THIS WORK PACKAGE COVERS:

- Removal (page 0027 00-2).
- Cleaning (page 0027 00-14).
- Installation (page 0027 00-3).

INITIAL SETUP:

Maintenance Level

General Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Socket wrench set (WP 0033 00, Item 34)
- Torque wrench (WP 0033 00, Item 41)

References

See your -20

Materials/Parts

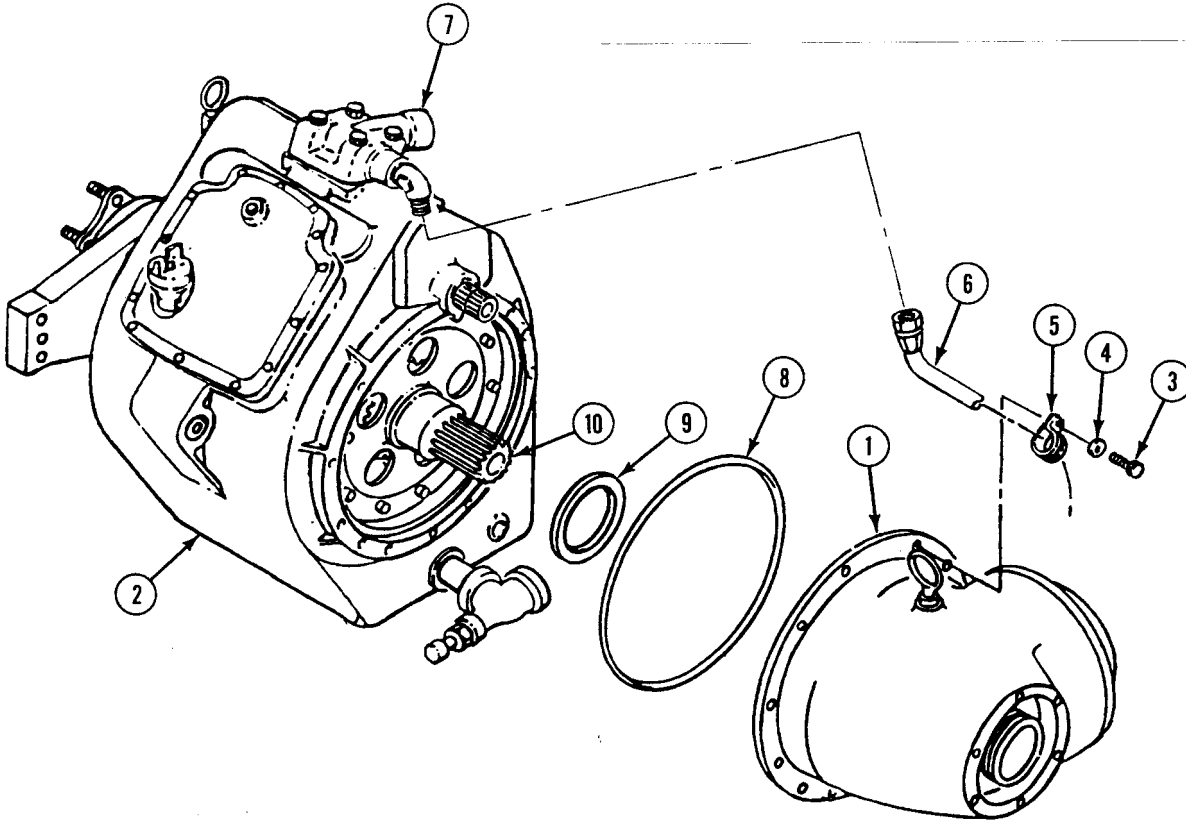
- Antiseize compound (WP 0035 00, Item 1)
- Petrolatum (WP 0035 00, Item 11)
- Packing

Equipment Condition

- Steering control differential removed from carrier (see your -20)
 - Left output shaft removed (WP 0023 00)
-

REMOVAL

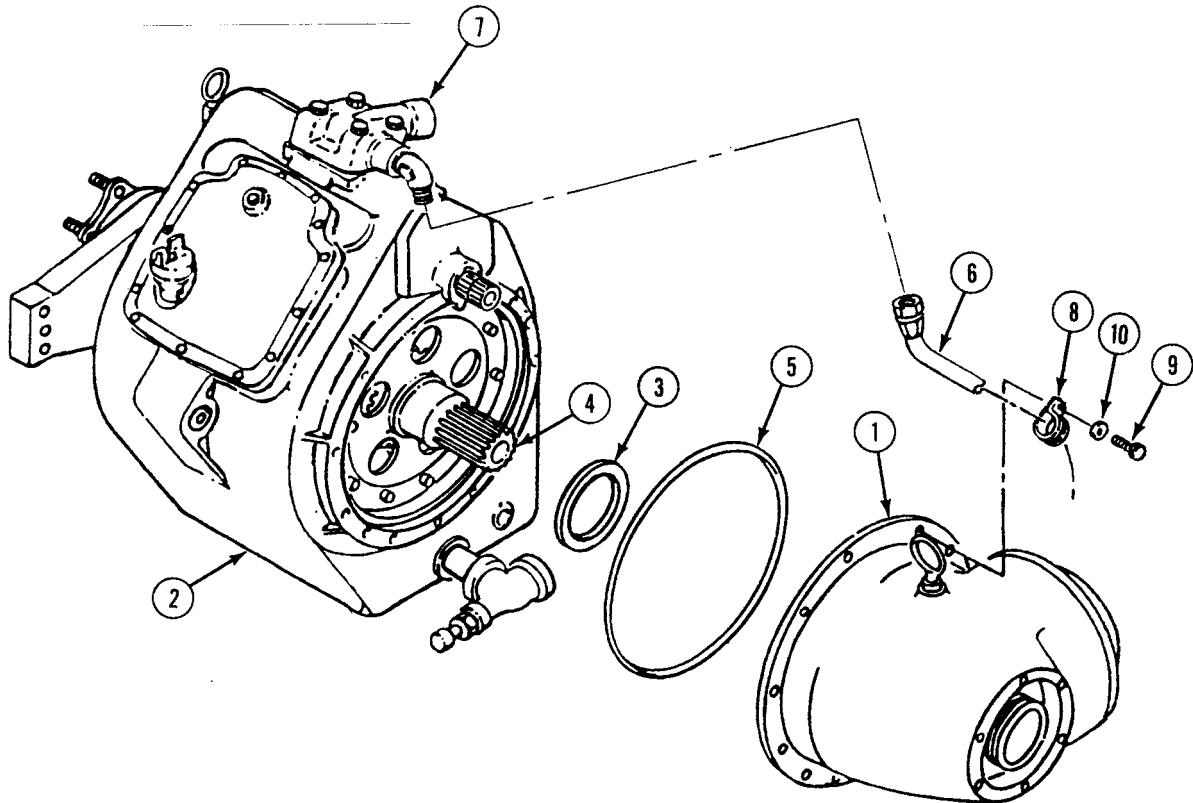
1. Remove right angle gearbox (1) from housing (2) as follows. Remove 11 cap screws (3) and washers (4) holding gearbox (1) to housing (2). Remove loop clamp (5) and hose (6) from gearbox.
2. Remove hose (6) from adapter (7).
3. Install two cap screws (3) in threaded jack screw holes, and tighten screws uniformly to separate gearbox (1) from housing (2). Remove cap screws. Remove packing (8) from gearbox and discard packing. Remove thrust washer (9) from steering unit assembly (10).

**CLEANING****CLEAN, INSPECT, AND REPLACE**

1. Clean all parts, and check for cracks, wear, and damage. Replace if needed.

INSTALLATION

1. Install right angle gearbox (1) on differential housing (2). Install thrust washer (3) on shaft of steering control assembly (4). Lubricate new packing (5) with petrolatum and install packing on right angle gearbox.
2. Install hose (6) on adapter (7).
3. Install loop clamp (8) on nonmetallic hose (6). Clean threads of screws (9) thoroughly. Apply a light coat of antiseize compound to clean threads of 11 cap screws (9). Place right angle gearbox and loop clamp (8) with attached hose (6) on housing. Secure with 11 washers (10) and cap screws (9). Tighten screws to 252-300 lb-in (26-34 N•m) torque. Use torque wrench and socket set.

**END OF TASK**

REPAIR DIFFERENTIAL RIGHT ANGLE GEARBOX

0028 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0028 00-2).
 - Cleaning (page 0028 00-8).
 - Assembly (page 0028 00-9).
 - Wear Limits (page 0028 00-21).
-

INITIAL SETUP:

Maintenance Level

General Support

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Bearing inserter (WP 0033 00, Item 1)
- C-clamp (WP 0033 00, Item 3)
- Soft plastic hammer (WP 0033 00, Item 10)
- Dial indicator gage (WP 0033 00, Item 12)
- Arbor press (WP 0033 00, Item 16)
- Mechanical puller kit (WP 0033 00, Item 17)
- Remover/Replacer (WP 0033 00, Item 21)
- Remover/Replacer (WP 0033 00, Item 23)
- Remover/Replacer (WP 0033 00, Item 24)
- Jack screw (2) (WP 0033 00, Item 30)
- Differential backlash tool (WP 0033 00, Item 36)
- Torque wrench (WP 0033 00, Item 39)
- Torque wrench (WP 0033 00, Item 41)
- Torque wrench (WP 0033 00, Item 43)
- Vernier height gage (WP 0033 00, Item 8)

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Engine oil (WP 0035 00, Item 5)
- Grease (WP 0035 00, Item 6)
- Non-electrical wire (WP 0035 00, Item 9)
- Petrolatum (WP 0035 00, Item 10)
- Sealing compound (WP 0035 00, Item 12)
- Sealing compound (WP 0035 00, Item 13)
- Key washer (26)
- Key washer

Personnel Required

Track Vehicle Repairer

References

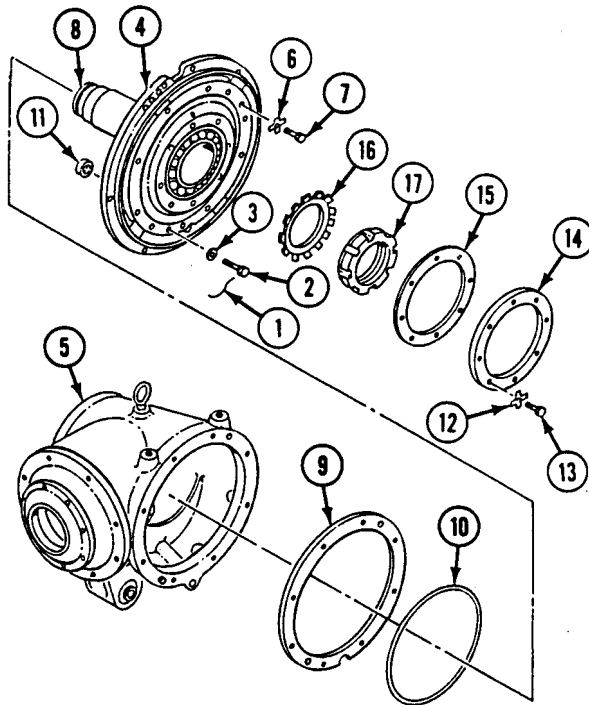
TM 9-214

Equipment Condition

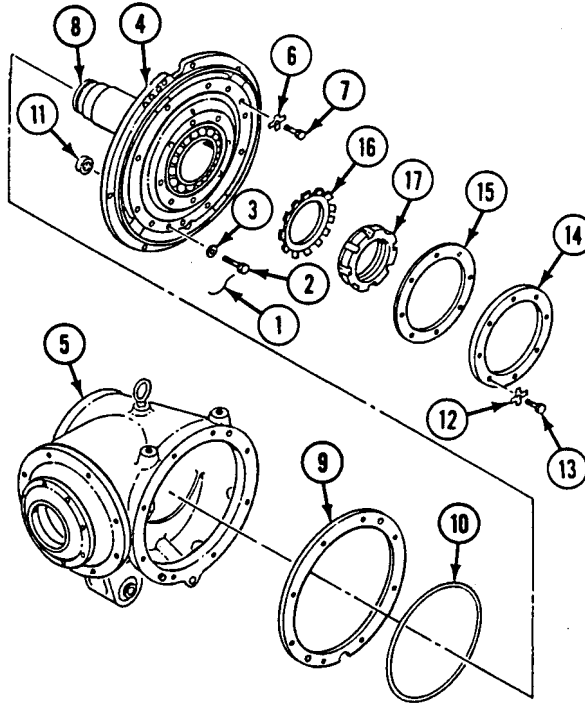
Differential right angle gearbox removed from differential assembly (WP 0027 00)

DISASSEMBLY

1. Remove lockwire (1) (four places), eight cap screws (2), and washers (3) holding adapter plate (4) to gearbox housing (5). Discard lockwire.
2. Bend tabs on two key washers (6). Remove two cap screws (7) and key washers from plate (4). Discard key washers.



3. Install two 3/8 x 16 cap screws 2 inches (5 cm) long (minimum length) in jacking holes where screws were removed in Step 2. Tighten screws uniformly to separate plate (4) and output hub (8) with attached parts as an assembly from housing (5).
4. Remove laminated shim (9), packing (10), and gasket (11) from plate (4). Discard shim, packing, and gasket.
5. Bend tabs on eight key washers (12). Remove eight cap screws (13), key washers, bearing retainer (14), and laminated shim (15) from plate (4). Discard key washers.
6. Straighten tabs on key washer (16). Remove round nut (17) and key washer from hub (8). Discard key washer.



7. Bend tabs on eight key washers (1). Remove eight cap screws (2) and key washers holding bearing housing (3) to gearbox housing (4). Remove bearing housing with input bevel gear (5) as an assembly. Discard key washers.
8. Remove laminated shim (6) and packing (7) from bearing housing (3). Discard shim and packing.

NOTE

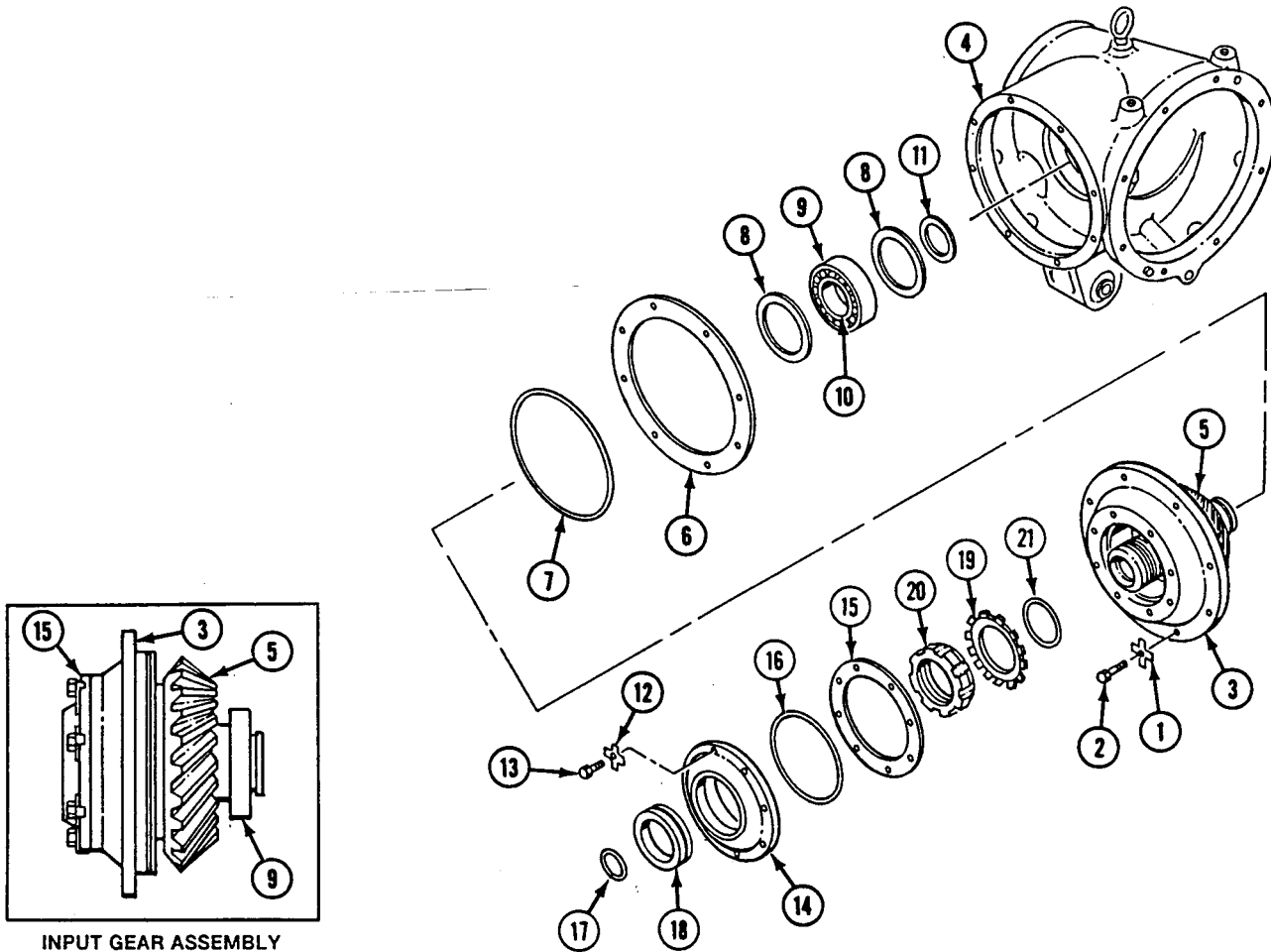
If inspection indicates that outer race of ball bearing requires replacement, do Step 9.

9. Remove inner retaining ring (8), outer race of bearing (9), and outer retaining ring (8) from gearbox housing (4). Discard outer race.

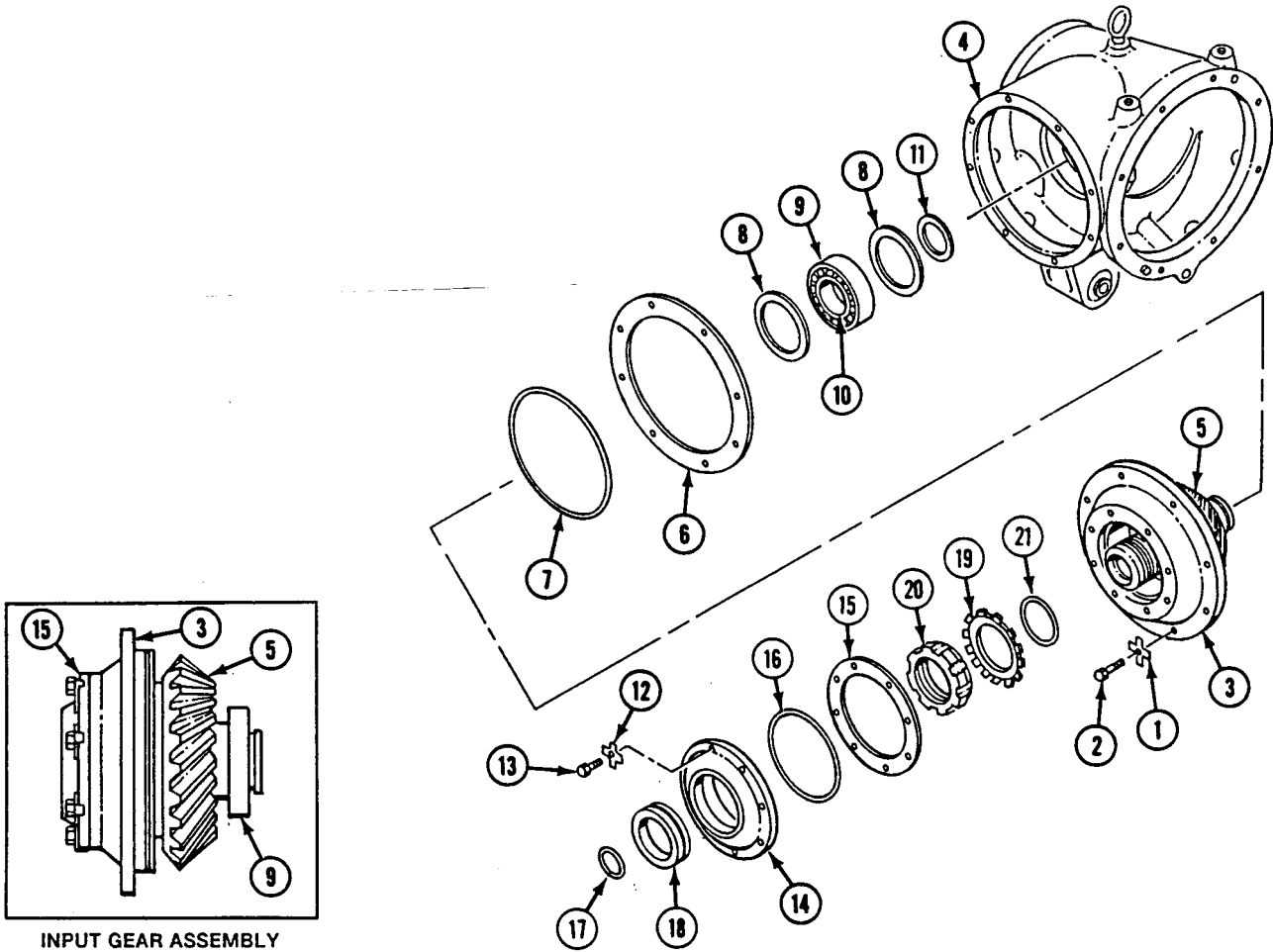
NOTE

Bearing inner race (10) and outer race (9) must be replaced as matched set.

