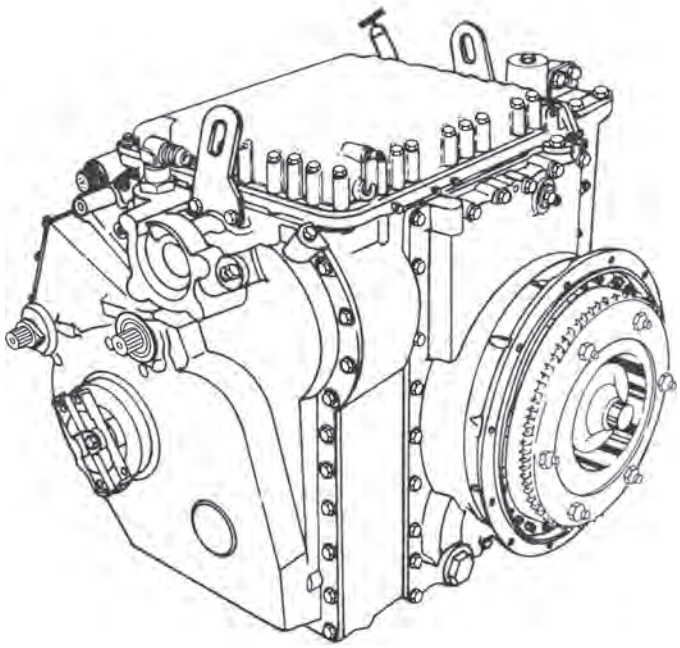
* TM 9-2520-272-40

TECHNICAL MANUAL

SUSTAINMENT MAINTENANCE MANUAL
FOR

CROSS-DRIVE TRANSMISSION WITH CONTAINER

MODEL X200-4A
P/N 12371043 (NSN 2520-01-397-1074) (EIC N/A)



* TM 9-2520-272-40, dated 13 February 2012, supersedes TM 9-2520-272-34&P, dated 14 February 2006, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

13 FEBRUARY 2012

WARNING SUMMARY

WARNING SUMMARY

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operations and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and hazardous materials icons used within the technical manual.

FIRST AID

For first aid information, see FM 4-25.11.

EXPLANATION OF SAFETY WARNING ICONS

HEAVY PARTS – Heavy object pinning human figure against wall shows that heavy moving parts or press present a danger to life or limb.

HEAVY PARTS – Object falling on a human figure shows that components are heavy and can fall and present danger to life and limb.

FLYING PARTICLES – Arrows bouncing off face shows that particles flying through the air will harm face.

FLYING PARTICLES – Arrows bouncing off face shield shows that particles flying through the air will harm face.

HOT AREA – Hand over object radiating heat shows that part is hot and can burn.

CRUSHED HAND – Object crushing hand shows danger of fingers being crushed.

MOVING PARTS – Human figure with an arm caught between gears shows that the moving parts of the equipment present a danger to life or limb.

WARNING SUMMARY – (Continued)

FALLING PARTS – Falling object on foot shows danger of possibility of parts falling.

FIRE – Flame shows that a material may ignite and cause burns.

GENERAL SAFETY WARNINGS DESCRIPTION

WARNING

Transmission and transmission components are heavy and can crush you. Check slings and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestles can break and cause injury or death. To avoid injury, do not stand under transmission or components when lifting them. The X200-4A Transmission weighs about 975 lb (442 kg). Transmission and container weigh about 1565 lb (710 kg). To avoid injury or death, keep out from under and clear of transmission at all times. Do not let transmission swing freely during hoisting.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (207 kPa). Use only with effective chip-guarding and personal protective equipment (goggles, shields, gloves, etc.).

WARNING

Pressurized steam is specif ed in cleaning operations that may cause injury to personnel if safety precautions are not followed. Use rubberized gloves, boots, suit, hood, and face shield for protection against burns and scalding.

WARNING SUMMARY – (Continued)

WARNING

Procedures specify the heating and cooling of parts to aid in assembly. The heated and cooled parts may cause injury to personnel if hand protection is not worn when handling. Wear protective gloves for maximum protection.

WARNING

Use caution when operating a drill. Keep hands clear of drill bit. Do not wear loose-f tting clothing. Wear safety goggles. Injury to personnel could occur from improper use of drill.

WARNING

Parts under spring tension cause injury to personnel. To avoid injury during disassembly, release spring tension slowly. To avoid injury during assembly, apply spring tension slowly. Wear adequate eye protection.

WARNING

Use caution when using a press. Improper tools or tools not properly aligned may cause injury or death to personnel.

WARNING SUMMARY – (Continued)

WARNING

Rotating thrust washer bearings (transmission output f anges) can strike and injure persons too close. Warn personnel to stand clear before starting the engine. Keep all personnel away when the engine/test stand is running. Personal injury or damage to equipment can occur if personnel get in the way of the rotating f anges.

EXPLANATION OF HAZARDOUS MATERIALS ICONS

CHEMICAL – Drops of liquid on hand shows that material will cause burns or irritation to human skin or tissue.