10. If inspection indicates that bearing inner race (10) requires replacement, remove retaining ring (11) and inner race from bevel gear (5). Use remover and replacer (WP 0033 00, Item 24) and mechanical puller (WP 0033 00, Item 17). Discard inner race.



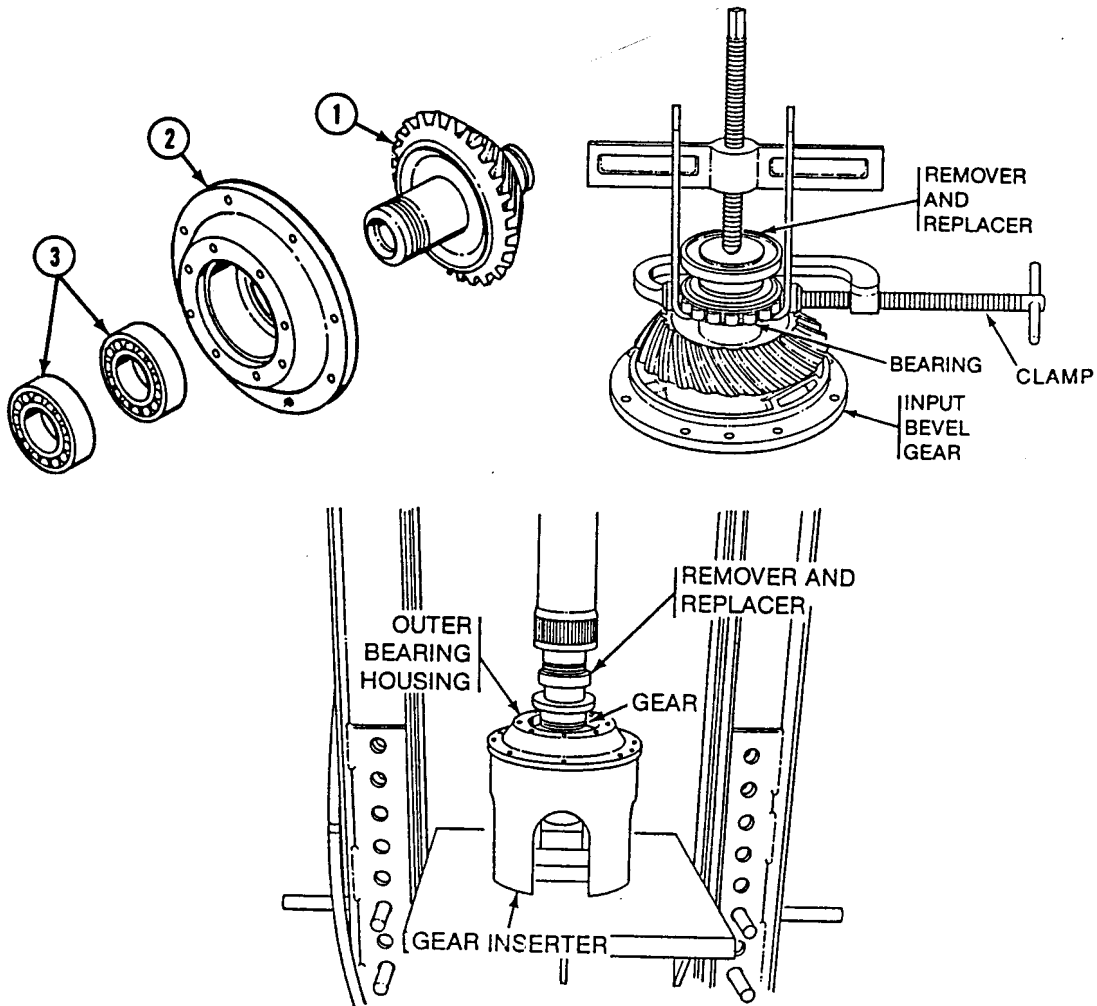
11. Bend tabs on eight key washers (12). Remove eight cap screws (13), key washers, and oil seal retainer (14) from gearbox housing (3). Remove laminated shim (15) and packing (16). Discard key washers, shim, and packing.
12. Remove packing (17), bevel gear (5), and encased oil seal (18) from retainer (14). Discard packing and oil seal.
13. Straighten tabs on key washer (19). Remove round nut (20) key washer, and spacer (21) from bevel gear (5). Discard key washer.



NOTE

If inspection indicates that bevel gear requires replacement, do Step 14.

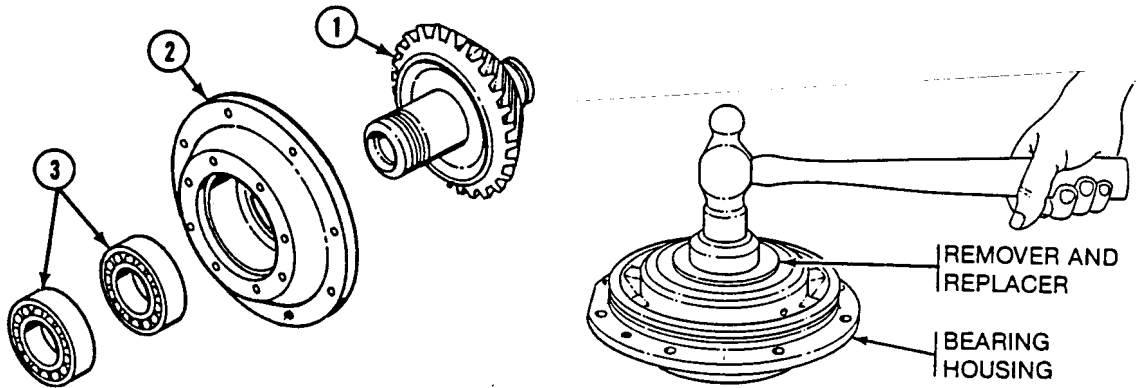
14. Remove bevel gear (1) from outer bearing housing (2). Attach clamp around bearing (3). Use arbor press, remover and replacer (WP0033 00, Item 24) and gear inserter. Remove clamp.



NOTE

If inspection indicates that tapered roller bearings require replacement, or if bevel gear was removed, do Step 15.

15. Remove bearings (3) from outer bearing housing (2). Use remover and replacer (WP 0033 00, Item 24). Discard bearings.

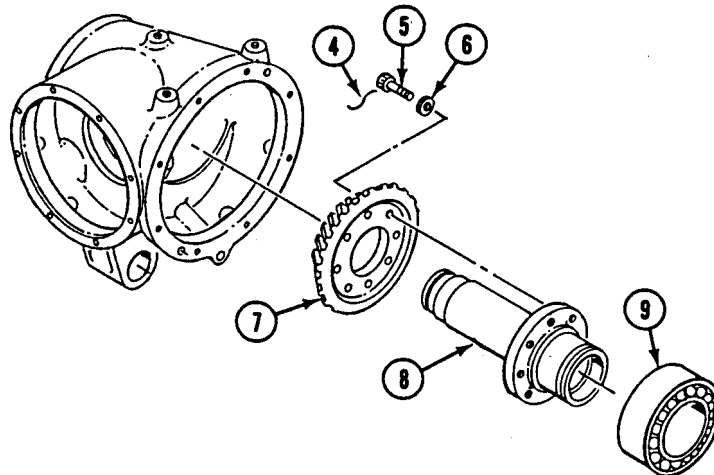


NOTE

If inspection indicates that output bevel gear, hub, or ball bearing require replacement, do Step 16 and Step 17.

Inspect eight cap screws to determine grade type. If screws are not grade 8 (six radial marks on screw heads), discard screws.

16. Remove lockwire (4) (four places), eight cap screws (5), and washers (6) holding gear (7) to hub (8). Remove gear. Discard lockwire. If gear is damaged, discard gear.
17. Press bearing (9) from hub (8). Discard bearing.



NOTE

If inspection indicates that ball bearing requires replacement, do Step 18.

18. Remove ball bearing (1) from gearbox housing (2). Use a suitable bearing puller.

NOTE

If inspection indicates resilient mount requires replacement, do Step 19.

19. Remove resilient mount (3) from gearbox housing (2). Use remover and replacer (WP 0033 00, Item 21).

NOTE

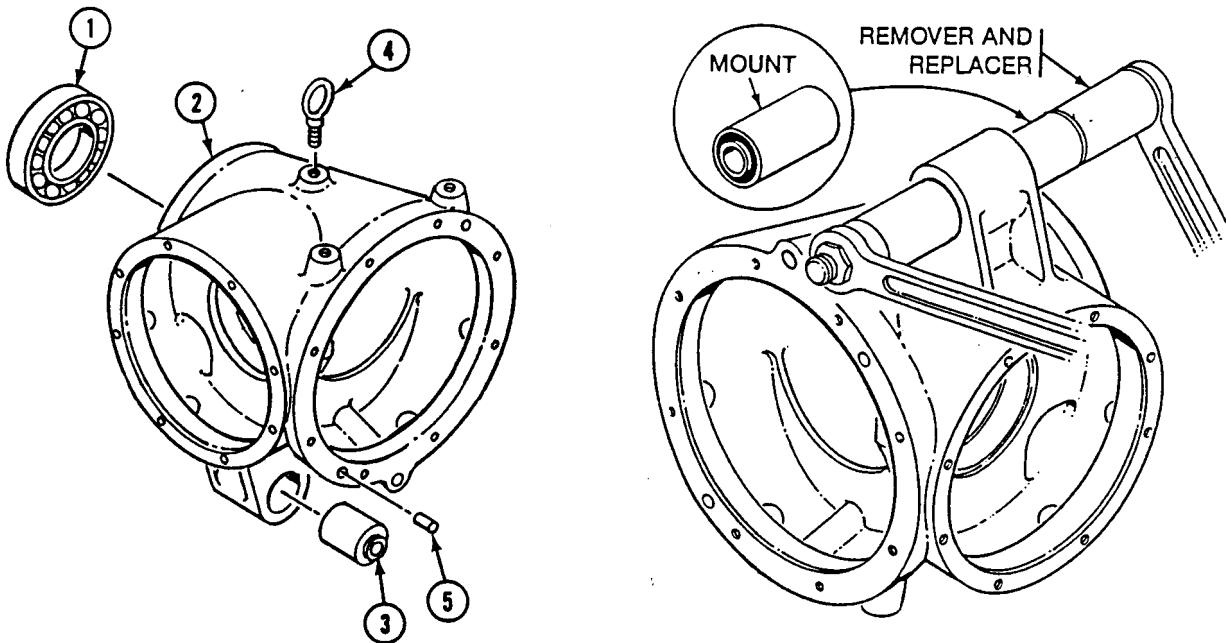
If inspection indicates that eye bolt requires replacement, do Step 20.

20. Remove eye bolt (4) from gearbox housing (2). Discard eye bolt.

NOTE

If inspection indicates that pin(s) require replacement, do Step 21.

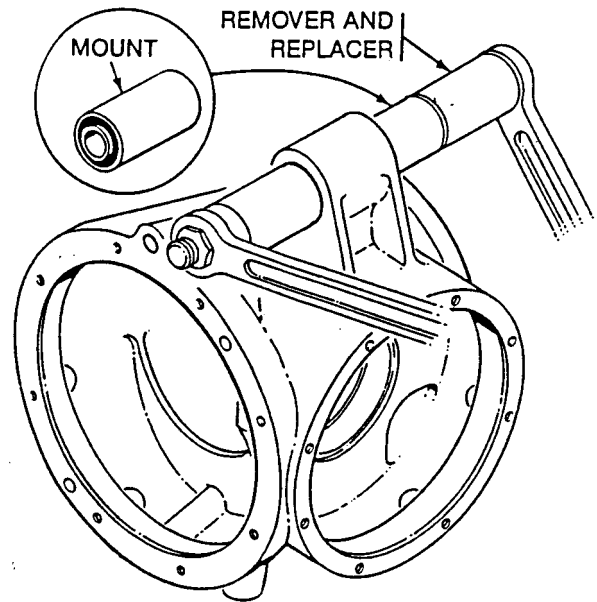
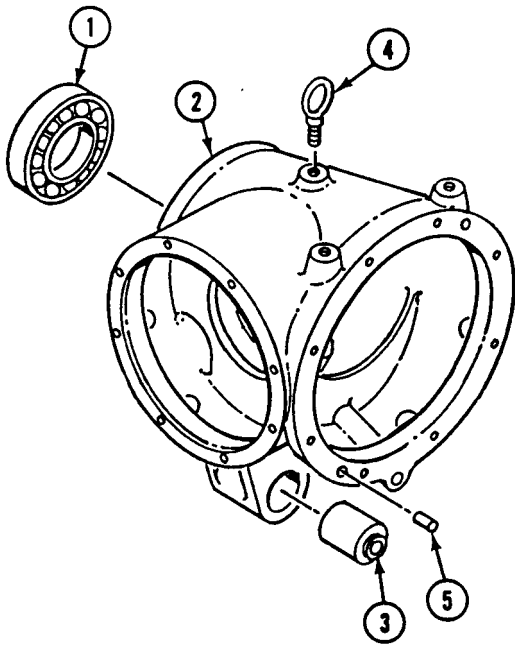
21. Remove pin(s) (5) from housing (2). Discard pins.

**CLEANING****CLEAN, INSPECT, AND REPAIR**

1. Before inspection, repair, or assembly, clean all parts of each output shaft assembly. See WP 0014 00.
2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures. Check for minimum, maximum, and important clearances of new or rebuilt parts and for wear limits to which a part may be worn before replacement is required (page 0028 00-21).

ASSEMBLY

1. If pin(s) (5) was removed, install pin(s) in gearbox housing (2) so they protrude $19/32 \pm 1/32$ inch ($1.4 \pm .076$ cm).
2. If eye bolt (4) was removed, install new eye bolt in gearbox housing (2).
3. If resilient mount (3) was removed, install new resilient mount in gearbox housing (2). Use remover and replacer (WP 0033 00, Item 21).
4. If ball bearing (1) was removed, install new ball bearing in gearbox housing (2). Use arbor press and 5 inch (13 cm) diameter ring (1 inch (2.5 cm) minimum length).

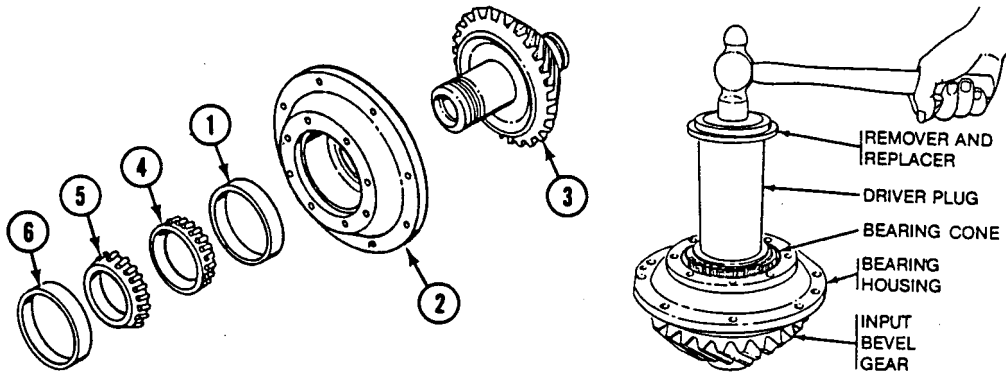


NOTE

If both tapered roller bearings were removed in page 0028 00-2, do Steps 5 - 8.

To aid in installation of bearings, heat housing to 250°-300°F (121°-149°C) and freeze bearing cups.

5. Install cup (1) of inner roller bearing in bearing housing (2). Use remover and replacer (WP 0034 00, Item 24) and bearing inserter.
6. Insert shaft of bevel gear (3) into bearing housing (2).
7. Heat cone (4) of inner bearing and cone (5) of outer bearing to 240°-260°F (116°-127°C). Install cones in bearing housing (2). Use remover and replacer (WP 0033 00, Item 24) and bearing inserter.
8. Install cup (6) of outer bearing in bearing housing (2). Use remover and replacer (WP 0033 00, Item 24) and bearing inserter.

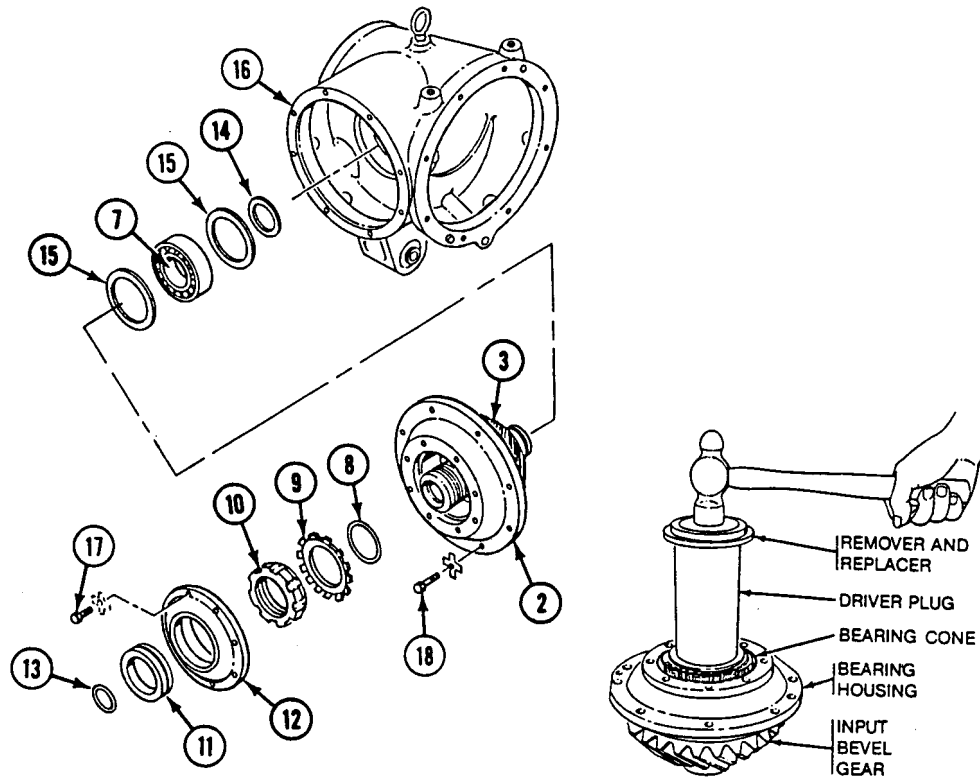


9. If inner race (7) of ball bearing was removed, install new race in bevel gear (3). Use remover and replacer (WP 0033 00, Item 24) and bearing inserter.
10. Install ring spacer (8), new key washer (9), and round nut (10) on bevel gear (3). Bend tangs on key washer.
11. Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to outer edge of encased oil seal (11).

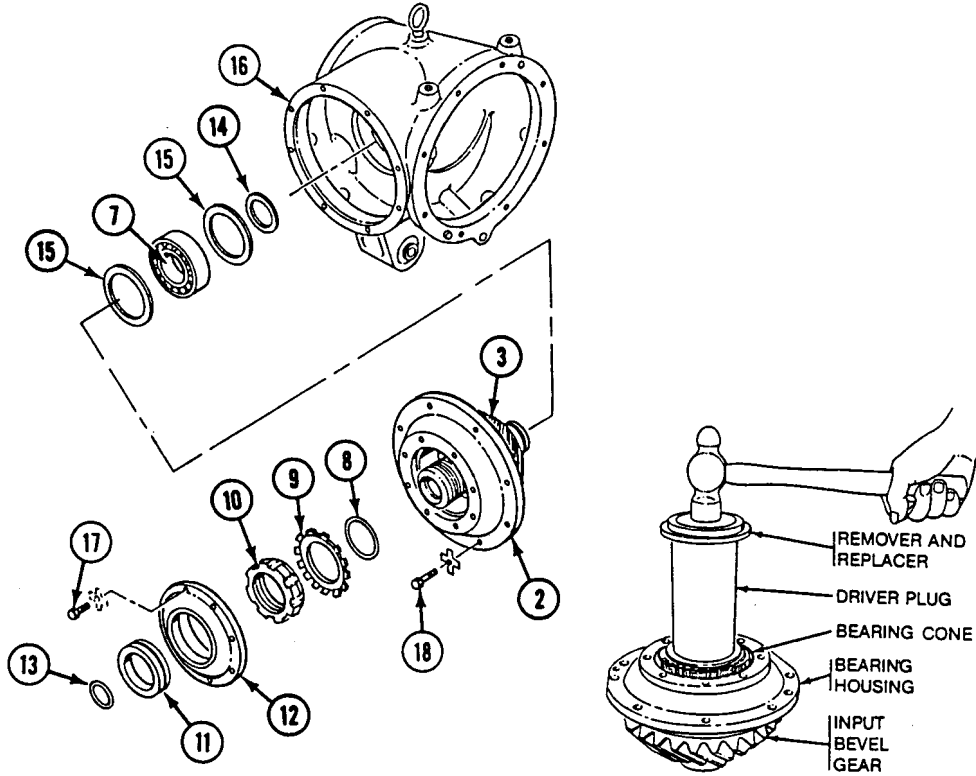
CAUTION

To prevent damage to encased oil seal, do not press seal beyond face of bore. After installation, seal must be flush with outer surface within .032 inch (.081 cm).

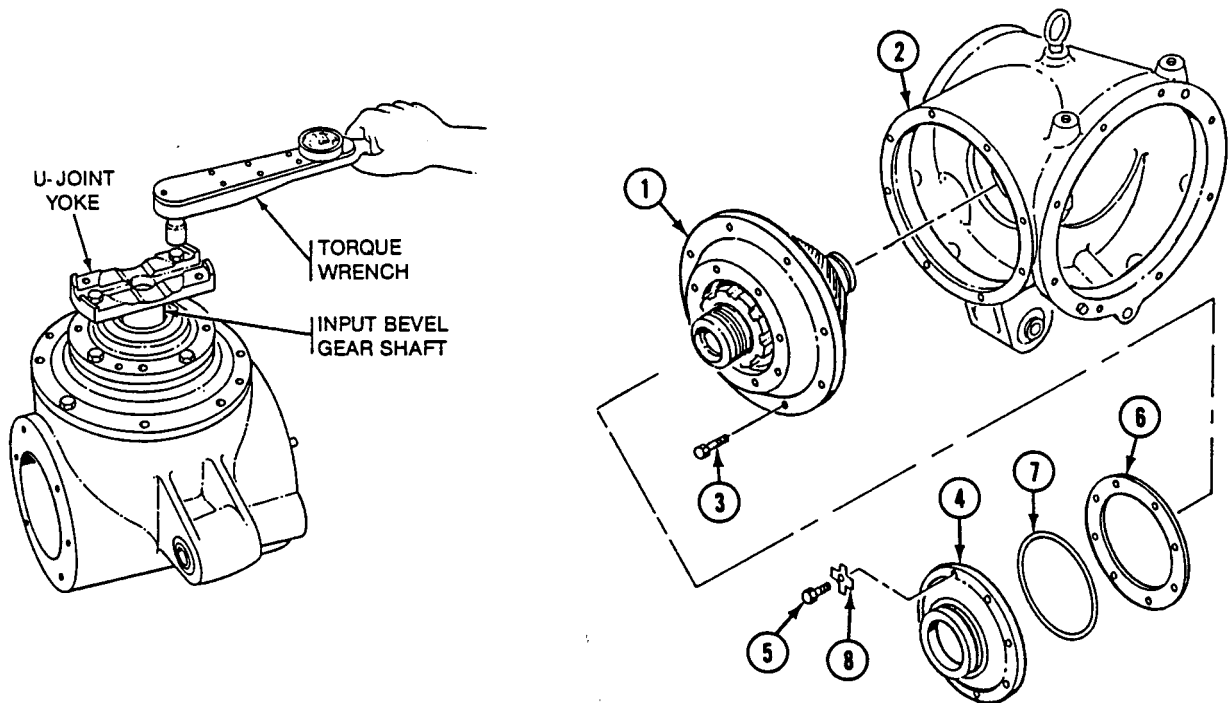
12. Install encased oil seal (11) in oil seal retainer (12). Use remover and replacer (WP 0033 00, Item 24) and hammer.



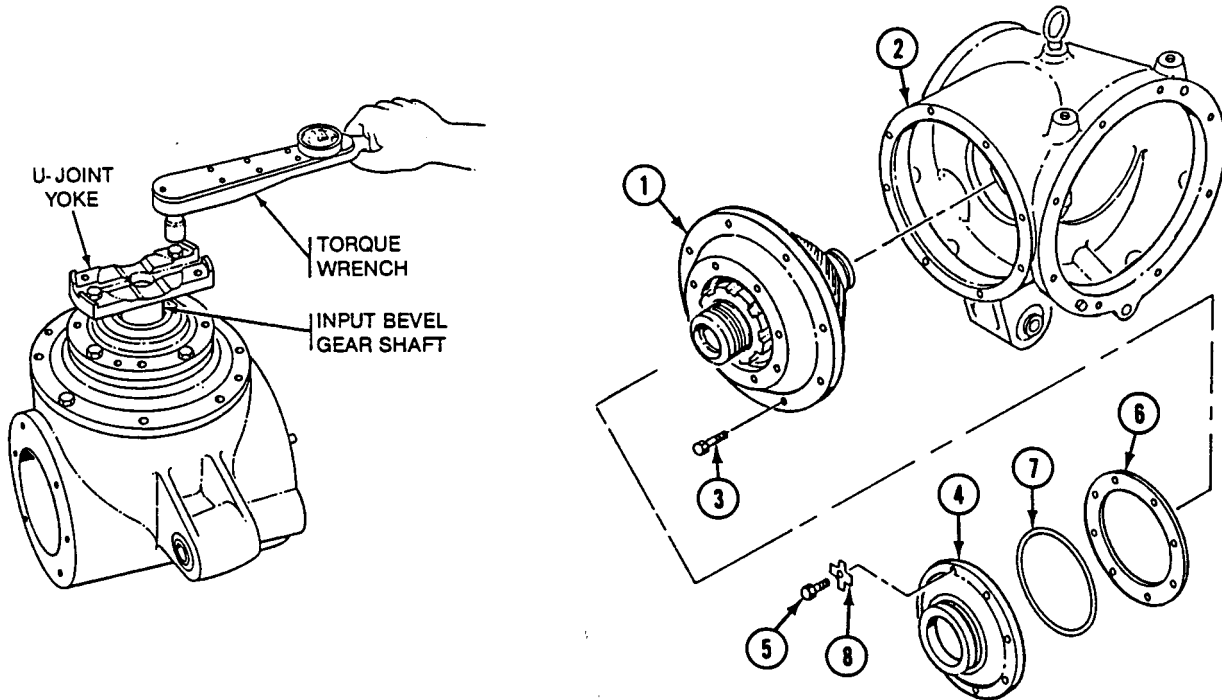
13. Lubricate new packing (13) with grease or petrolatum. Install packing on shaft of bevel gear (3).
14. Install retaining ring (14) on shaft of bevel gear (3).
15. Install outer race of bearing (7) with two retaining rings (15) in gearbox housing (16).
16. Lubricate six cap screws (17) and (18) with engine oil.



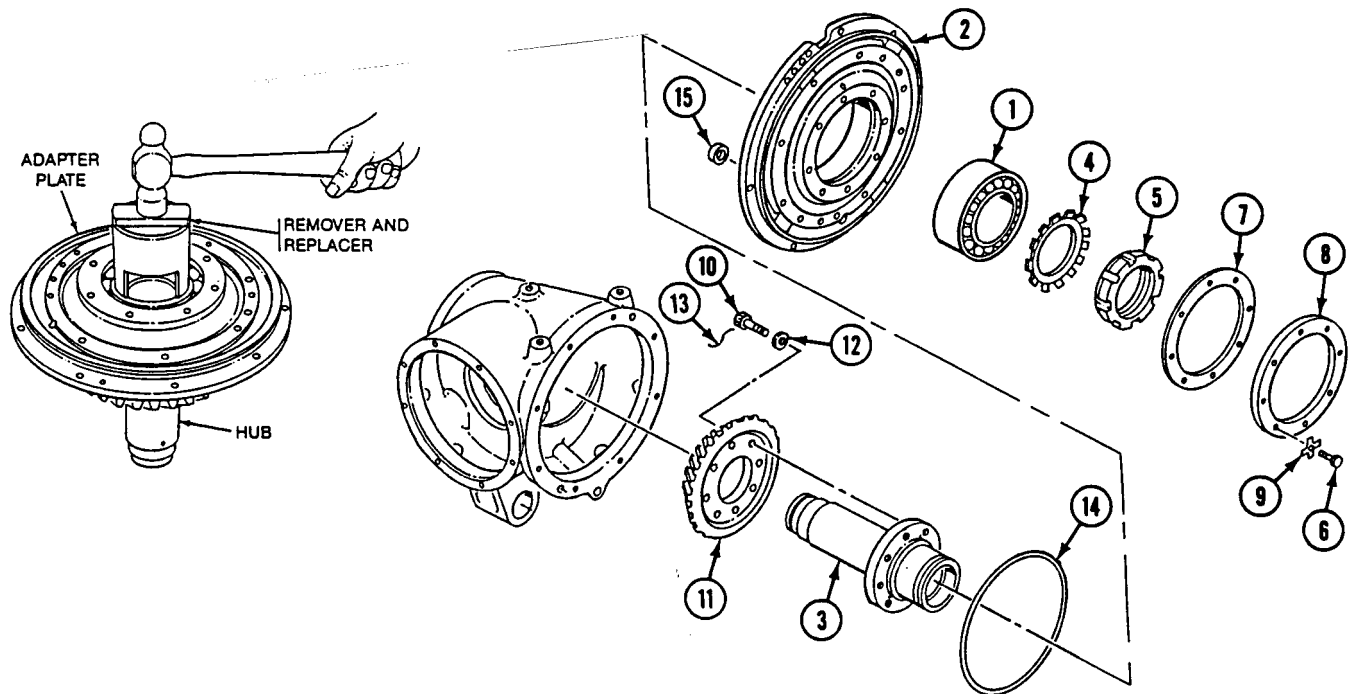
17. Without shim installed, place bearing housing (1) on gearbox housing (2). Secure with two cap screws (3) positioned 180 degrees apart. Tighten screws to 10-25 lb-in (2 N•m) torque. Use torque wrench (WP 0033 00, Item 39).
18. Place oil seal retainer (4) on bearing housing (1). Secure with four cap screws (5) spaced 90 degrees apart. Tighten screws to 10-25 lb-in (2 N•m) torque. Use torque wrench (WP 0033 00, Item 39).
19. Measure and record gap between retainer (4) and bearing housing (1) at four equal places around retainer and determine the average of these readings. Peel shim (6) to this thickness or to the next laminate thinner.
20. Remove four cap screws (5) and retainer (4) from bearing housing (1).
21. Lubricate new packing (7) with grease or petrolatum. Install packing on retainer (4).
22. Clean threads of eight cap screws (5). Apply light coat of antiseize compound to threads at installation.
23. Place peeled shim (6) and retainer (4) on bearing housing (1). Secure with eight new key washers (8) and cap screws (5). Tighten screws to 252-300 lb-in (28-34 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Do not bend tabs on key washers at this time.



24. Check preload by installing input yoke (part of carrier power train installation) with cap screw installed in yoke flange. Apply torque to cap screw.
25. Reading on torque wrench (WP 0033 00, Item 39) should be 10-25 lb-in (2 N•m) rolling torque (take reading when the yoke just starts to turn).
26. If reading is not obtained, remove retainer (4) and peeled shim (6) from bearing housing (1). Repeat Steps 18 - 25 above with new shim until correct reading is obtained.
27. Remove two cap screws (3) and bearing housing (1) as an assembly from gearbox housing (2).



28. Install ball bearing (1) in adapter plate (2). Use a soft plastic hammer.
29. Place bearing (1) with plate (2) to hub (3) and install bearing. Use remover and replacer (WP 0033 00, Item 23) and hammer.
30. Secure hub (3) to bearing (1) with new key washer (4) and round nut (5). Bend tangs on key washer.
31. Lubricate four cap screws (6) with engine oil.
32. Without shim (7) installed, place bearing retainer (8) on plate (2). Secure with four cap screws (6) spaced 90 degrees apart. Tighten screws to 14-16 lb-in (1 N.m) torque. Use torque wrench (WP 0033 00, Item 39).
33. Measure and record gap between retainer (8) and plate (2) at four equal places around retainer and determine the average of the readings and subtract .002-.003 inch (.005-.008 cm) to obtain required deflection in retainer (8). Peel shim (7) to this thickness or to the next laminate thinner.
34. Remove four cap screws (6) and retainer (8) from plate (2).
35. Clean threads of eight cap screws (6). Apply light coat of antiseize compound to threads at installation.
36. Place peeled shim (7) and retainer (8) on plate (2). Secure with eight new key washers (9) and cap screws (6). Tighten screws to 252-300 lb-in (28-34 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.

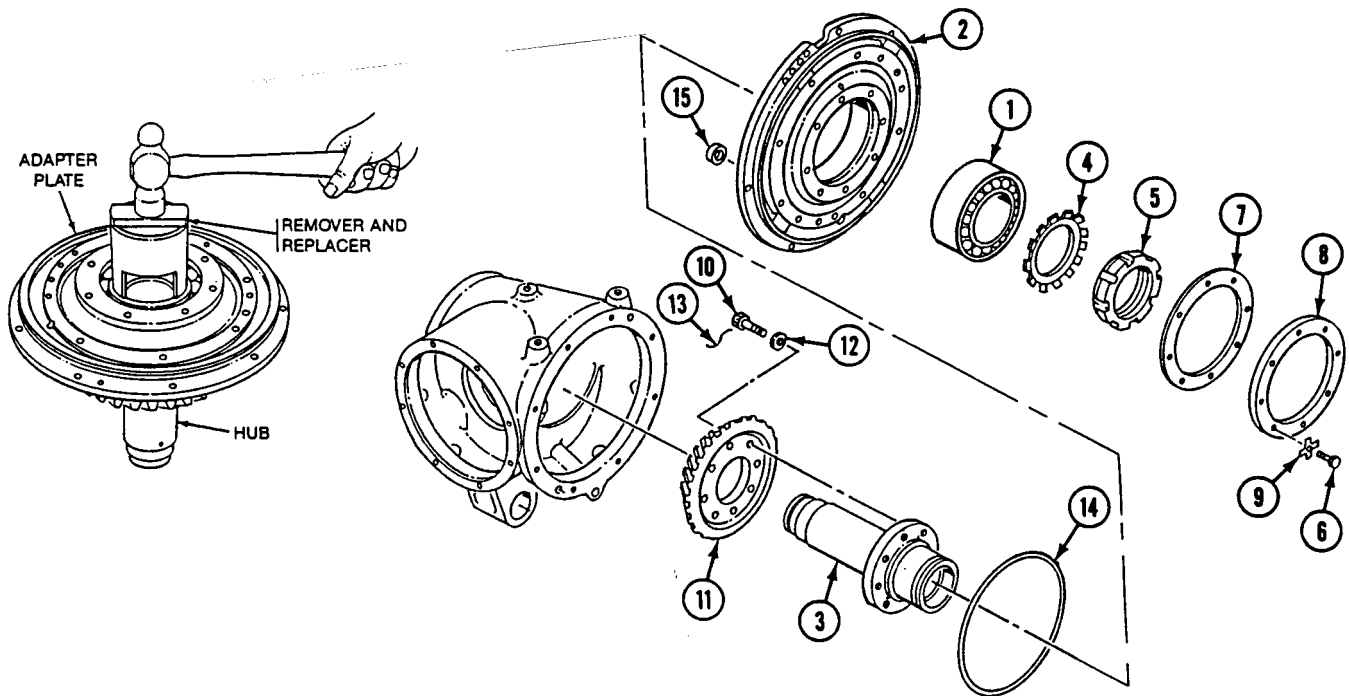


NOTE

If output bevel gear was removed in page 0029 00-2, do Steps 37 - 39.

Check that eight cap screws being installed are grade 8 screws (six radial marks on screw heads).

37. Clean threads of eight cap screws (10) and lubricate threads with engine oil.
38. Position bevel gear (11) to hub (3) and secure with eight washers (12) and cap screws (10). Tighten screws to 95-100 lb-ft (129-137 N•m) torque. Use torque wrench (WP 0033 00, Item 43).
39. Install new lockwire (13) between adjacent screws (four places).
40. Lubricate new packing (14) with grease or petrolatum. Install new gasket (15) and packing on plate (2).



41. Measure distance between face of bevel gear (1) and adapter plate (2) (dimension Y) at three places 120 degrees apart. Take the average of these readings and record.
42. Note true mounting distance etched on face of gear (1) (dimension X) and add the dimension recorded above. Subtract 5.002 inches (12.7 cm) from the resulting value and record as the thickness of shim. Peel shim (3) to this thickness.

NOTE

Check that eight cap screws being installed are grade 8 screws (six radial marks on screw heads).