CRYOGENIC – Hand in a block of ice shows that the material is extremely cold and can cause injury to human skin or tissue.

VAPOR – Human f gure in a cloud shows that material vapors present a danger to life or health.

HAZARDOUS MATERIALS DESCRIPTION

WARNING

TEFLON®

Fumes from burning Tef on can cause serious injury or death. Clutch piston seal rings and step-joint seal rings contain Tef on. Do not dispose of them by burning.

WARNING SUMMARY – (Continued)

WARNING

ALKALINE SOLUTION

Alkaline solution is used in cleaning operations. Avoid contact of alkaline solution with eyes or skin. Contact with skin can cause rash or blisters. Scrub with soap and water. Contact with eyes can cause blindness. Flush with clean water and get medical attention immediately.

WARNING

TOXIC/FLAMMABLE VAPORS

Adhesives, solvents, and sealing compounds can burn easily, give off harmful vapors, and are harmful to skin and clothing. To avoid injury or death, keep away from open f re and use in a well-ventilated area. If adhesive, solvent, or sealing compound gets on skin or clothing, wash immediately with soap and water.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

NOTE: The portion of text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to text are indicated by shaded areas/bars. Zero in the “Change No.” column indicates an original page or work package.

Date of issue for original manual is:

Original 13 February 2012

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 44 AND TOTAL NUMBER OF WORK PACKAGES IS 80 CONSISTING OF THE FOLLOWING:

LIST OF EFFECTIVE PAGES/WORK PACKAGES - (Continued)

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 13 FEBRUARY 2012

TECHNICAL MANUAL

SUSTAINMENT MAINTENANCE MANUAL
FOR

CROSS-DRIVE TRANSMISSION WITH CONTAINER

MODEL X200-4A
P/N 12371043 (NSN 2520-01-397-1074) (EIC N/A)

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any errors, or if you would like to recommend any improvements to the procedures in this publication, please let us know. The preferred method is to submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms) through the Internet on the TACOM Unique Logistics Support Applications (TULSA) Web site. The Internet address is https://tulsa.tacom.army.mil. Access to all applications requires CAC authentication, and you must complete the Access Request form the first time you use it. The DA Form 2028 is located under the TULSA Applications on the left-hand navigation bar. Fill out the form and click on SUBMIT. Using this form on the TULSA Web site will enable us to respond more quickly to your comments and to better manage the DA Form 2028 program. You may also mail, e-mail, or fax your comments or DA Form 2028 directly to the U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command, ATTN: AMSTA-LCL-MPP / TECH PUBS, MS 727, 6501 E. 11 Mile Road, Warren, MI 48397-5000. The e-mail address is tacomlcmc.daform2028@us.army.mil. The fax number is DSN 786-1856 or Commercial (586) 282-1856. A reply will be furnished to you.

* TM 9-2520-272-40P, dated 13 February 2012, supersedes TM 9-2520-272-34&P, dated 14 February 2006, including all changes.

TABLE OF CONTENTS

Page No.
WP Sequence No.

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

TABLE OF CONTENTS – (Continued)

HOW TO USE THIS MANUAL

SCOPE

This manual has been prepared to tell you how to perform Sustainment Maintenance on the Allison Transmission Cross-Drive Transmission, Model X200-4A. Your success in accomplishing your assigned tasks depends very much upon how well you learn to use this manual.

You must make yourself familiar with every part of the manual before beginning any troubleshooting or maintenance assignments.

It is particularly important for you to understand and remember the contents of Chapter 3, WP 0067, General Maintenance Information, before doing any work on the transmission.

You must familiarize yourself with all steps in a maintenance procedure before beginning the maintenance task.

FOLLOWING THE FRONT COVER

Warnings are placed in the manual when you are about to do something that could injure or kill you or someone else. Always take the precautions described in the warnings. A summary of warnings used throughout the manual begins following the front cover of the manual. For your safety and the safety of others around you, be sure you understand all of these warnings.

TABLE OF CONTENTS

The Table of Contents lists the main subjects of the manual and shows the Work Package number where each begins. These main subjects are made up of Chapters and the Glossary.

INTRODUCTION

The General Information work package (WP 0001) to the manual provides you with an introduction to the transmission. WP 0002, Equipment Description and Data, pictorially identifies the major assemblies and subassemblies of the transmission. WP 0003 provides the theory of operation.

In WP 0001, you will find the Nomenclature Cross-Reference List. Sometimes a part is generally known by a common name which is not the same as the formal name used in the associated Repair Parts and Special Tools List (RPSTL), which is TM 9-2520-272-40P for this transmission. When maintenance procedures use the common name for a part, the Nomenclature Cross-Reference List will usually provide the formal name for the part as shown in the RPSTL.

For example, the name used by maintenance personnel for the hydrostatic pump and motor assembly is “hydrostat.” The RPSTL calls this unit “hydrostatic pump and motor assembly.” If you were to look in the RPSTL for “hydrostat” and did not find it, then you would go to the Nomenclature Cross-Reference List (WP 0001) to determine what the part is called in the RPSTL.