43. Lubricate four cap screws (4) with engine oil.

NOTE

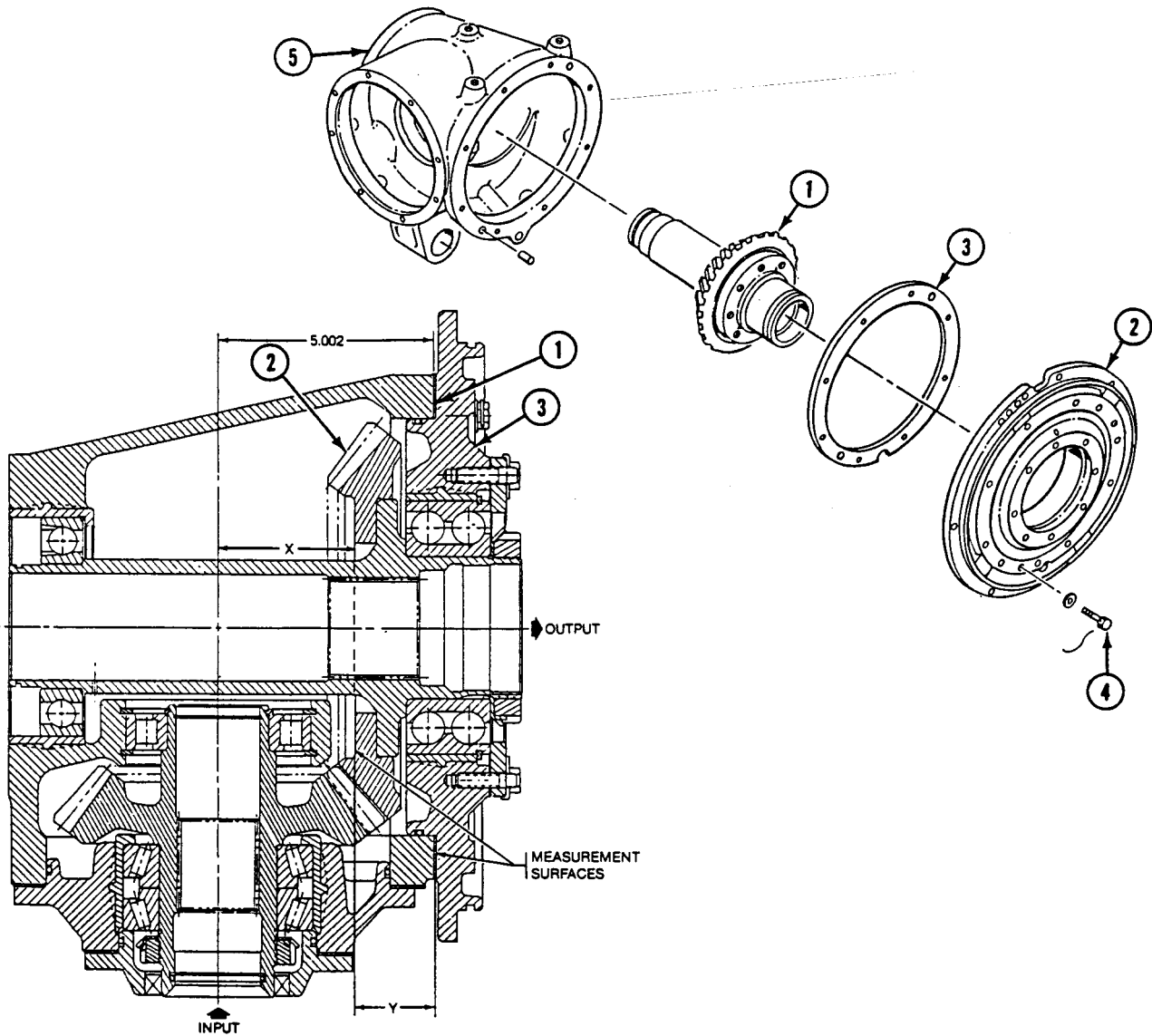
$$ST = X + Y - 5.002 \text{ inch}$$

ST = Thickness of shim (3)

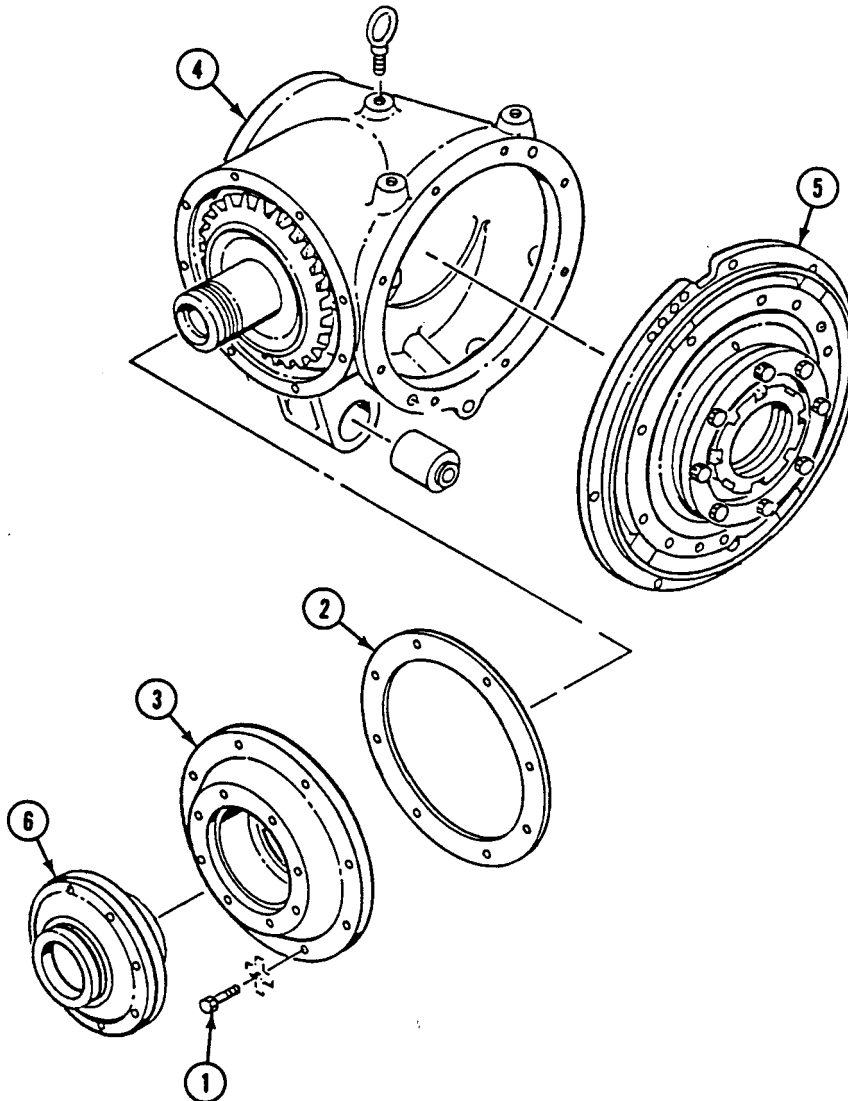
X = Etched true mounting distance on face of bevel gear (1)

Y = Measured distance after assembly of bevel gear (1) and adapter plate (2)

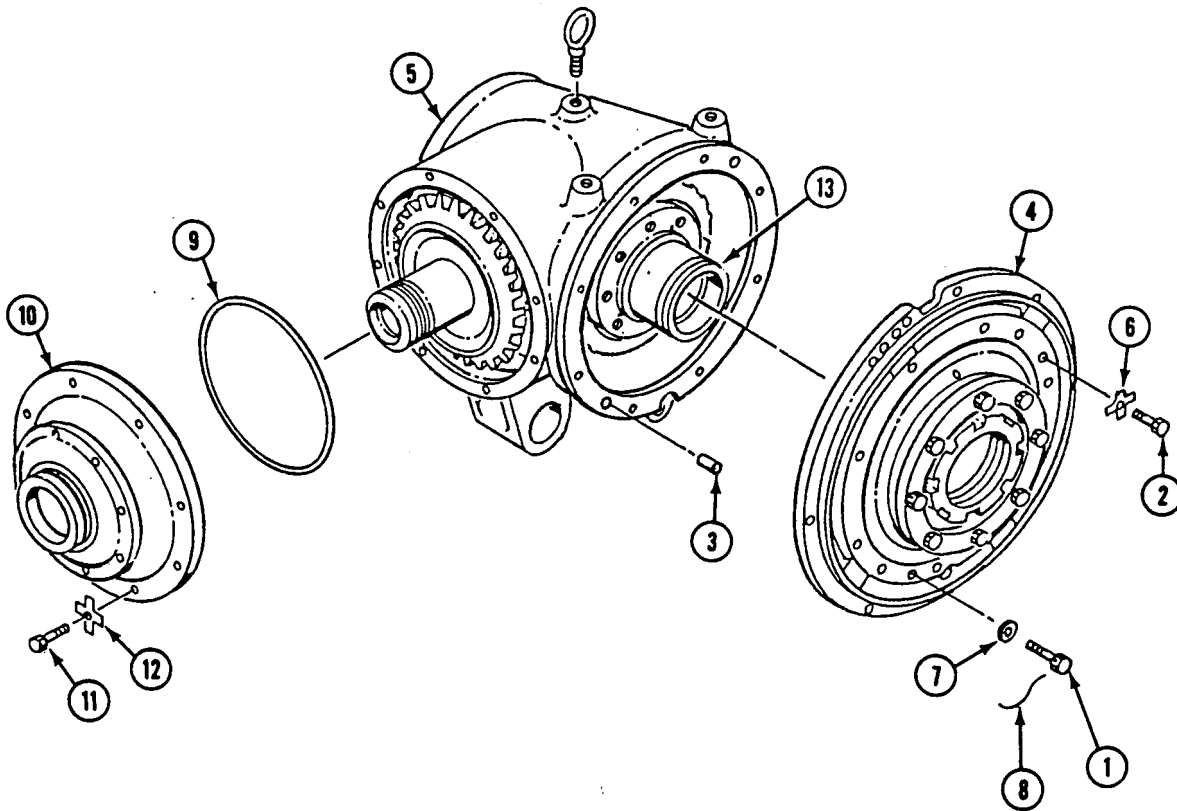
44. Place peeled shim (3) and output assembly (adapter plate (2) with attached parts) on gearbox housing (5). Secure with four screws (4) spaced 90 degrees apart. Tighten screws to 14-16 lb-in (1.7 N•m) torque. Use torque wrench (WP 0033 00, Item 39).



45. Lubricate two cap screws (1) with engine oil.
46. Install peeled shim (2) and input assembly (bearing housing (3) with attached parts) on gearbox housing (4). Secure with two cap screws (1) spaced 180 degrees apart. Tighten screws to 14-16 lb-in (1.7 N•m) torque. Use torque wrench (WP 0033 00, Item 39).
47. Install dial indicator gage (WP 0033 00, Item 12) and fabricated differential backlash tool on output assembly (adapter plate (5) with attached parts). Install gage feeler rod into slot on tool arm.
48. Hold oil seal retainer (6) on input assembly and rotate plate (5) on output assembly and check gage for backlash. Backlash should read .006-.011 inch (.15-.28 mm).
49. If backlash is too high, remove laminate(s) from shim (2). Adjust shim until correct reading is obtained.
50. Remove two cap screws (1) and separate input assembly from gearbox housing (4).

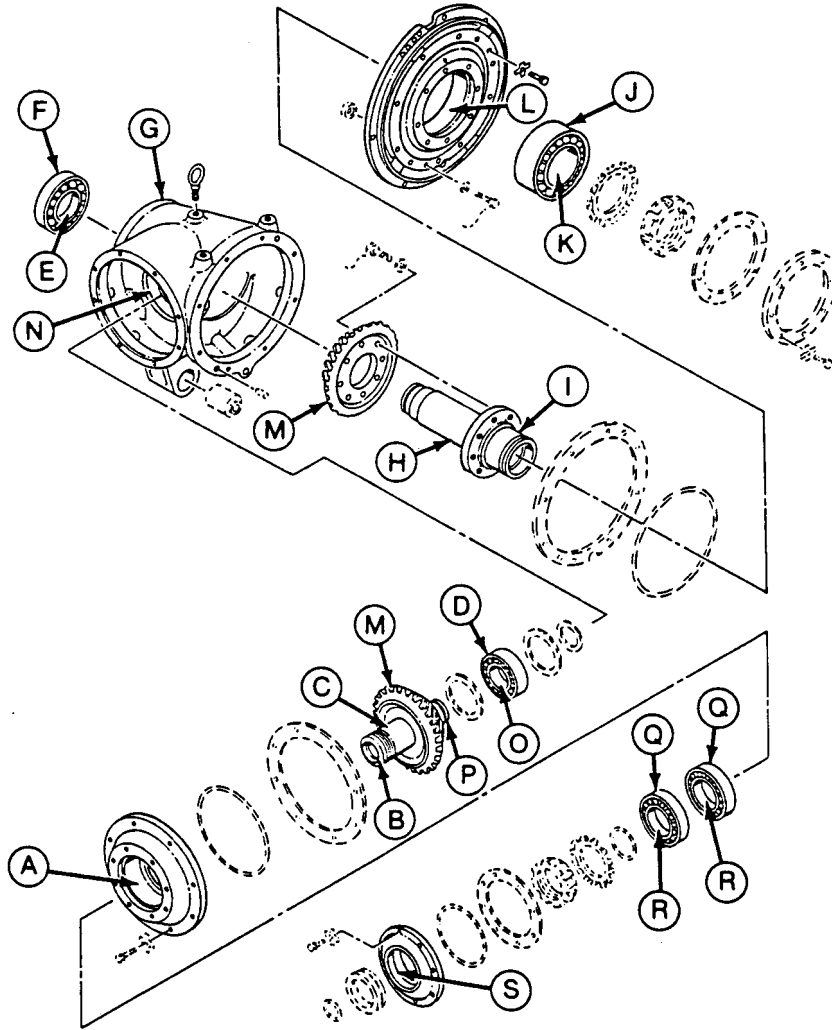


51. Remove four cap screws (1).
52. Clean 10 cap screw threads of cap screws(1), cap screws(2), and 2 alignment pins (3).
53. Apply a thin film of sealing compound (WP 0035 00, Item 12) or (WP 0035 00, Item 13) to 10 cap screw threads of cap screws (1), cap screws(2) and 2 dowel holes marked G on surfaces in contact with adapter plate (4).
54. Secure output assembly on gearbox housing (5) with two new key washers (6), cap screws (2), eight washers (7), and cap screws (1). Tighten screws (1) to 300-360 lb-in (34-41 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on two key washers.
55. Secure eight cap screws (1) in pairs with new lockwire (8) (four places with 13 inches (33 cm) minimum length of wire required for each place).
56. Lubricate new preformed packing (9) with grease or petrolatum. Install packing on bearing housing (10).
57. Clean threads of eight cap screws (11). Apply light coat of antiseize compound to threads at installation.
58. Secure input assembly on gearbox housing (5) with eight new key washers (12) and cap screws (11). Tighten screws to 252-300 lb-in (28-34 N•m) torque. Use torque wrench (WP 0033 00, Item 41). Bend tabs on key washers.
59. Coat interior splines of hub (13) with engine oil.



WEAR LIMITS

1. See TM 9-214 to check bearings.
2. Check parts that have reference letters in figure.



3. Check the parts dimensions with chart to determine replacement.

Table 1. DIFFERENTIAL RIGHT ANGLE GEARBOX WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Inside diameter at bearing surface in bearing housing	4.4375 to 4.4385	4.4390
B	Outside diameter at seal surface of bevel gear	2.6220 to 2.6280	2.6200
C	Outside diameter at bearing surface of bevel gear	2.7515 to 2.7525	(*)(**)
D	Outside diameter of bearing	4.3301 to 4.3307	(*)(**)
E	Inside diameter of bearing	2.9522 to 2.9528	(*)(**)
F	Outside diameter of bearing	5.1173 to 5.1181	(*)(**)
G	Inside diameter at bearing surface of housing	3.1179 to 5.1189	(**) 5.1194
G-F	Fit of bearing in housing	0.0016L to 0.0002T	0.0021L
H	Outside diameter at bearing surface of gear hub	2.9527 to 2.9533	(*)(**)
H-E	Fit of bearing on gear hub	0.0001L to 0.0011T	(*)
I	Outside diameter at bearing surface of gear hub	3.3464 to 3.3471	(*)(**)
J	Outside diameter of bearing	5.9047 to 5.9055	(*)(**)
K	Inside diameter of bearing	3.3457 to 3.3465	(*)(**)
K-I	Fit of bearing on gear hub	0.0001L to 0.0014T	(*)
L	Inside diameter of bearing surface of adapter plate	5.9053 to 5.9060	(**) 5.9065
L-J	Fit of bearing in plate	0.0013L to 0.002T	0.0018L
M	Backlash between gears in plane of rotation	0.008 to 0.013	(*)(***)
N	Inside diameter at bearing surface in housing	4.3300 to 4.3309	(**) 4.3312
N-D	Fit of bearing in housing	0.0008L to 0.0007T	0.0011L
O	Inside diameter of bearing	2.3616 to 2.3622	(*)(**)
P	Outside diameter at bearing surface of bevel gear	2.3630 to 2.3637	(*)(**)
P-O	Fit of bearing on bevel gear	0.0008T to 0.0021T	(*)
Q	Outside diameter of bearing	4.4375 to 4.4385	(*)(**)
Q-A	Fit of bearing in housing	0.0010L to 0.0010T	0.0015L
R	Inside diameter of bearing	2.7500 to 2.7510	(*)(**)
R-C	Fit of bearing on bevel gear	0.0005T to 0.0025T	(*)
S	Inside diameter at seal surface of retainer	3.3490 to 3.3510	(*)(****)

* Must be within new parts dimensions.
** Measure only if there is visual indication of bearing turning.
*** To measure backlash see repair differential right angle gearbox (WP 0029 00).
**** Measure only if there is visual indication of surface damage.

END OF TASK

REPAIR STEERING CONTROL DIFFERENTIAL HOUSING

0029 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0029 00-2).
- Cleaning (page 0029 00-3).
- Assembly (page 0029 00-4).
- Wear Limits (page 0029 00-5).

INITIAL SETUP:

Maintenance Level

General Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Remover/Replacer (WP 0033 00, Item 21)
- Socket wrench set, 3/8 in drive (WP 0033 00, Item 34)
- Torque wrench (WP 0033 00, Item 41)
- Vernier height gage (WP 0033 00, Item 8)

References

TM 9-214

Materials/Parts

- Antiseize compound (WP 0035 00, Item 1)
- Non-electrical wire (WP 0035 00, Item 9)
- Sealing compound (WP 0035 00, Item 14)
- Grommet
- Needle roller bearing (4)

Equipment Condition

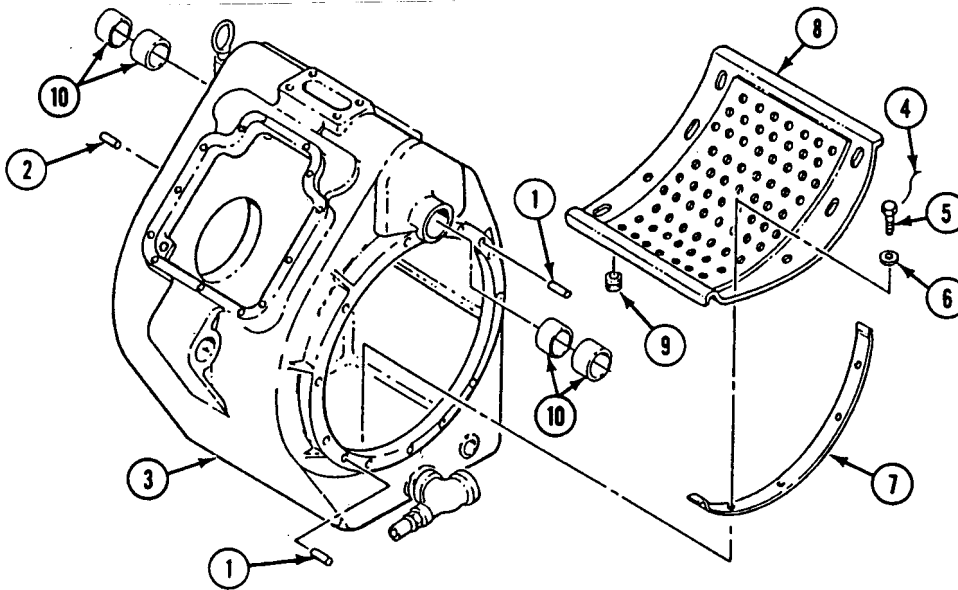
- Output shaft assemblies removed (WP 0023 00)
 - Differential right angle gearbox removed (WP 0027 00)
 - Steering control differential housing removed from steering control differential (WP 0029 00)
-

DISASSEMBLY

NOTE

If inspection indicates alignment dowel pins require replacement, do Step 1.

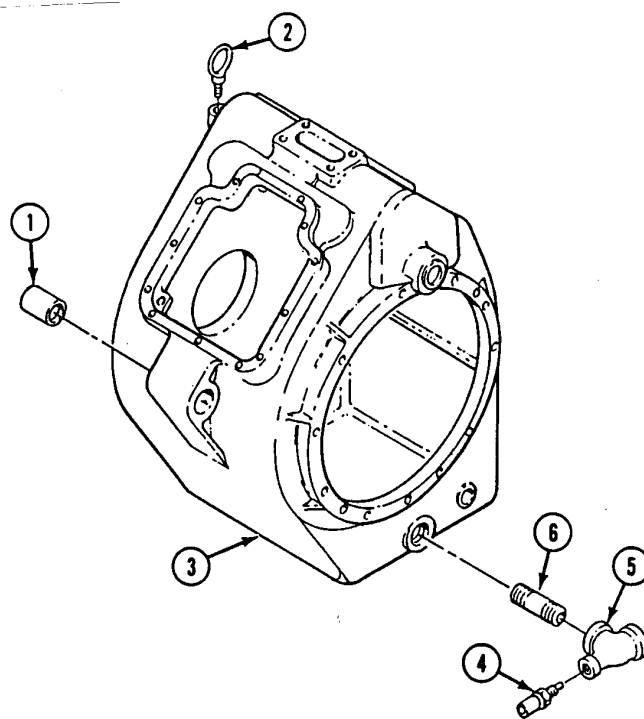
1. Remove alignment dowel pin (1) and dowel pin (2) from housing (3). Discard pins.
2. Remove lockwire (4), eight cap screws (5), and washers (6) holding two retainers (7) and strainer (8) to housing (3). Remove retainers (7) and strainer (8). Discard lockwire.
3. Remove grommet (9) from strainer (8). Discard grommet.
4. Remove four needle roller bearings (10). Discard needle roller bearings.



NOTE

If inspection indicates resilient mounts require replacement, do Step 5.

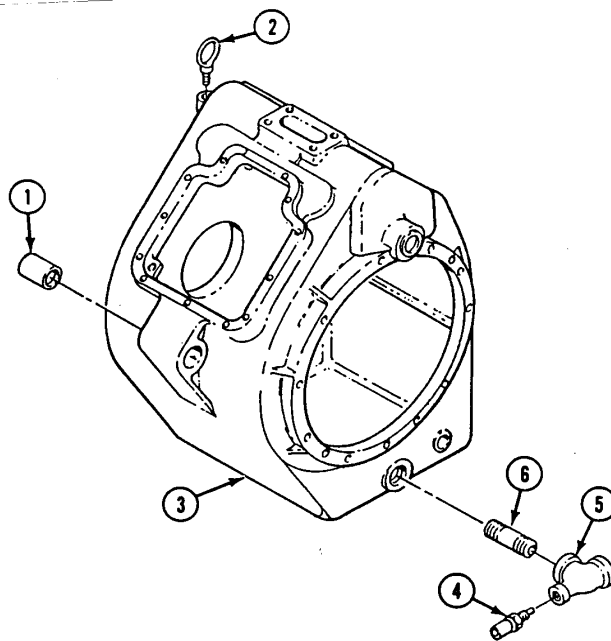
5. Remove resilient mounts (1). Use remover and replacer.
6. Turn lifting eye (2) to left and remove from housing (3).
7. Remove high oil temperature switch (4), pipe tee (5), and pipe nipple (6) from housing (3).

**CLEANING****CLEAN, INSPECT, AND REPAIR**

1. Before inspection, repair, or assembly, clean all parts of steering control differential housing (WP 0014 00).
2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures. Check for minimum, maximum, and important clearances of new or rebuilt parts, and for wear limits which determine when part will be replaced page 0029 00-5.
3. Inspect surface of strainer and retainers for wear, scratches, cracks, and deformations. Remove minor defects. Replace parts that can not be repaired.
4. Inspect strainer mesh for enlarged holes and breaks. Repair damage or replace strainer.
5. Inspect alignment pin holes in housing for elongation or other damage. Replace housing if holes are damaged beyond repair.

ASSEMBLY

1. Apply sealing compound to small end of threads on pipe nipple (6). Do not apply sealant beyond small end of pipe threads. Do not fill leading thread.
2. Screw pipe nipple (6) into lower well on housing (3).
3. Install pipe tee (5) on pipe nipple (6). Angle tee for connection to differential oil pump hose.
4. Install high oil temperature switch (4) on pipe tee (5). Tighten switch to 240-300 lb-in (27-34 N•m) torque. Use torque wrench and socket wrench set.



5. Clean threads of lifting eye (1). Apply a light coat of antiseize compound to threads.
6. Install lifting eye (1) in housing (2) by turning lifting eye to the right.

NOTE

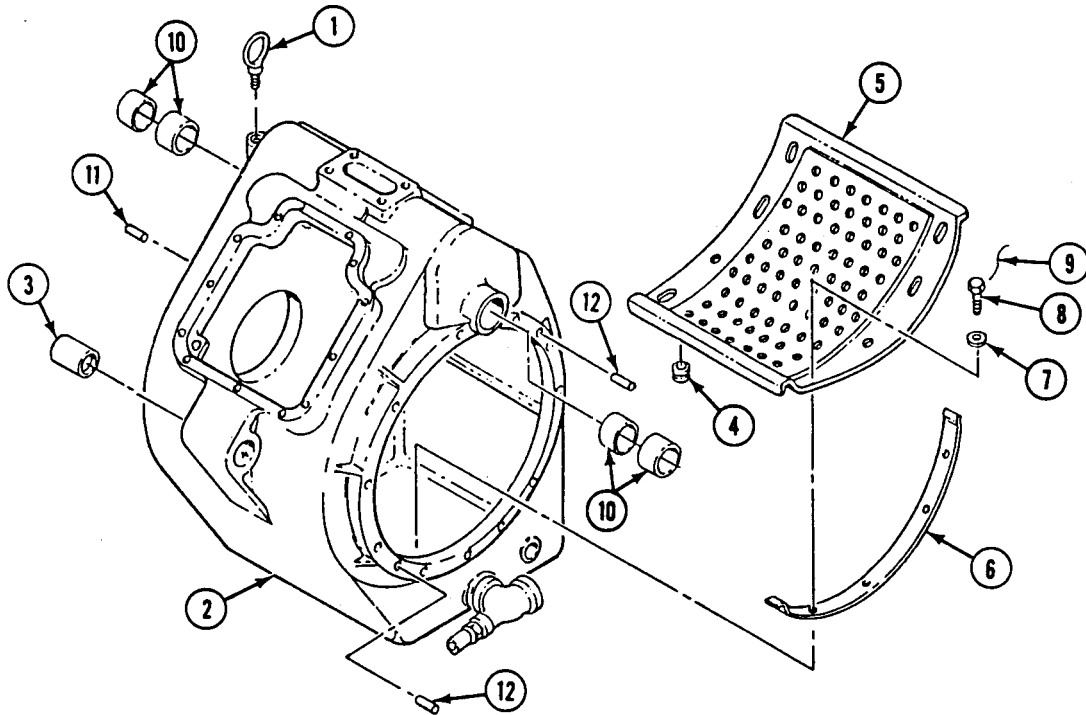
If resilient mounts were removed in page 0029 00-2, do Step 7.

7. Install resilient mounts (3). Use remover and replacer.
8. Install new grommet (4) in strainer (5).
9. Place two retainers (6) in housing (2).
10. Place strainer (5) in housing (2). Secure to two retainers (6) with eight washers (7) and cap screws (8). Install new lockwire (9) between screws on each retainer.
11. Install two new needle roller bearings (10) on right side housing (2).
12. Install two new needle roller bearings (10) on left side housing (2).

NOTE

If any alignment dowel pins were removed from housing in page 0029 00-2, do Step 13 and Step 14.

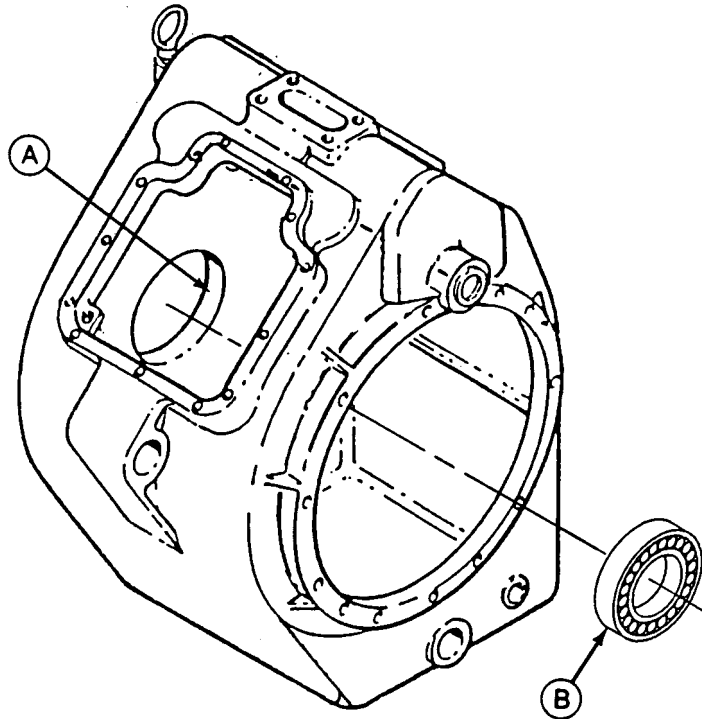
13. Install new alignment dowel pin (11) to protrude 21/32 inch (1.68 cm) from housing (2).
14. Install two new alignment dowel pins (12) to protrude 3/8 inch (.97 cm) from housing (2).



WEAR LIMITS

1. See TM 9-214 to check bearings.

2. Check parts that have reference letters in figure.



3. Check the parts dimensions with chart to determine replacement.

Table 1. STEERING CONTROL DIFFERENTIAL HOUSING WEAR LIMITS

Reference Letter	Point of Measurement	Size and Fit of New Parts	Wear Limits
A	Inside diameter at bearing surface in housing	5.1179 to 5.1189	(*) (**)
A-B	Fit of bearing in housing	0.0016L to 0.002T	
* Must be within new parts dimensions.			
** Measure only if there is visual indication of bearing turning.			

END OF TASK

CHAPTER 8

**DIRECT SUPPORT MAINTENANCE INSTRUCTIONS
FOR REPAIR SINGLE DISK PIVOT STEER BRAKE AND HYDRAULIC MASTER BRAKE
CYLINDER**

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
REPAIR SINGLE DISK PIVOT STEER BRAKE ASSEMBLY.....	0030 00
REPAIR HYDRAULIC MASTER BRAKE CYLINDER.....	0031 00

REPAIR SINGLE DISK PIVOT STEER BRAKE ASSEMBLY

0030 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0030 00-2).
- Cleaning (page 0030 00-5).
- Assembly (page 0030 00-6).

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Arbor press, hand (WP 0033 00, Item 16)
- Reliner, brake and clutch (WP 0033 00, Item 19)
- Remover/Replacer tool (WP 0033 00, Item 22)

References

See your -20

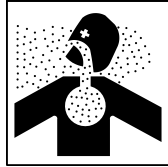
Equipment Condition

Pivot steer brake assembly removed from carrier (see your -20)

Materials/Parts

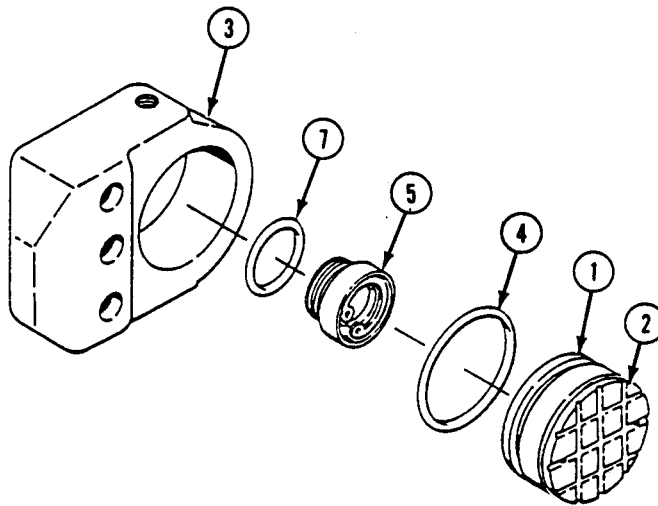
- Castile soap (WP 0035 00, Item 2)
- Grease (WP 0035 00, Item 6)
- Petrolatum (WP 0035 00, Item 10)
- Wiping rags (WP 0035 00, Item 17)
- Preformed packing
- Preformed packing
- Preformed packing
- Preformed packing
- Retaining ring

DISASSEMBLY

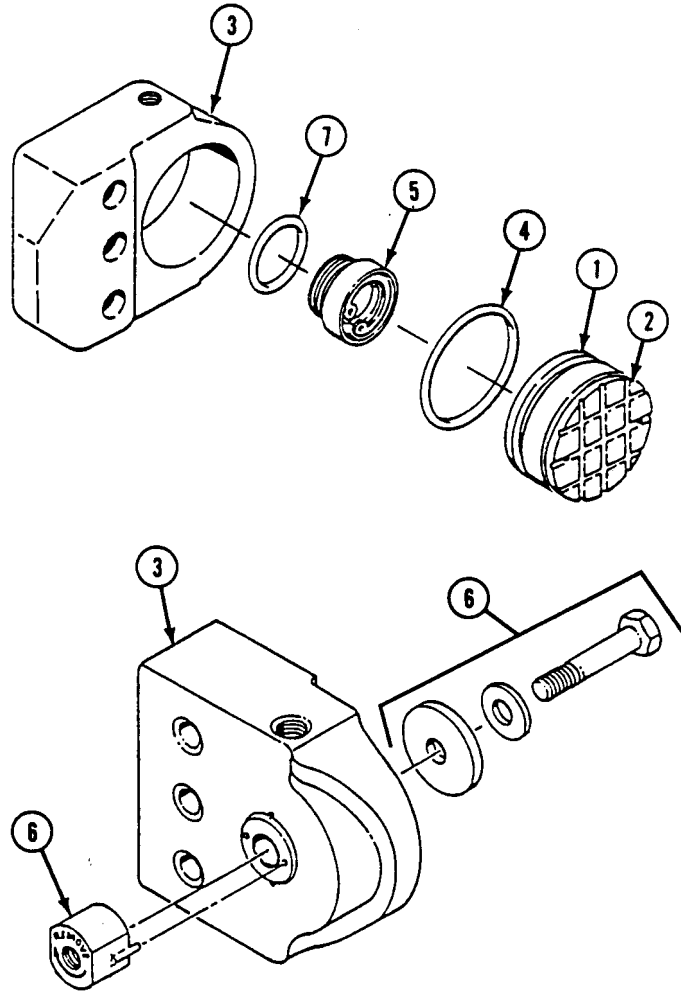
WARNING

Parts of the brake assembly may be coated with asbestos dust. Breathing this dust can harm personnel. Use a filter mask approved for use against asbestos dust. Never use compressed air or dry brush to clean these assemblies. Use an industrial type vacuum cleaner with a high-efficiency filter system to remove dust. Use water and a soft bristle brush or cloth to remove dirt or mud.

1. Remove release unit piston (1) with attached brake lining (2) from brake housing (3) using an arbor press. Remove packing (4) from piston. Discard packing.



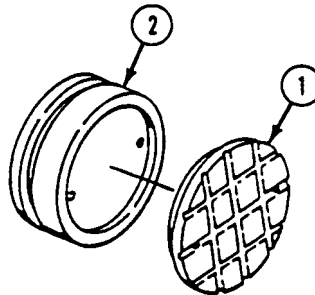
- Remove release unit nut (5) with attached parts from housing (3) using remover and replacer tool (6). Remove packing (7) from release unit nut. Discard packing.



NOTE

Turn remover and replacer tool in the clockwise direction.

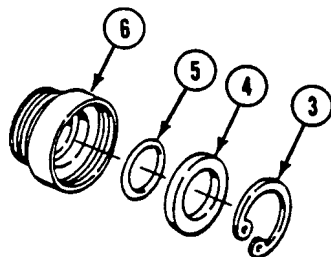
- Separate lining (1) from piston (2) using brake and clutch reliner.



NOTE

On some early brake assemblies, the lining is held in place with two rivets and two clips.
Remove and discard rivets, if installed.

4. Remove retaining ring (3), spacer (4), and packing (5) from release unit nut (6). Discard retaining ring and packing.



5. Repeat Steps 1 - 4 above for other housing.

NOTE

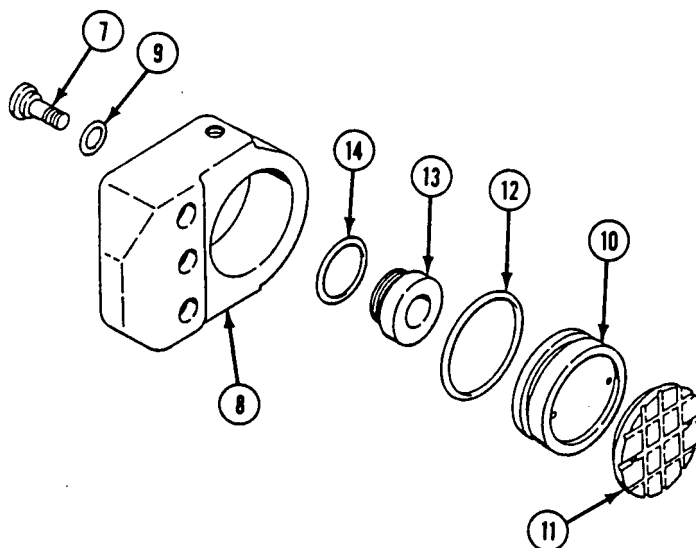
If vehicle has optional pivot steer brake, do Steps 6 - 9.

6. Remove shoulder screw (7) from brake housing (8). Remove packing (9) from screw. Discard packing.
7. Remove release unit piston (10) with attached brake lining (11) from housing (8) using an arbor press. Remove packing (12) from piston. Discard packing.
8. Remove release unit nut (13) from housing (8) using remover and replacer tool. Remove packing (14) from release unit nut. Discard packing.

NOTE

Turn remover and replacer tool in the clockwise direction.

9. Separate brake lining (11) from piston (10) using brake and clutch reliner.



CLEANING**CLEAN, INSPECT, AND REPAIR**

1. Before inspection, repair, or assembly, clean brake housing as described in (WP 0014 00). Clean piston assembly with solution of clean water and mild castile soap. Rinse in clean water until all traces of soap disappear. Wipe dry using a clean dry cloth.
2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures.
3. Check brake lining for chips, cracks, or excessive wear. If lining thickness is less than 1/4 inch, replace lining.