There are a few common terms which will not appear in the Nomenclature Cross-Reference List and they will not appear in the RPSTL. One of these terms is “range pack,” meaning all of the parts in one area of the transmission (mostly clutch assemblies) that function individually or collectively to vary the speed and power output or to change forward-reverse direction. Since the term “range pack” is a collective term applying to several parts and assemblies in the RPSTL, it has no specific RPSTL equivalent. Therefore, the term “range pack” will appear in the Glossary only. If you encounter a term which is not shown in the Nomenclature Cross-Reference List or the RPSTL, check the Glossary.

EQUIPMENT DATA

The Equipment Data section (WP 0002) provides particulars about the transmission such as input horsepower, ratios of forward and reverse ranges, oil capacity, transmission weight, and Usable on Codes (UOCs).

HOW TO USE THIS MANUAL – (Continued)

TROUBLESHOOTING PROCEDURES

Chapter 2 provides reference to the Field Maintenance manual, TM 9-2350-277-13&P, for troubleshooting problems with X200-4A Transmission. No troubleshooting procedures are required at the Sustainment Maintenance level for the X200-4A Transmission.

GENERAL MAINTENANCE INSTRUCTIONS

WP 0067, General Maintenance Information (GMI), provides general instructions which are applicable to all areas of transmission maintenance.

Maintenance instructions in the GMI are used repeatedly throughout all of your work on the transmission. Most of the instructions in the GMI are not repeated in the remaining maintenance work packages throughout Chapter 3. It would be laborious for you to read through the standard cleaning and inspection steps every time you removed something from the transmission. For that reason, certain general procedures which are used over and over are provided only once—in the GMI. These general procedures are just as much a part of transmission maintenance procedures as the maintenance procedures provided in the rest of Chapter 3. The difference is that procedures in Chapter 3 are provided for you where needed. You will have to apply procedures from WP 0067 to all tasks throughout Chapter 3 from your memory.

When procedures provided in the GMI (such as cleaning or inspection) are not adequate for a maintenance task, then specif c instructions will be provided in the text of Chapter 4's specif c maintenance procedures. For example, acceptability of a part that you have removed from the transmission may depend upon certain dimensions obtained by measurement during inspection. In such event, specif c inspection instructions will be provided in the specif c work package in question in Chapter 3.

TRANSMISSION MAINTENANCE PROCEDURES

Maintenance procedures in Chapter 3 begin with WP 0006. The work packages proceed in logical sequence until the transmission has been completely disassembled, repaired, and assembled.

The Table of Contents will guide you to the work package for each procedure. Procedural work packages are numbered in sequence throughout Chapter 3. A work package number and the name of a major maintenance procedure identify each work package.

Work packages are divided into tasks. The actual maintenance work is performed from instructions at the task level. Tasks are named and they are arranged in logical disassembly, repair, and assembly order.

TOOLS/SPECIAL TOOLS

The initial setup of each maintenance work package provides a list of common tools you will need to perform the task. These common tools are listed by description or by tool set in which they may be found. When required, special tools are listed by noun, along with a reference to the Tool Identif cation List in WP 0079, where manufacturer's code (Commercial and Government Entity Code [CAGEC]) and manufacturer's part number can be found.

FABRICATED TOOLS

When locally manufactured, fabricated tools are required, they are listed by noun and item number and referenced to WP 0075 of the manual, where instructions for making the tools are provided.

REPAIR PARTS

All repair parts for the X200-4A Transmission are listed in the Repair Parts and Special Tools List (RPSTL) in a separate manual, TM 9-2520-272-40P. Mandatory replacement parts are listed in the Materials/Parts section of the Initial Setup of each work package, when required, along with a reference to WP 0080, where the full list can be found.

HOW TO USE THIS MANUAL – (Continued)

EXPENDABLE AND DURABLE ITEMS

Expendable and durable items are called out under Materials/Parts in the Initial Setup section of maintenance procedures, when required, along with a reference to WP 0078, where the full list can be found. For example, the notation “(WP 0078, Item 8)” following the name of a supply item means that the description of the item is located on the list of expendable items, WP 0078, under Item 8.

SPECIAL CONDITIONS

Special conditions, such as unusual environmental conditions, are shown in a note before procedural steps begin. The most common note regarding special conditions occurs in procedures when the transmission is mounted on the maintenance stand.

Procedures that must be accomplished before you can perform your assigned maintenance task are shown on the initial setup page under Equipment Conditions. Usually, Equipment Conditions will show only one procedure to be done just before your assigned step. When you go back to the work package shown in Equipment Conditions, you may f nd another equipment condition in that work package. This arrangement of cross-referencing work package with preliminary steps continues in sequence until you get back to the very f rst work package required.

Additional procedures that must be accomplished after your assigned work package has been completed are shown under Follow-On Maintenance.

FINAL ADJUSTMENTS AND PREPARATION FOR STORAGE AND SHIPMENT

After the transmission has been repaired, preliminary brake adjustment must be made by torque wrench check before the transmission is placed in the container. The torque wrench brake check is provided in Chapter 3 (WP 0064).

REFERENCES TO OTHER PUBLICATIONS

Chapter 4 (WP 0077) provides a reference list of other manuals or publications that may provide additional information for your maintenance tasks.

ILLUSTRATED LIST OF MANUFACTURED ITEMS

WP 0075, Illustrated List of Manufactured Items, provides information for making locally fabricated items. These items are called out on the Initial Setup pages of procedures under Tools and Special Tools where reference is made to the Work Package, such as “(WP 0075, Item 1)”.

WP 0075 contains procedures and illustrations to manufacture the required part.

TORQUE LIMITS

This work package (WP 0076) provides a reference of standard torque specif cations of standard bolts used in the maintenance and repair of the X200-4A Transmission and its metal storage and shipping container. These values are provided as a reference and are not to override or change specif c torque values given in the maintenance work packages. In some applications a nonstandard torque may be specif ed in the maintenance work package.

GLOSSARY

The glossary contains abbreviations, terms, and def nitions which may be unique to transmissions. Words or terms that are generally understood among maintenance personnel are not listed in the glossary.

CHAPTER 1

GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

FOR

CROSS-DRIVE TRANSMISSION WITH CONTAINER, MODEL X200-4A

SUSTAINMENT MAINTENANCE

GENERAL INFORMATION

SCOPE

This manual addresses Sustainment Maintenance for the Allison Transmission Hydrokinetic Cross-Drive Transmission, Model X200-4A. Field Maintenance is addressed as necessary. The purpose of this equipment is to transmit power from the engine to the f nal drive. The transmission provides steering and braking for the vehicle. The X200-4A Transmission is part of the vehicle drive system for the M113 Family of Vehicles.

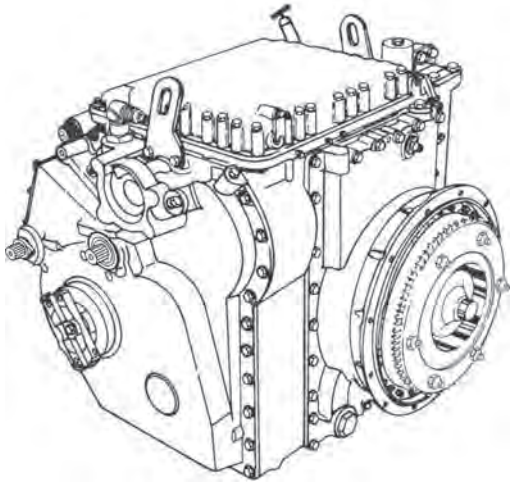


Figure1. Hydrokinetic Cross-Drive Transmission, Model X200-4A, Right Front External View.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your transmission needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you do not like about your equipment. Let us know why you do not like the design or performance. If you have Internet access, the easiest and fastest way to report problems or suggestions is to follow the instructions and links below:

For ALL non-Aviation/Missile Warranty, EIR and PQDRs must be submitted through the Web Product Quality Deficiency Reporting (PQDR) site. The Web PQDR site is: http://www.nslcptsmh.csd.disa.mil/webpqdr/webpqdr.htm. New accounts can be established at the following address: http://www.nslcptsmh.csd.disa.mil/accessforms/uarform.htm.

You may also submit your information using an SF 368 (Product Quality Deficiency Report). You can send your SF 368 using e-mail, regular mail, or fax using the addresses/fax numbers specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual. We will 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 future items. Corrosion specif cally occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron. Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking. Plastics, composites, and rubbers can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking.

SF Form 368, Product Quality Def ciency Report, should be submitted to the address specif ed in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

DESTRUCTION OF ARMY MATERIAL TO PREVENT ENEMY USE

Refer to TM 750-244-6 for methods and/or procedures needed for destruction of Army materiel to prevent its use by enemies.

PREPARATION FOR SHIPPING OR STORAGE

OVERVIEW

The X200-4A Transmission is installed in a protective container for storage or shipment. Dependent upon the condition of the transmission, transmissions may be installed and removed at the Field Maintenance, Depot Maintenance, or Below Depot Maintenance levels of maintenance. Unserviceable transmission assemblies in reusable shipping and storage containers are returned to Depot Maintenance. Refer to WP 0002 for more information about the shipping and storage container.

Transmission assemblies repaired at the Sustainment Maintenance level are usually reinstalled in the vehicle. Sometimes a repaired transmission assembly in a reusable shipping and storage container is to be returned to Field Maintenance or retained in long-term storage. Unserviceable transmission assemblies are often sent in a reusable shipping and storage container to Depot Maintenance. Proper preparation for packing the transmission assembly in a reusable shipping and storage container is important. The transmission assembly should be clean and drained of f uid. All appropriate plugs and covers should be installed on all inlets and outlets.