ASSEMBLY

NOTE

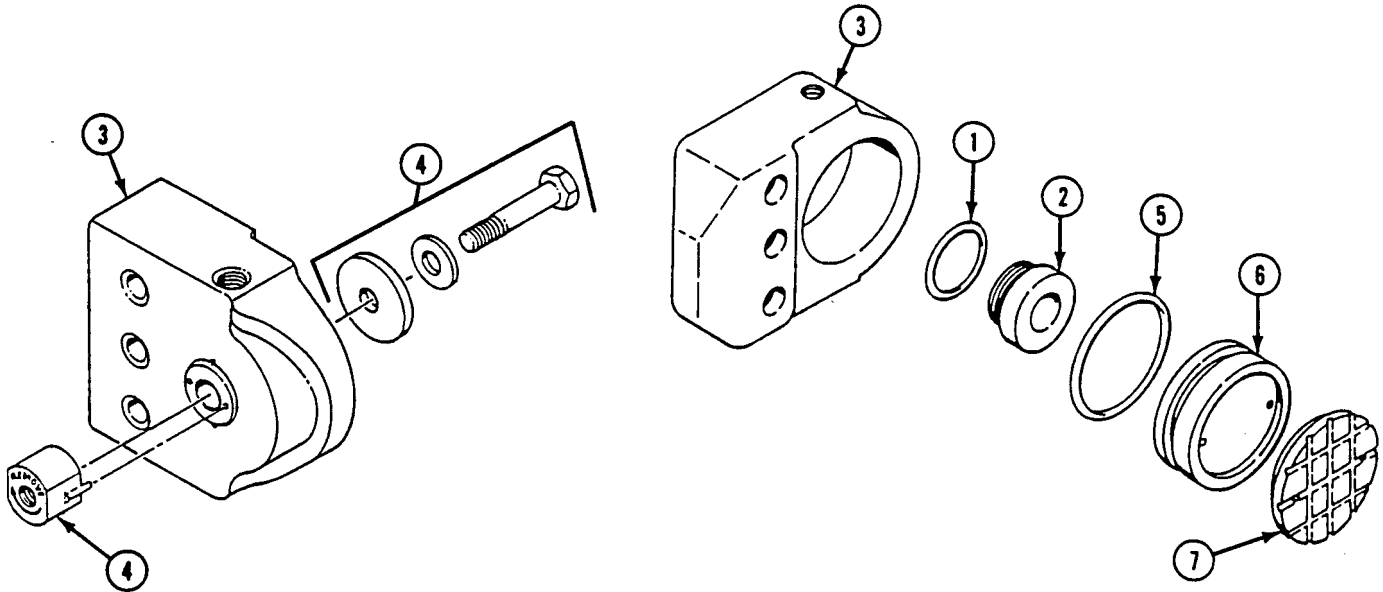
If optional pivot steer brake was removed, do Steps 1 - 6.

1. Lubricate new packing (1) with grease or petrolatum, and install on release unit nut (2).
2. Install release unit nut (2) in brake housing (3) using remover and replacer tool (4).

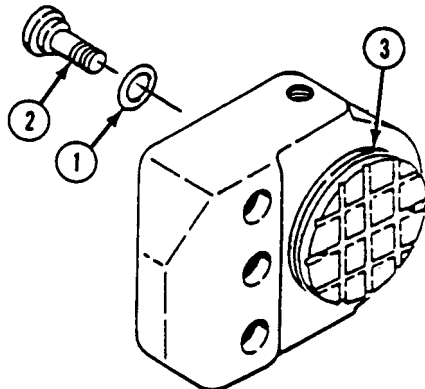
NOTE

Turn remover and replacer tool in the counterclockwise direction.

3. Deform one thread in release unit nut (2) securely in two places a minimum of 45 degrees from holes in unit.
4. Lubricate new packing (5) with grease or petrolatum, and install packing on release unit piston (6).
5. Place brake lining (7) on face of release unit piston (6). Using brake and clutch reliner, install piston in housing (3) until piston is flush with outer edge of release unit nut (2).



6. Lubricate new packing (1) with grease or petrolatum, and install packing on shoulder screw (2). Install screw in release unit piston (3).

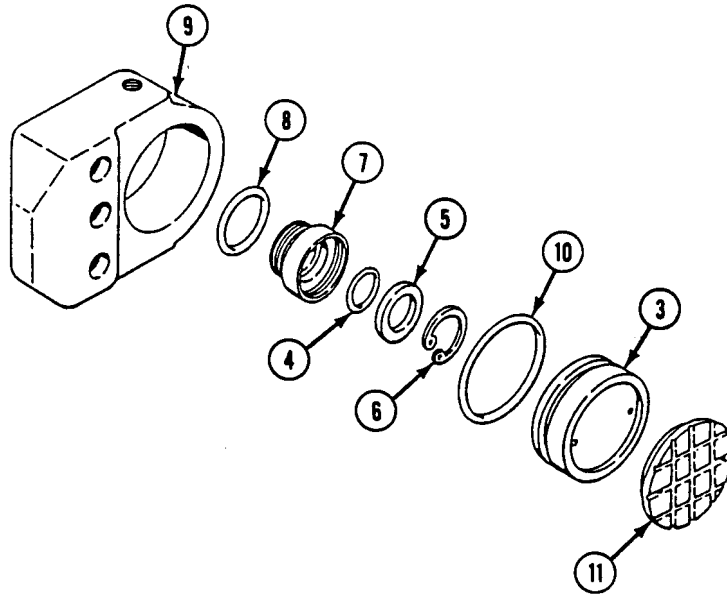


7. Lubricate new packing (4) with grease or petrolatum, and install packing, spacer (5), and new retaining ring (6) in release unit nut (7).
8. Lubricate new packing (8) with grease or petrolatum, and install new packing (8) on release unit nut (7).
9. Install release unit nut (7) in brake housing (9) using remover and replacer tool.

NOTE

Turn remover and replacer tool in the counterclockwise direction.

10. Deform one thread in release unit nut (7) securely in two places a minimum of 45 degrees from holes in unit.
11. Lubricate new packing (10) with grease or petrolatum, and install packing on release unit piston (3).
12. Place brake lining (11) on face of release unit piston (3). Using brake and clutch reliner, install piston with lining in housing (9) until piston is flush with outer edge of release unit nut (7).



END OF TASK

REPAIR HYDRAULIC MASTER BRAKE CYLINDER

0031 00

THIS WORK PACKAGE COVERS:

- Disassembly (page 0031 00-2).
- Cleaning (page 0031 00-4).
- Assembly (page 0031 00-5).
- Set Relief Valve Pressure (page 0031 00-8).

INITIAL SETUP:

Maintenance Level

Direct Support

Personnel Required

Track Vehicle Repairer

Tools and Special Tools

- General mechanic's tool kit (WP 0033 00, Item 37)
- Face wrench socket (WP 0033 00, Item 33)
- Socket wrench set, 3/8 inch drive (WP 0033 00, Item 34)
- Torque wrench, 3/8 inch drive, 0-600 lb-in (WP 0033 00, Item 41)
- Torque wrench, 1/2 inch drive, 0-300 lb-ft (WP 0033 00, Item 42)

References

See your -20

Equipment Condition

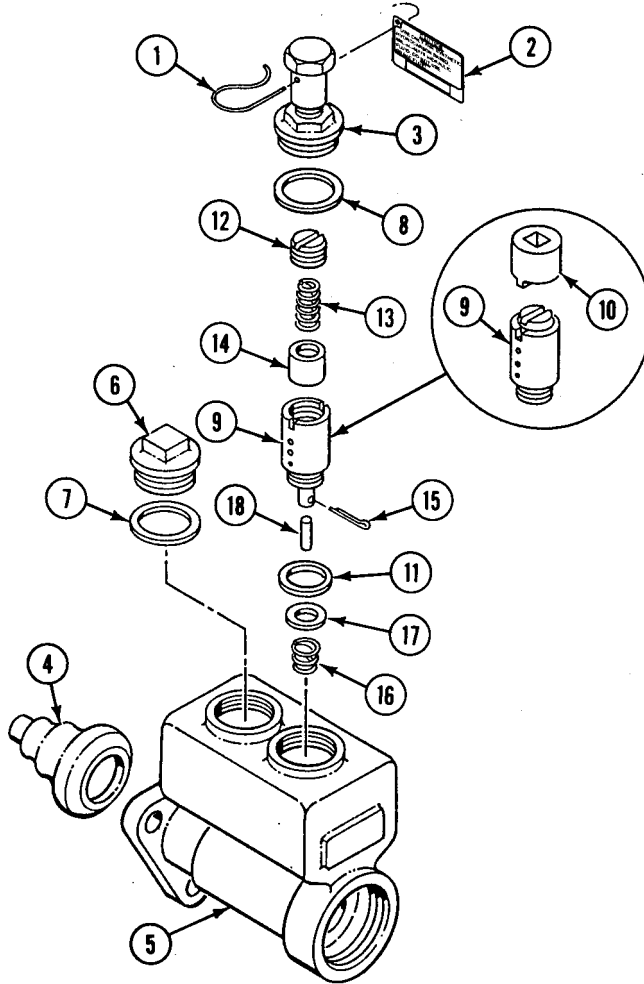
Hydraulic master brake cylinder removed from carrier (see your -20)

Materials/Parts

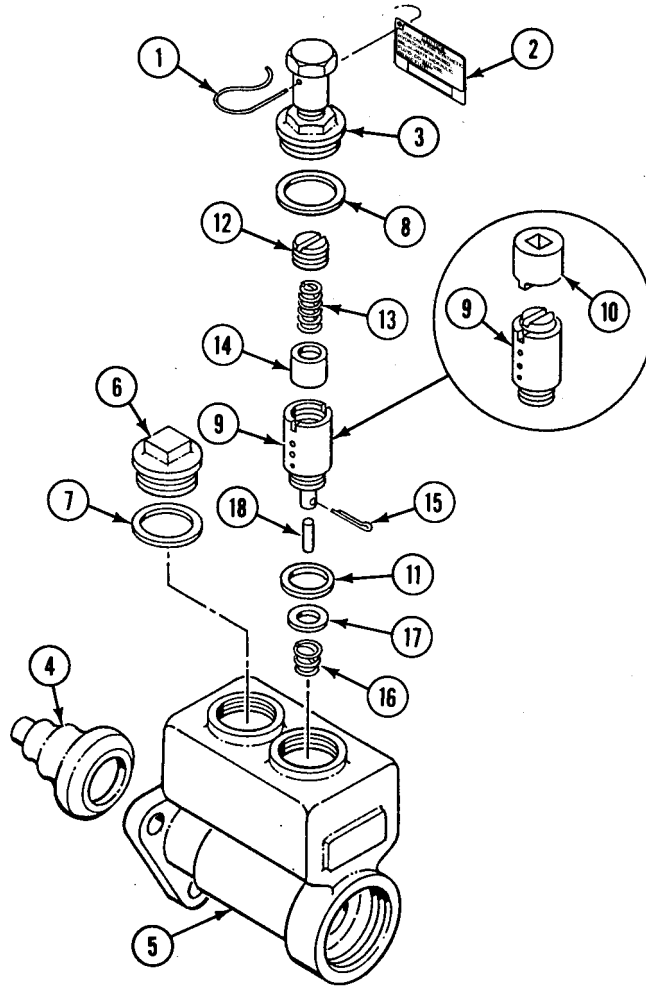
- Denatured alcohol (WP 0035 00, Item 3)
 - Hydraulic fluid (FRH) (WP 0035 00, Item 7)
 - Hydraulic parts kit (WP 0035 00, Item 8)
 - Non-electrical wire (WP 0035 00, Item 9)
 - Wiping rags (WP 0035 00, Item 17)
-

DISASSEMBLY

1. Remove lockwire (1) and instruction plate (2) from vent plug (3). Discard lockwire.
2. Remove protection bellows (4) from master cylinder housing (5). Discard bellows.
3. Remove filler plug (6) with gasket (7) from housing (5). Remove gasket from plug. Discard gasket.
4. Remove vent plug (3) and gasket (8) from relief valve (9). Discard gasket.
5. Remove relief valve (9) from housing (5) using 1/2 inch drive ratchet wrench and face wrench socket (10).



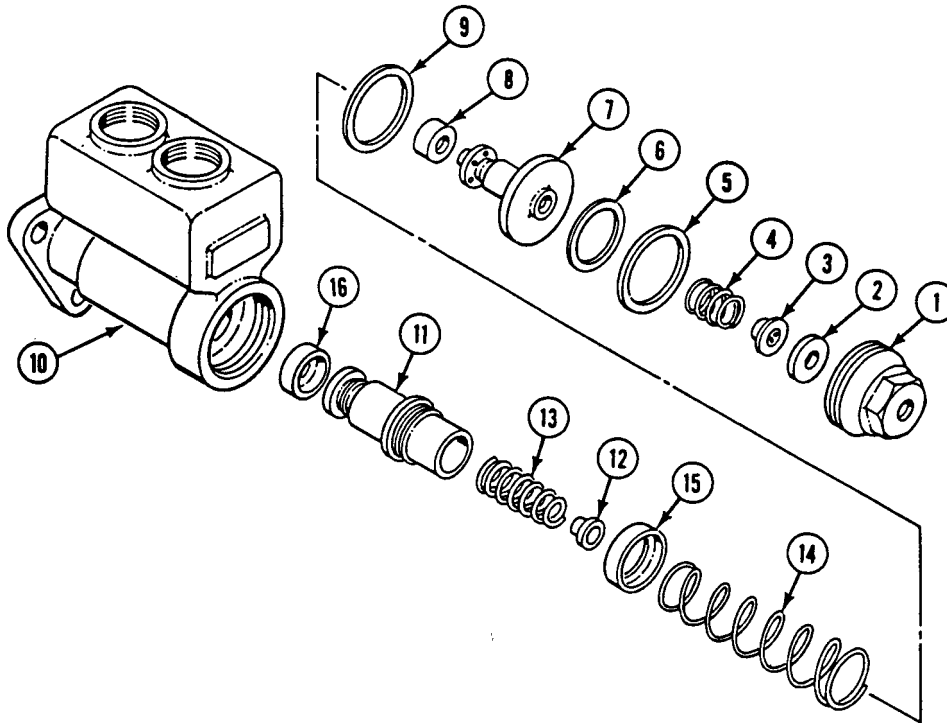
6. Remove gasket (11) from relief valve (9). Discard gasket.
7. Remove adjusting screw (12), spring (13), and piston (14) from relief valve (9).
8. Remove cotter pin (15), spring (16), and relief valve disk (17) from relief valve (9). Discard cotter pin, spring, and disk.
9. Remove metering needle (18) from relief valve (9).



CAUTION

Use caution when removing end plug which is under spring pressure.

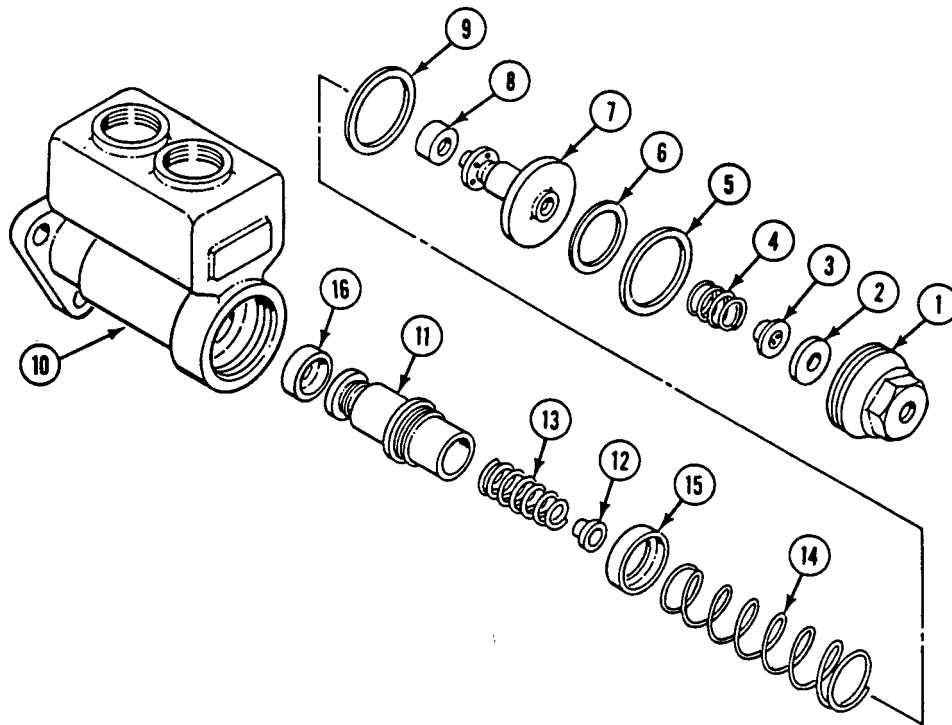
10. Remove end plug (1), check valve seat (2), check valve (3), spring (4), gasket (5), end plug seal (6), high pressure piston (7), primary cup (8), and gasket (9) from housing (10). Discard check valve seat, check valve, spring, gaskets, end plug seal, and primary cup.
11. Push low pressure piston (11) through housing (10) from pushrod end. Remove spring retainer (12), primary spring (13), and secondary spring (14) from low pressure piston.
12. Separate secondary cup (15) and secondary cup (16) from low pressure piston (11). Discard secondary cups.

**CLEANING****CLEANING, INSPECT, AND REPAIR**

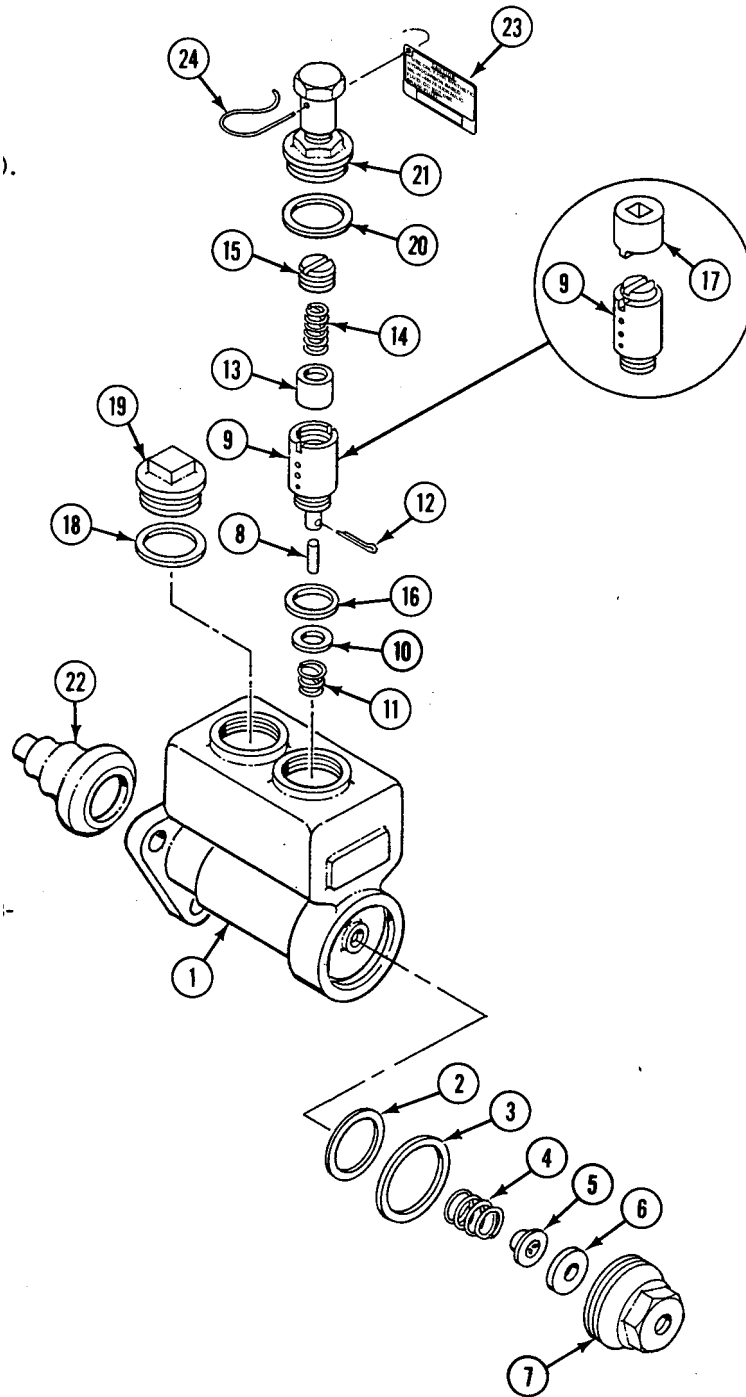
1. Before inspection, repair, or assembly of master brake cylinder, clean all parts with denatured alcohol. Immediately after cleaning, dry all parts and coat lightly with same hydraulic fluid as used in brake cylinder.
2. Inspect all parts. Refer to (WP 0014 00) for general inspection and repair procedures.