Refer to the Field Maintenance manual for the X200-4A Transmission, TM 9-2350-277-13&P, for detailed instructions on installing the transmission in or removing the transmission from the reusable shipping and storage container.

SHIPPING

NOTE

On early model transmission assemblies, the installation tag states to remove and discard six nuts and six support brackets that secure the torque converter to the transmission assemblies for shipment. This tag is in error. The six support brackets and six nuts must be retained. However, only three brackets and three nuts need be installed for shipping.

Some later models of the transmission assemblies utilize three shipping brackets, three nuts, three bolts, and 15 washers for retaining the torque converter for shipping.

Latest model transmission assemblies utilize three shipping brackets and three nuts for retaining the torque converter for shipping. These brackets and nuts are identical to those used on early six-bracket conf gurations.

Do not reuse nuts for transmission assembly installation. Use used nuts only for reinstallation of shipping brackets.

All bolts, washers, nuts, and brackets will be stored with reusable shipping and storage container for use when installing transmission assemblies in reusable shipping and storage containers.

Dependent upon where transmission assembly in reusable shipping and storage container originated from, shipping plugs and caps may or may not be present.

Field Maintenance personnel must ship unserviceable transmission assemblies and reusable shipping and storage containers to Sustainment Maintenance.

Sustainment Maintenance personnel must ship unserviceable transmission assemblies and reusable shipping and storage containers to Depot Maintenance. Sustainment Maintenance personnel may also return to supply or return to unit repaired transmission assemblies as necessary.

Empty reusable shipping and storage containers are to be shipped or stored in accordance with local directives.

NOMENCLATURE CROSS-REFERENCE LIST

This list matches common names used in this manual with the off cial nomenclature used in the Description column of the associated Repair Parts and Special Tools List (RPSTL) in TM 9-2520-272-40P.

Table 1. Nomenclature Cross-Reference List.

Common Name	Off cial Nomenclature
Cam shaft	Control cam
Clutch backing plate	Clutch disk
Dipstick	Oil level indicator
External-tanged clutch plate	Clutch disk
Filter-in tube	Metallic tube
Filter-out tube	Metallic tube
Friction-faced clutch plate	Clutch disk
Helical coil insert	Screw thread insert
Hydrostat	Hydrostatic pump and motor assembly
Internal-splined clutch plate	Clutch disk
Lube tube	Metallic tube
Petroleum jelly	Petrolatum
Range input shaft	Shouldered shaft
Reaction plate	Clutch disk
Scavenge tube	Metallic tube
Sump communication tube	Metallic tube
Thrust washer	Thrust washer bearing

LIST OF ABBREVIATIONS/ACRONYMS

This list provides common abbreviations and acronyms used in this manual.

Table 2. List of Abbreviations and Acronyms.

Abbreviation/Acronym	Def nition
	A
AEPS	Army Electronic Product Support
AMC	Army Materiel Command
AMSTA	Army Materiel Sub Command Tank Automotive
appx.	Approximate
	B
BE	Bale
BF	Board Foot
BT	Bottle
Bx	Box
	C
°C	Degrees Celsius, Degrees Centigrade
C	Crew
CAGEC	Commercial and Government Entity Code
CN	Can
CPC	Corrosion Prevention and Control
CTA	Common Table of Allowances

Abbreviation/Acronym	Def nition
	D
D	Depot
DA	Department of the Army
DA PAM	Department of the Army Pamphlet
DMWR	Depot Maintenance Work Requirement
DSN	Defense Switched Network
DZ	Dozen
	E
EA	Each
EIC	End Item Code
EIR	Equipment Improvement Recommendation
e-mail	Electronic Mail Transmittal
etc.	Et Cetera
	F
°F	Degrees Fahrenheit
F	Field (Maintenance) / Maintainer
FAX	Facsimile Transmittal
Fig	Figure
ft	Foot
	G
gal	Gallon
GL	Gallon
GMC	General Motors Corporation
GMI	General Maintenance Information
GMTK	General Mechanic’s Tool Kit
G2	Governor 2
	H
H	Below Depot Maintenance
HP	Horsepower
	I
ID	Inside Diameter
i.e.	That Is
in.	Inch
IUID	Item Unique Identif cation Data
	K
kg	Kilogram
kPa	Kilopascals
KT	Kit

Abbreviation/Acronym	Def nition
	L
L	Liter
L	Lubrication
lb	Pound
lb-ft	Pound Feet
lb-in.	Pound Inch
Lube	Lubrication
	M
max	Maximum
MI	Michigan
MIL	Military (specif cation)
mm	Millimeter
MPH	Miles per Hour
MRP	Mandatory Replacement Parts
MS	Military Standard
MTOE	Modif ed Table of Organization and Equipment
MWO	Modif cation Work Order
	N
N	Newton
N·m	Newton-Meter
NO.	Number
NSN	National Stock Number
	O
OD	Outside Diameter
oz	Ounce
	P
&P	(Including Repair Parts and Special Tools Lists)
PAM	Pamphlet
pg	Page
PK	Package
PMCS	Preventive Maintenance Checks and Services
P/N	Part Number
PR	Pair
PSI	Pounds per Square Inch
pt.	Point
	Q
QTY	Quantity
	R
RL	Roll
RPM	Revolutions per Minute
RPSTL	Repair Part and Special Tools List

Abbreviation/Acronym	Def nition
	S
SF	Standard Form
SH	Sheet
	T
TACOM	Tank-Automotive and Armaments Command
TAMMS	The Army Maintenance Management System
TB	Technical Bulletin
TB	Tube
TM	Technical Manual
TMDE	Test, Measurement, and Diagnostic Equipment
	U
U/I	Unit of Issue
UNC	Unif ed National Coarse Thread
UOC	Usable On Code
U.S.	United States
UV	Ultraviolet
	W
WP	Work Package
	X
X200-4A	Cross-Drive Transmission
	Y
YD	Yard

QUALITY OF MATERIAL

Material used for replacement, repair, or modif cation must meet the requirements stated in this manual, TM 9-2520-272-40. If quality of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specif cations, or approved engineering change proposals applicable to the subject equipment.

SUPPORTING INFORMATION FOR REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Common Tools and Equipment

For authorized common tools and equipment, refer to the Modif ed Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment, or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

Special Tools

Special tools must be manufactured for use in Sustainment Maintenance procedures. Refer to the Illustrated List of Manufactured Items for a list of these tools and their specif cations (WP 0075).

Repair Parts

Repair parts are listed and illustrated in the Repair Parts and Special Tools list (TM 9-2520-272-40P).

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The purpose of the Cross-Drive Transmission, Model X200-4A is to transmit power from the engine to the f nal drive. The X200-4A transmission is part of the vehicle drive system for the M113 Family of Vehicles.

Vehicle Drive Power

Power is transmitted from engine to transmission through the torque converter. The torque converter is a f uid coupling and torque multiplier. The increased torque from the torque converter is extended through selected planetary gears to output shafts.

Left and right output shafts transmit power to the f nal drive assemblies. The f nal drive units operate sprocket drive shafts for left and right tracks. A clutch arrangement in the transmission enables gear selection.

Steering

Steering is accomplished through the transmission.

Braking

Braking is accomplished through the transmission.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

General knowledge of the description, location, interaction, and function of the transmission major assemblies is imperative in the performance of maintenance functions. General knowledge of the major assemblies will also assist in the ability to identify repair parts. Refer to Figure 1 for an exploded view of the major assemblies of the X200-4A Transmission.