ASSEMBLY

1. Install new secondary cup (16) and secondary cup (15) on low pressure piston (11).
2. Install low pressure piston (11), primary spring (13), spring retainer (12), secondary spring (14), and new gasket (9) in housing (10).
3. Install new primary cup (8) on high pressure piston (7).
4. Push low pressure piston (11) forward 1 1/2 inches (3.8 cm) from pushrod end, using screwdriver or similar tool.
5. Maintain spring pressure and insert piston into housing (10) until base of piston sits on gasket (9).
6. Release spring pressure and, at the same time, apply sufficient pressure to base of high pressure piston (7) to prevent primary cup (8) from unseating.

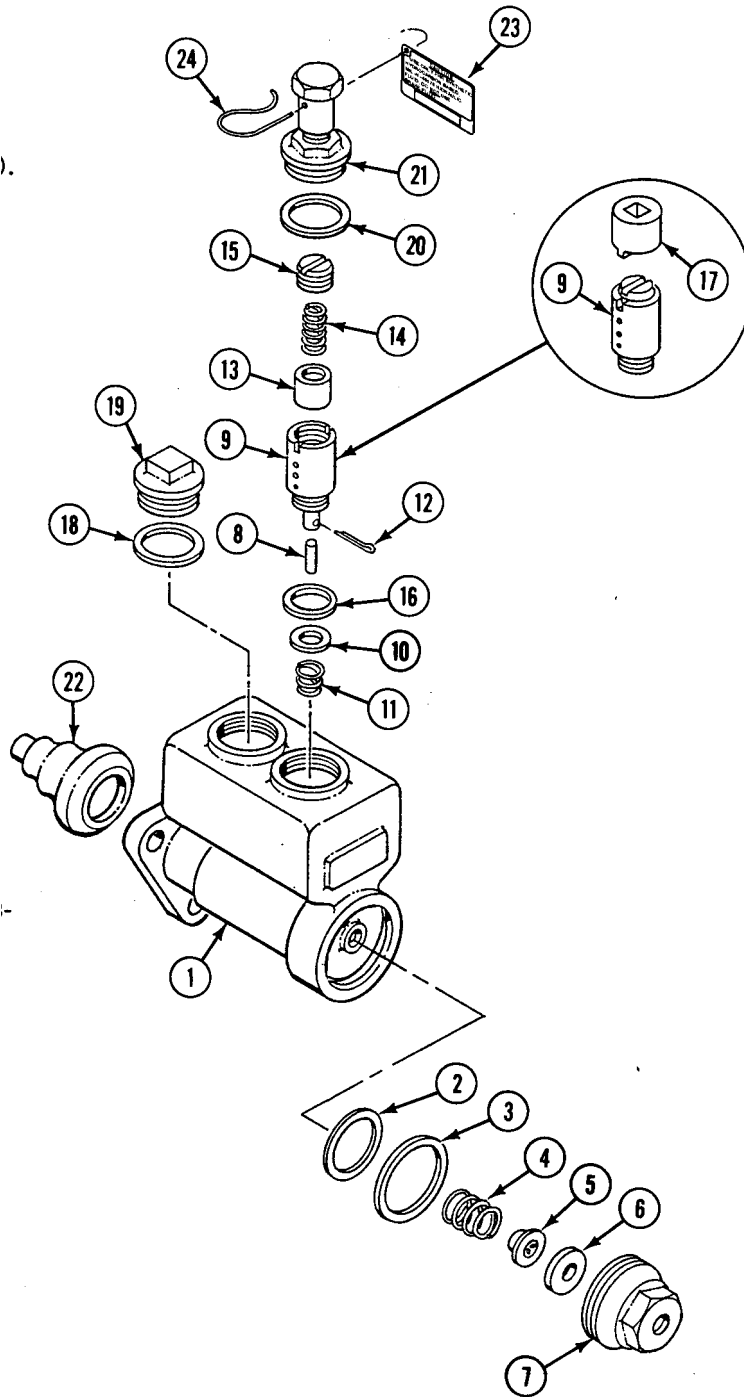


7. Insert screwdriver through opening in housing (1) and apply enough pressure to keep assembled parts in place.
8. Install new end plug seal (2), new gasket (3), new spring, (4) new check valve (5), and new check valve seat (6) in housing (1). Secure end plug (7). Tighten plug to 80-95 lb-ft (108-129 N•m) torque. Use torque wrench (WP 0033 00, Item 42).
9. Install metering needle (8) in relief valve (9). Secure with new relief valve disk (10), new spring (11), and new cotter pin (12).
10. Install piston (13) and spring (14) in relief valve (9).
11. Install adjusting screw (15) until one screw thread shows in relief valve (9).
12. Install new gasket (16) and relief valve (9) on housing (1). Tighten relief valve to 204-240 lb-in (23-27 N•m) torque. Use torque wrench (WP 0033 00, Item 41) and face wrench socket (17).



SET RELIEF VALVE PRESSURE

1. Install pressure gauge in output well of housing (1).
2. Fill housing (1) with hydraulic fluid and install new gasket (18) and filler plug (19).
3. Apply pressure at pushrod end and turn adjusting screw (15) until relief pressure is 100-130 psi (69-90 kPa).
4. Remove pressure gage and drain hydraulic fluid from housing (1).
5. Install new gasket (20) and vent plug (21) on relief valve (9).
6. Install new protection bellows (22) on housing (1).
7. Install instruction plate (23) on vent plug (21) with new lockwire (24).



END OF TASK

CHAPTER 9
SUPPORTING INFORMATION

WORK PACKAGE INDEX

<u>Title</u>	<u>Sequence No.</u>
REFERENCES.....	0032 00
COMMON TOOLS AND SUPPLEMENTS AND SPECIAL TOOLS/FIXTURES LIST.....	0033 00
FABRICATED TOOLS.....	0034 00
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST.....	0035 00

REFERENCES

0032 00

SCOPE

This work package lists all forms, field manuals, technical manuals and miscellaneous publications to be used by personnel in maintaining drive train components. The Department of the Army Pamphlets (DA PAM 25-30 series) should for the latest changes or revisions to references given in this work package and for new publications relating to the material covered in this technical manual.

TECHNICAL MANUALS

- Organizational Maintenance Manual: Carrier, Personnel, Full Tracked, Armored, M113A2, 2350-01-068-4077; Carrier, Command Post, Light, Tracked M577A2, 2350-01-068-4089; Carrier Mortar, 107-MM, Self Propelled M106A2, 2350-01-069-6931; Carrier, Mortar, 81-MM, Self Propelled M125A2, 2350-01-068-0487; Chassis, Gun, Anti-Aircraft Artillery, 20-MM, Self Propelled (M163 Weapons System) M741A1, 2350-01-099-8929; Carrier, Smoke Generator, Full Tracked, Armored M1059, 2350-01-203-0188; Combat Vehicle, Anti-Tank, Improved Tow Vehicle, M901A1, 2350-01-103-5641; Carrier, Mortar, 120-MM, Self Propelled M1064, 2350-01-338-3116; Carrier, Standardized Integrated Command Post System M1068, 2350-01-354-5657.....TM 9-2350-261-20

- Unit Maintenance, Intermediate Direct Support and Intermediate General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools List) for Carrier, Personnel, Full Tracked, Armored, M113A2, 2350-01-068-4077; Carrier, Command Post, Light, Tracked M577A2, 2350-01-068-4089; Carrier Mortar, 107-MM, Self Propelled M106A2, 2350-01-069-6931; Carrier, Mortar, 81-MM, Self Propelled M125A2, 2350-01-068-0487; Chassis, Gun, Anti-Aircraft Artillery, 20-MM, Self Propelled (M163 Weapons System) M741A1, 2350-01-099-8929; Carrier, Smoke Generator, Full Tracked, Armored M1059, 2350-01-203-0188; Combat Vehicle, Anti-Tank, Improved Tow Vehicle, M901A1, 2350-01-103-5641; Carrier, Mortar, 120-MM, Self Propelled M1064, 2350-01-338-3116; Carrier, Standardized Integrated Command Post System M1068, 2350-01-354-5657.....TM 9-2350-261-20P

- Direct Support and General Support Maintenance: Carrier, Personnel, Full Tracked, Armored, M113A2, 2350-01-068-4077; Carrier, Command Post, Light, Tracked M577A2, 2350-01-068-4089; Carrier Mortar, 107-MM, Self Propelled M106A2, 2350-01-069-6931; Carrier, Mortar, 81-MM, Self Propelled M125A2, 2350-01-068-0487; Chassis, Gun, Anti-Aircraft Artillery, 20-MM, Self Propelled (M163 Weapons System) M741A1, 2350-01-099-8929; Carrier, Smoke Generator, Full Tracked, Armored M1059, 2350-01-203-0188; Combat Vehicle, Anti-Tank, Improved Tow Vehicle, M901A1, 2350-01-103-5641; Carrier, Mortar, 120-MM, Self Propelled M1064, 2350-01-338-3116; Carrier, Standardized Integrated Command Post System M1068, 2350-01-354-5657.....TM 9-2350-261-34

- Organizational Maintenance: Carrier, Cargo, Tracked, 6-Ton M548, 2320-00-078-4545.....TM 9-2350-247-20

- Direct Support and General Support Maintenance: Carrier, Cargo, Tracked 6-Ton M548, 2320-00-078-4545.....TM 9-2350-247-34

- Unit Maintenance: Carrier, Personnel, Full Tracked, Armored M113A2, 2350-01-219-7577; Carrier, Command Post, Light Tracked M577A3, 2350-01-369-6085; Carrier, Anti-Tank (TOW), Full Tracked, Armored M901A3, 2350-01-369-7253; Carrier, Fire Support Personnel, Full tracked, Armored M981A3, 2350-01-369-6079; Carrier, Smoke Generator, Full Tracked M1059A3, 2350-01-369-6083; Carrier Mortar, 120-MM, Self Propelled M1064A3, 2350-01-369-6082; Carrier, Standardized Integrated Command Post

REFERENCES—Continued

0032 00

System M1068A3, 2350-01-369-6086; Chassis, Mechanized Smoke Obscurant M58, 2350-01-418-6654.....TM 9-2350-277-20

Intermediate Direct Support and General Support Maintenance: Carrier, Personnel, Full Tracked, Armored M113A3, 2350-01-219-7577; Carrier, Command Post, Light Tracked M577A3, 2350-01-369-6085; Carrier, Anti-Tank (TOW), Full Tracked, Armored M901A3, 2350-01-369-7253; Carrier, Fire Support Personnel, Full tracked, Armored M981A3, 2350-01-369-6079; Carrier, Smoke Generator, Full Tracked M1059A3, 2350-01-369-6083; Carrier Mortar, 120-MM, Self Propelled M1064A3, 2350-01-369-6082; Carrier, Standardized Integrated Command Post System M1068A3, 2350-01-369-6086; Chassis, Mechanized Smoke Obscurant M58, 2350-01-418-6654.....TM 9-2350-277-34

Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools) for Angle Drive, Cooling Fan, 2990-00-712-1280, 3010-01-318-5670; Gearcase, Transfer, 2520-01-061-5570, 2520-01-047-8613, 2520-00-572-8605, 2520-01-087-0156, 2520-01-362-8589; Differential Steering Control, 2520-00-714-6135; Drive Assembly, Final, 2520-01-061-5766, 2520-00-895-9164, 2520-01-067-8933, 2520-00-224-7952; Brake, Single Disk, Pivot, 2520-00-088-9866; Cylinder, Hydraulic, Master, 2530-00-679-9169.....TM 9-2520-238-34P

Direct Support and General Support Quality Control: Inspector’s Inspection Criteria.....TM 750-245-4

Inspection, Care, and Maintenance of Antifriction Bearings.....TM 9-214

Maintenance Expenditure Limits for FSC Group 25, FSC Class 2520.....TB 750-98-25

Operator’s Manual: Welding Theory and Application.....TM 9-237

Painting Instructions for Field Use.....TM 43-0139

FIELD MANUALS

First Aid for Soldiers.....FM 21-11

General Body Repair and Related Operations.....FM 43-2

Fundamentals of Machine Tools.....FM 9-24

OTHER PUBLICATIONS

Packaging of Army Materiel for Shipment and Storage.....AR 746-1

Processing for Storage and Shipment of Carriers, Personnel, Full-Tracked; Armored, M113, M113A1, M113A2, M113A2/EFT, and M113A3; Mortars, Self Propelled: 107-MM, M106, M106A1, and M106A2, and 81-MM, M125A1 and M125A2; and Smoke Generator: M1059.....MIL-C-45360F(AT)

Preservation, Packaging, and Packing of Military Supplies and Equipment (Packing, TM 38-230-1, Vol. 1 and 2).....TM 38-230-2

Preparation and Inspection of Industrial Equipment for Storage or Shipment.....TM 38-260

Use and Care of Hand Tools and Measuring Tools.....TM 9-243

Quality Deficiency Report (Category II).....SF 368

The Army Maintenance Management System (TAMMS).....DA PAM 738-750

REFERENCES—Continued

003 00

Verification Inspection of Uneconomically Repairable Major End Items.....AR 702-8

FORMS

Equipment Component Register.....DA Form 2408-10

Equipment Control Record.....DA Form 2408-9

Equipment Daily or Monthly Log.....DA Form 2408-1

Equipment Modification Record.....DA Form 2408-5

Equipment Inspection and Maintenance Worksheet.....DA Form 2404

Maintenance Request.....DA Form 2407

Recommended Changes to Publications and Blank Forms.....DA Form 2028

Uncorrected Fault Record.....DA Form 2408-14

COMMON TOOLS AND SUPPLEMENTS AND SPECIAL TOOLS/FIXTURES LIST

0033 00

INTRODUCTION

Scope

This work package lists all common tools and supplements and special tools/fixtures needed to maintain the components in this manual.

Explanation of Columns in the Common Tools and Supplements and Special Tools/Fixtures List

Column (1) — Item Number. This number is assigned to the entry in the listing, and is referenced in the Initial Setup in the task under Tools to identify the item (e.g., "Torque wrench (Item 40)").

Column (2) — Name. This column lists the item by noun nomenclature and other descriptive features (e.g., "Wrench set, socket, 3/8 inch drive").

Column (3) — National Stock Number. This is the National Stock Number (NSN) assigned to the item. Use it to requisition the item.

Column (4) — Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

Column (5) — Reference. This column identifies the authorizing Supply Catalog (SC) or Repair Parts and Special Tools List (RPSTL) for items listed in this work package.

Table 1. Tool Identification List

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
1	BEARING INSERTER, BEARING REPLACER	5120-00-649-8126	10865981	TM 9-2520-238-34P
2	CALIPER, MICROMETER, OUTSIDE: 1-2 INCH RNG	5120-00-243-2933	GGG-C-105	SC 5280-95-CL-A01
3	C-CLAMP, 6 INCH	5120-00-203-6432	A-A-431 (58536)	SC 4910-95-CL-A31
4	DRILL PORTABLE, ELECT., 1/2 INCH	5130-00-293-1849	W-D-661	SC 3470-95-CL-A74
5	DRILL SET, TWIST	5133-00-540-4375	TL3284	SC 4910-95-CL-A31
6	DRILL SET, TWIST	5133-00-293-0983	GGG-D-751	
7	GAUGE SET, CALIPER	5210-00-250-4761	GGG-C-111	
8	GAUGE, VERNIER HEIGHT	5210-00-067-7118	599-586-18 (09058)	
9	GEAR INSERTER	5120-00-649-8140	10865984	TM 9-2520-238-34P
10	HAMMER, SOFT PLASTIC	5120-01-065-2211	57-534 (61711)	SC 4931-95-CL-A07
11	INDICATOR, DIAL	5210-00-459-8871	LT11	

COMMON TOOLS AND SUPPLEMENTS AND SPECIAL TOOLS/FIXTURES
LIST—Continued

0033 00

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
12	INDICATOR, DIAL	5210-00-277-8840	MIL-I-18422	
13	INDICATOR SET, RANGE DIAL	5210-01-145-5803	CM260	
14	PIN, STRAIGHT, HEADLESS (3)	5315-00-834-0118	MS-16556-367	TM 9-2520-238-34P
15	PLIER, WIRE TWISTER	5120-01-112-5031	GA-311C	
16	PRESS ARBOR, HAND	3444-00-449-7295		SC 4910-95-CL-A31
17	PULLER KIT, MECHANICAL	5120-00-313-9496	1178	SC 4910-95-CL-A31
18	PULLER KIT, MECHANICAL		5053251-1	TM 9-2520-238-34P
19	RELINER, BRAKE AND CLUTCH	4910-00-173-5310		SC 4910-95-CL-A31
20	REMOVER/REPL, BEARING RETAINER/ OUTPUT SHAFT	5120-00-771-7019	10874765	TM 9-2520-238-34P
21	REMOVER/REPLACER, DIFFERENTIAL BUSHING	5120-00-740-3346	10943279	TM 9-2520-238-34P
22	REMOVER/REPLACER	5120-00-966-5951	10932469	TM 9-2520-238-34P
23	REMOVER/REPLACER	5120-00-678-2789	10865770	TM 9-2520-238-34P
24	REMOVER/REPLACER	5120-00-678-2798	8763117	TM 9-2520-238-34P
25	REMOVER/REPLACER	5120-00-771-7018	10875326	TM 9-2520-238-34P
26	REMOVER/REPLACER	5120-00-771-7020	10875335	TM 9-2520-238-34P
27	REPLACER, BEARING CUPS	5120-00-776-1864	10886353	TM 9-2520-238-34P
28	SCREW, JACK	5305-00-071-2511	MS90728-14	
29	SCREW, JACK	5305-00-226-4832	MS90728-39	
30	SCREW, JACK	5305-00-269-3216	MS90728-66	
31	SCREWDRIVER BIT SET AND HANDLE	5120-00-832-6224		SC 4931-95-CL-A22
32	SLING, BEAM TYPE	4910-00-646-6893	10942647	TM 9-2520-238-34P
33	SOCKET, WRENCH, FACE (19207)	5120-00-557-8171	11633523	TM 9-2520-238-34P
34	SOCKET WRENCH SET, 3/8 INCH DRIVE	5120-00-322-6231		SC 4910-95-CL-A31
35	SPANNER SOCKET		5052331-1	TM 9-2520-238-34P
36	TOOL, DIFFERENTIAL BACKLASH	5120-00-074-1164	10942815	TM 9-2520-238-34P
37	TOOL KIT, GENERAL MECHANIC'S	5180-00-177-7033		SC 5180-90-N26
38	WRENCH, SOCKET, SCREWDRIVER ATTACHMENT	5120-01-367-3462	10E	TM 9-2520-238-34P
39	WRENCH, TORQUE, 1/4 INCH DRIVE, 2-36 LB-IN	5120-00-021-2041	A-A-2414	SC 4931-95-CL-A22