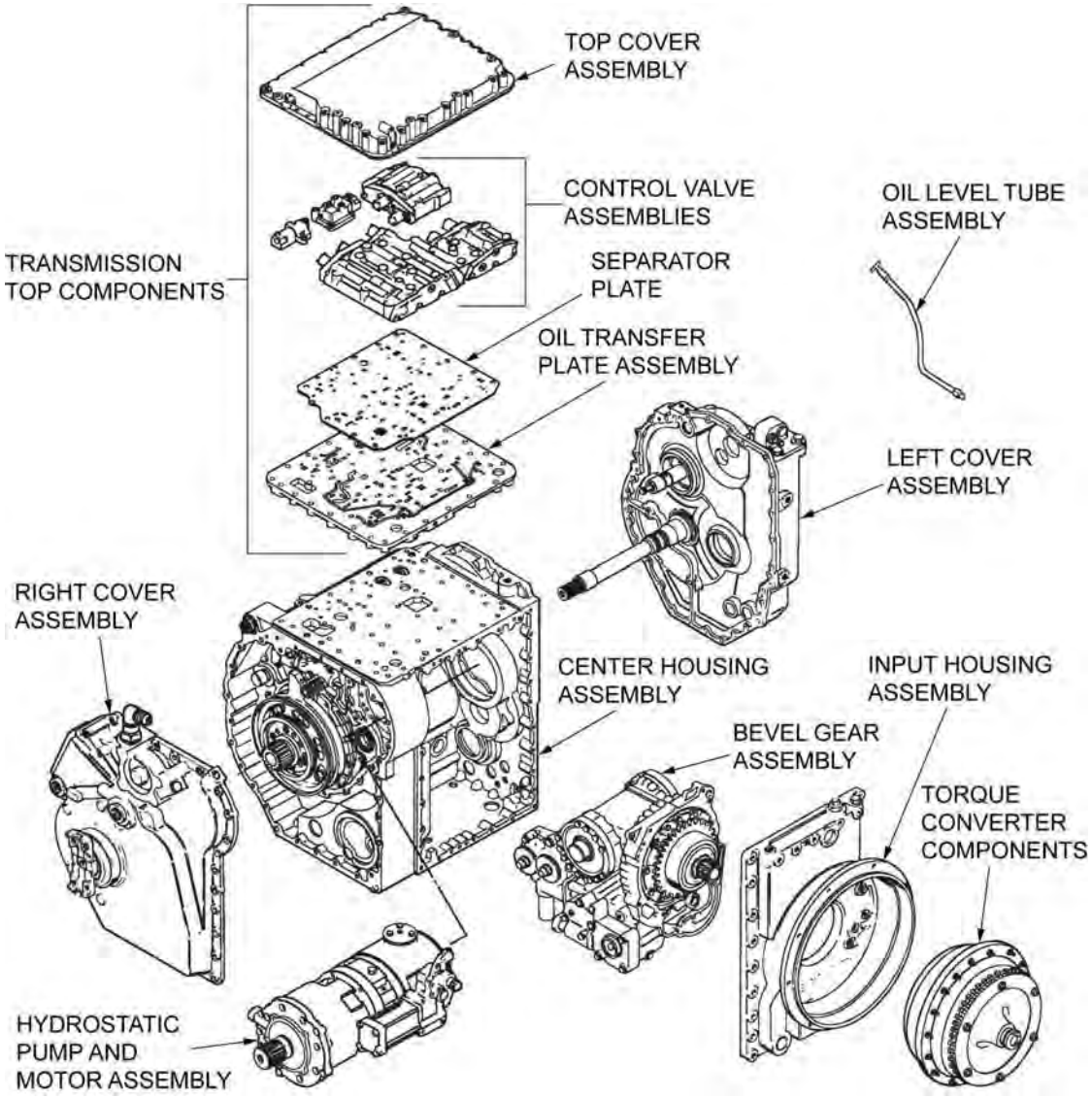


Figure 1. Major Assemblies of the Transmission.

Transmission Top Cover Assembly

Covers the control valve assemblies. Contains the push-start control rod and houses the vacuum modulator.

The functional components on top of the transmission are control valve assemblies and solenoids. All components must be removed from the top of the transmission prior to removal of the range pack. Sensor tubes and bolts extending into the range pack are accessed from the top center housing assembly, beneath the transmission top components. Refer to Figure 2 for an exploded view of the major top components of the X200-4A Transmission.

Control Valve Assemblies

Includes the valves, springs, and other components that control the selection of ranges and automatic shifting of gears. The control valve assemblies are mounted on the separator plate and oil transfer plate assembly at the top of the transmission center housing.

Separator Plate and Oil Transfer Plate Assembly

Channels oil between the control valve assemblies and the transmission center housing.

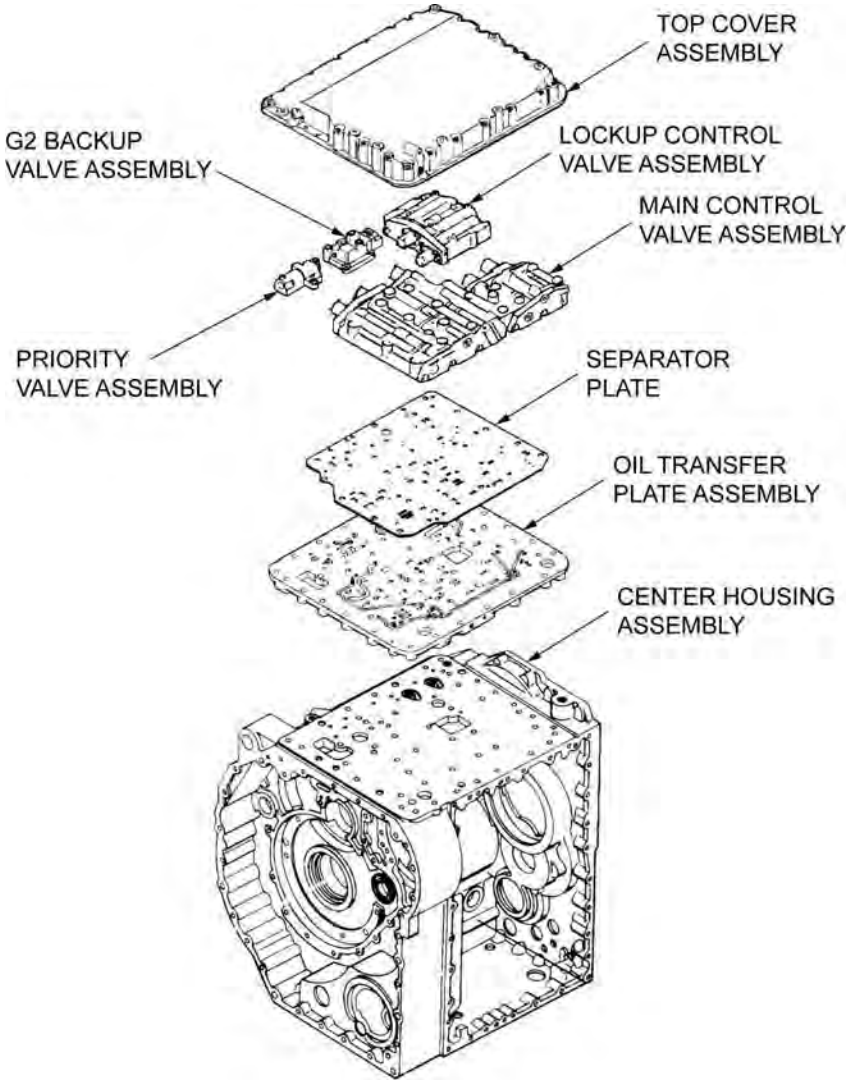


Figure 2. Exploded View of Major Top Components.