**COMMON TOOLS AND SUPPLEMENTS AND SPECIAL TOOLS/FIXTURES
LIST—Continued**

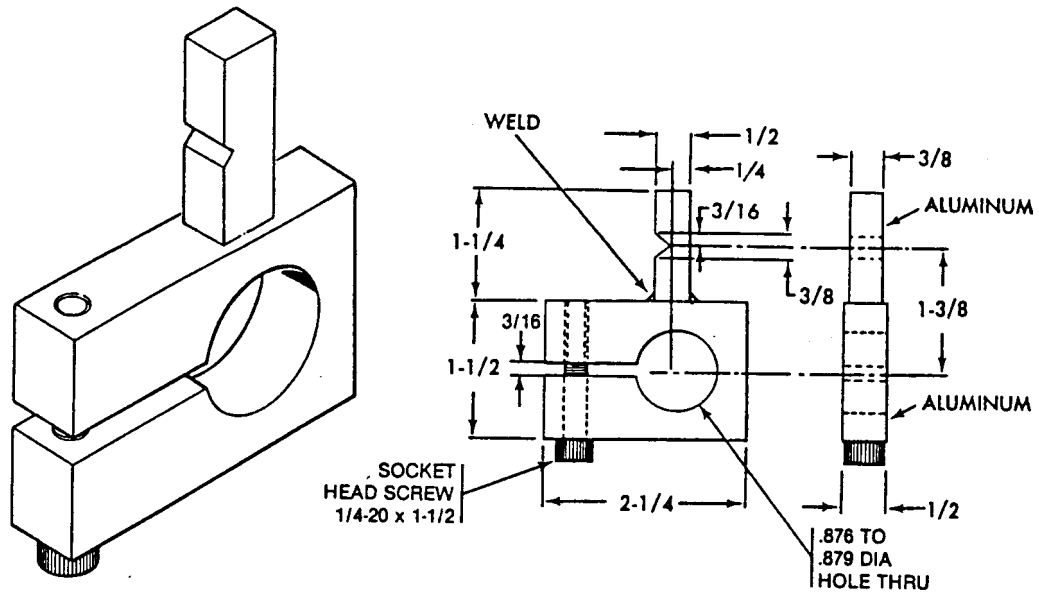
0033 00

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER	(5) REFERENCE
40	WRENCH, TORQUE, 3/8 INCH DRIVE, 0-150 LB-IN	5120-00-230-6380		SC 4910-95-CL-A31
41	WRENCH, TORQUE, 3/8 INCH DRIVE, 0-600 LB-IN	5120-00-542-5681	B58	TM 9-2350-261-24P
42	WRENCH, TORQUE, 1/2 INCH DRIVE, 0-300 LB-FT	5120-00-247-2536		SC 4910-95-CL-A31
43	WRENCH, TORQUE, 1/2 INCH DRIVE, 0-170 LB-FT	5120-00-640-6364	A-A-2411	SC 4910-95-CL-A31
44	WRENCH, TORQUE, 1/2 INCH DRIVE, 0-150 LB-FT	5120-00-247-2540		SC 4910-95-CL-A31

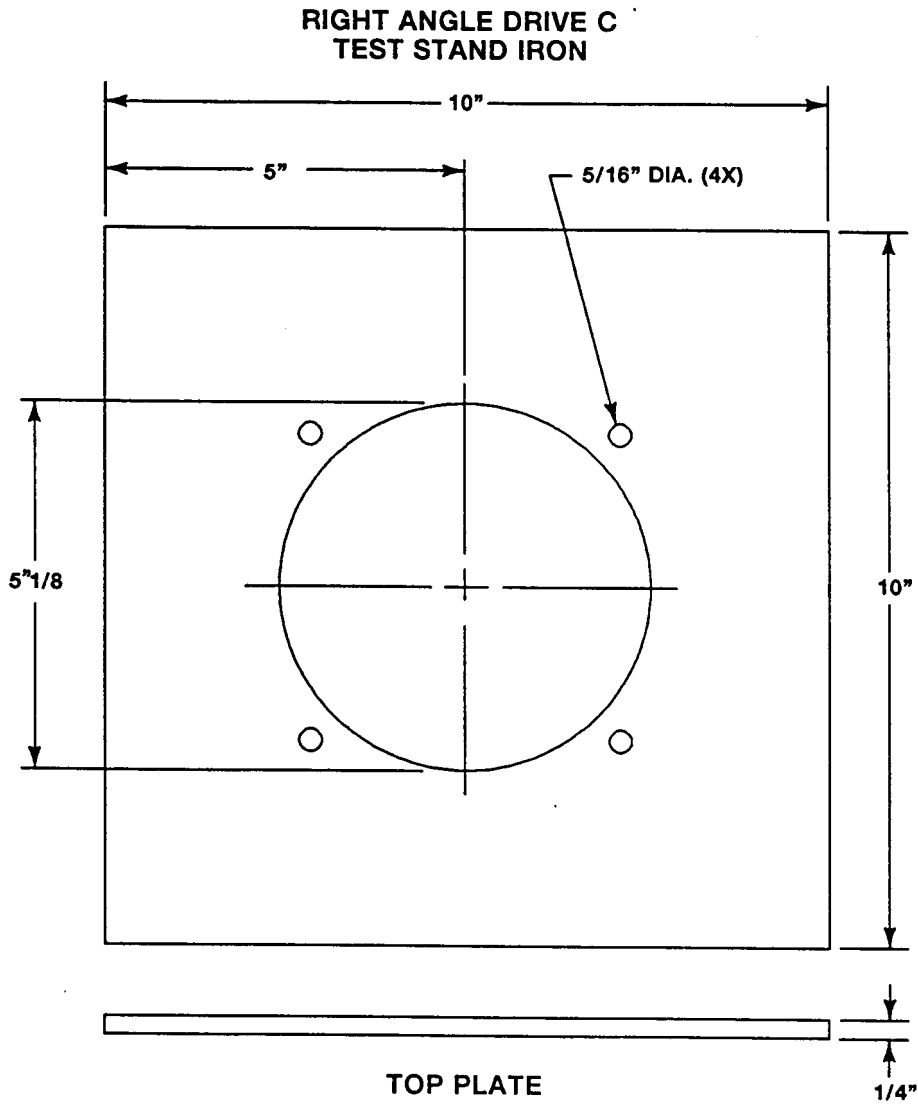
INTRODUCTION

SCOPE

This work package includes instructions to enable direct support and general support personnel to fabricate tools locally. Fabricated tools are not available for issue. Accompanying illustrations below show materials and dimensions required for tool fabrication.



Cooling Fan Right Angle Drive Backlash Adjusting Tool



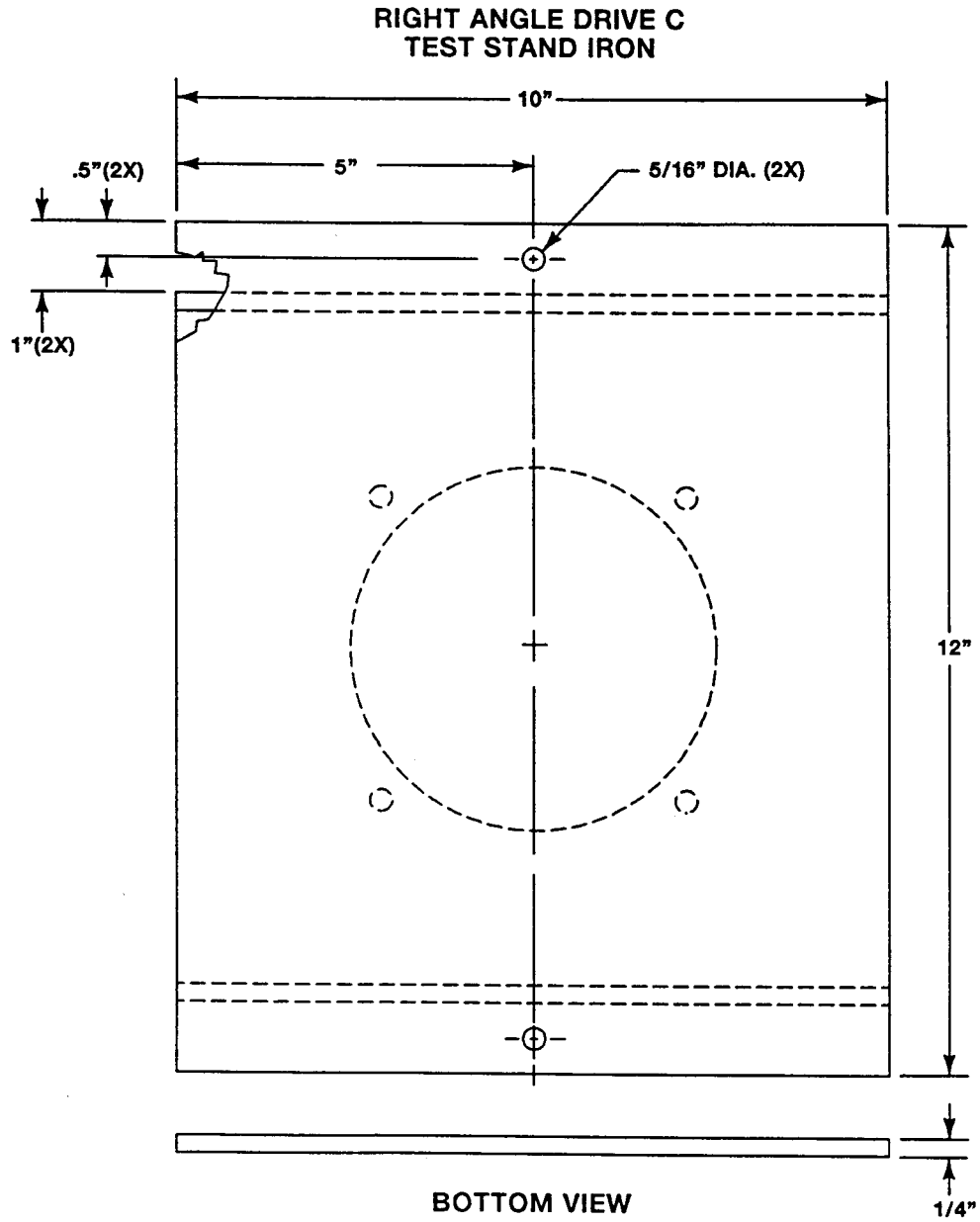
Right Angle Drive C Test Stand (top plate)

CHART

- A. 4 Places - drill 5/16" holes.
- B. 1 Place - Cut 5 1/8" hole.

NOTES:

1. Cut plate of iron 1/4" thick x 10" W x 10" L.
2. Locate holes in plate per diagram. Drill holes per A and B in chart above.

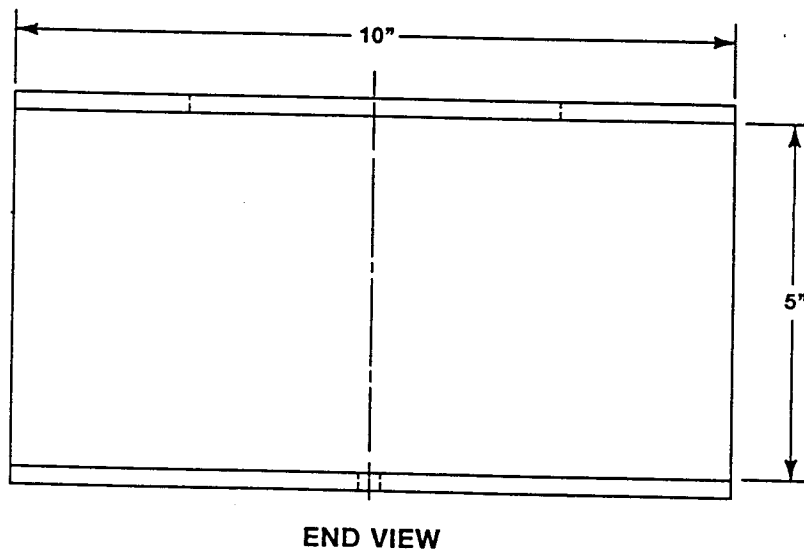
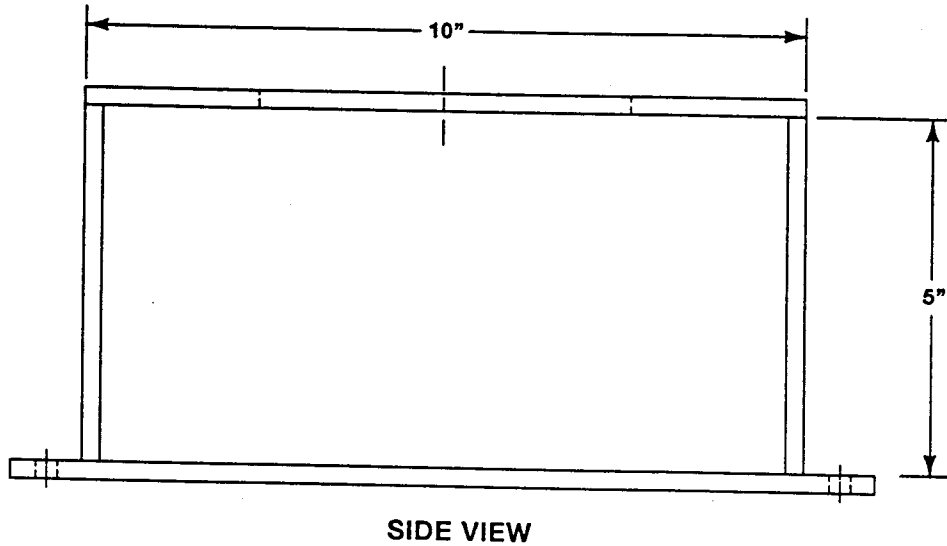


Right angle Drive C Test Stand (bottom plate)

NOTES:

1. Cut plate of iron 1/4" thick x 10" W x 12" L.
2. Locate holes in plate per diagram. Drill two 5/16" holes.

**RIGHT ANGLE DRIVE C
TEST STAND IRON**

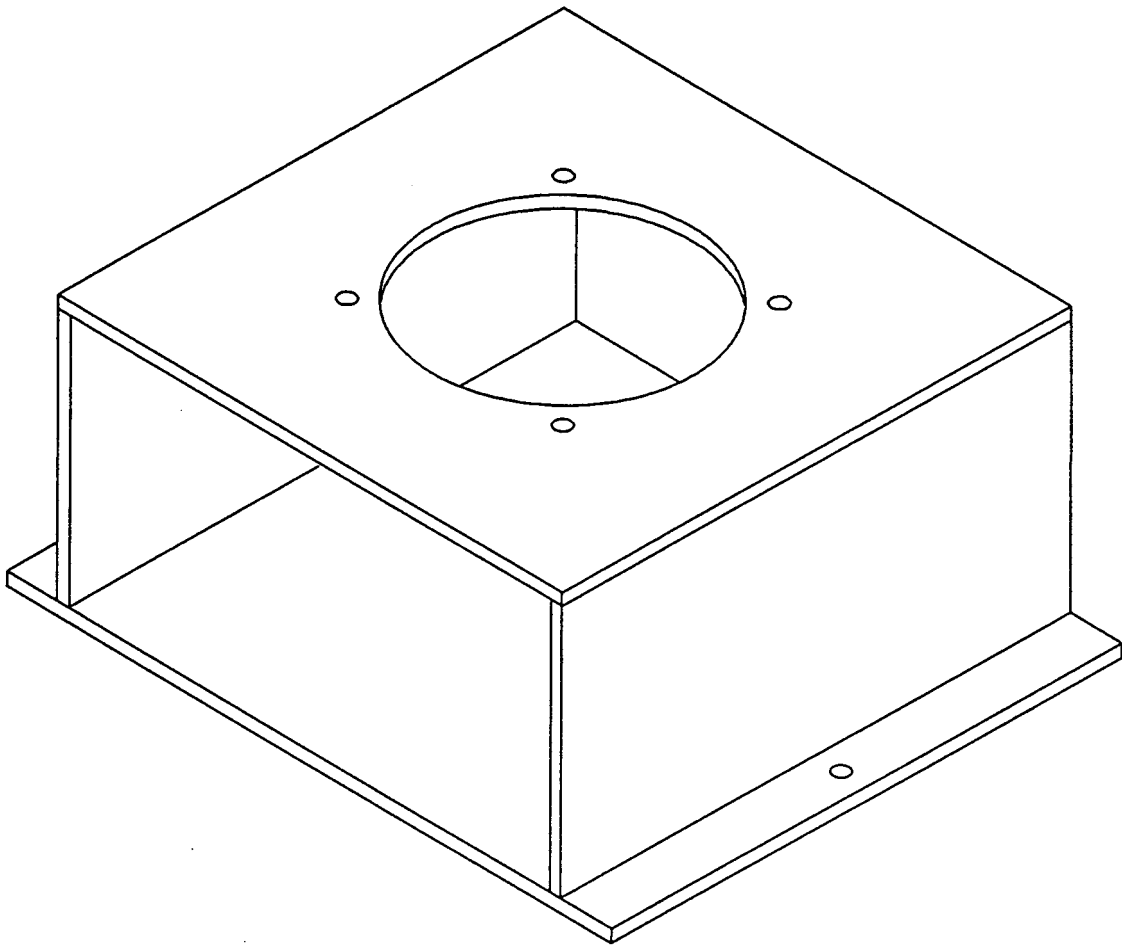


Right angle Drive C Test Stand (Side and End View)

NOTES:

1. Cut two plates of iron 1/4" thick x 5" W x 10" L.
2. Weld all plates using any method.

**RIGHT ANGLE DRIVE C
TEST STAND IRON**



ASSEMBLED

Right angle Drive C Test Stand (Assembled)

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

0035 00

INTRODUCTION

Scope

This work package lists expendable/ durable items you will need to maintain the components in this manual. These items are authorized to you by CTA 50-970, *Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items)*.

Explanation of Columns in the Expendable/Durable Items List

Column (1) — Item Number. This number is assigned to the entry in the listing, and is referenced in the Initial Setup section of the task under Materials/Parts to identify the material (e.g., “Antiseize compound (Item 1) ”).

Column (2) — Level. This column identifies the lowest level of maintenance that requires the listed item.

- O — Unit Maintenance
- F — Direct Support Maintenance
- H — General Support Maintenance

Column (3) — National Stock Number. This is the National Stock Number (NSN) assigned to the item; use it to request or requisition the item.

Column (4) — Description. Indicates the Federal item name and, if required, a description to identify the item. Also listed are the Commercial and Government Entity Code (CAGEC) in parentheses and the part number for the item.

Column (5) — Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

Table 1. Expendable and Durable Items List

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME,DESCRIPTION,CAGE,PART NUMBER	(5) U/M
1	O	8030-00-251-3980	ANTISEIZE COMPOUND (81349) MIL-A-907	LB
2	F	6505-01-210-4439	CASTILE SOAP (02318) 20300-030	EA
3	O	6810-00-543-7415	DENATURED ALCOHOL (81348) O-E-760	GL
4	O	6850-01-277-0595	CLEANING COMPOUND, SOLVENT (59557) 134-HI-SOLV	GL
5	O	9150-01-152-4119	ENGINE LUBRICATING OIL (81349) MIL-L-2104	GL
6	F	9150-00-190-0904	GREASE (GAA) (81349) MIL-G-10924	LB
7	O	9150-01-131-3324	HYDRAULIC FLUID (FRH) (81349) MIL-H-46170	QT
8	F	2530-01-054-9853	HYDRAULIC PARTS KIT (19207) 5703816	EA

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST—Continued

0035 00

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME,DESCRIPTION,CAGE,PART NUMBER	(5) U/M
9	O	9505-00-293-4208	NONELECTRICAL WIRE (96906) MS20995C32	LB
10	F	9150-00-250-0933	PETROLATUM (81348) VV-P-236	LB
11	O	8030-00-252-3391	SEALING COMPOUND (81349) MIL-S-45180	OZ
12	O	8030-00-291-1789	SEALING COMPOUND (81349) MIL-S-45180, TY II	PT
13	O	8030-00-656-1426	SEALING COMPOUND (81349) MIL-S-45180, TY III	GL
14	O	8030-01-166-0675	SEALING COMPOUND (05972) 567-47	TB
15	O	8030-01-054-0740	SEALING COMPOUND (05972) 59214	PT
16	O	8030-00-275-8111	SEALING COMPOUND (80244) MIL-S-12158, TY I	OZ
17	O	7920-00-205-1711	WIPING RAG (58536) A-A-2522	LB

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By Order of the Secretary of the Army:

Official


JOEL B. HUDSON
*Administrative Assistant to the
Secretary of the Army*
0105112

ERIC K. SHINSEKI
*General, United States Army
Chief of Staff*

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PUBLICATION NUMBER			DATE		TITLE			
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METRIC CONVERSION CHART

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Centimeters	Cubic Inches	0.060
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

TEMPERATURE CONVERSIONS

$$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$$

212° Fahrenheit is equivalent to 100° Celsius

90° Fahrenheit is equivalent to 32.2° Celsius

32° Fahrenheit is equivalent to 0° Celsius

$$9/5 \text{ C}^{\circ} + 32 = \text{F}^{\circ}$$

PIN: 028711-000