Left Cover Assembly

Covers range gears, range pack, and hydrostatic gears. Contains the oil filter and filter cover, output shaft, and coupling that transfers power to final drive.

The left cover assembly houses the oil filter. The left output flange connects to final drive linkage. Refer to Figure 3 for an exploded view of the major components of the left cover assembly.

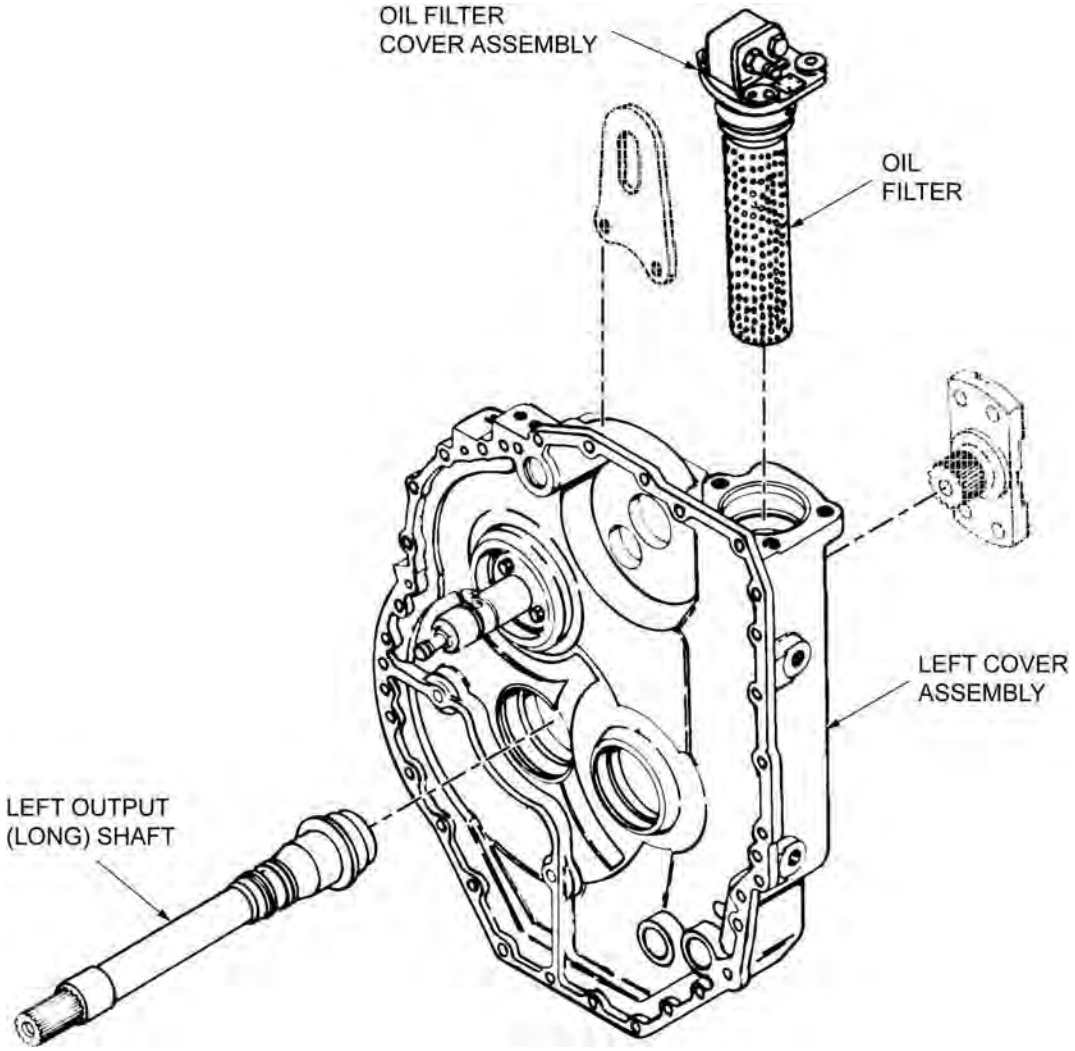


Figure 3. Exploded View of Major Components of Left Cover Assembly.

Right Cover Assembly

Covers left brake assembly, governor body, equalizer valve, steer shaft and gears, range output gears, and hydrostatic drive gear. Contains right brake assembly, steer gears, brake apply shafts for left and right brakes, brake apply valve, brake coolant valve, right brake adjust access cover, and output coupling that transfers power to f nal drive.

The right brake apply shaft and an extension of the left brake apply shaft connect to external brake control linkage. The right output f ange connects to f nal drive linkage. The majority of right cover internal components relate to the right brake or steering components. Refer to Figure 4 for an exploded view of the major components of the right cover assembly.

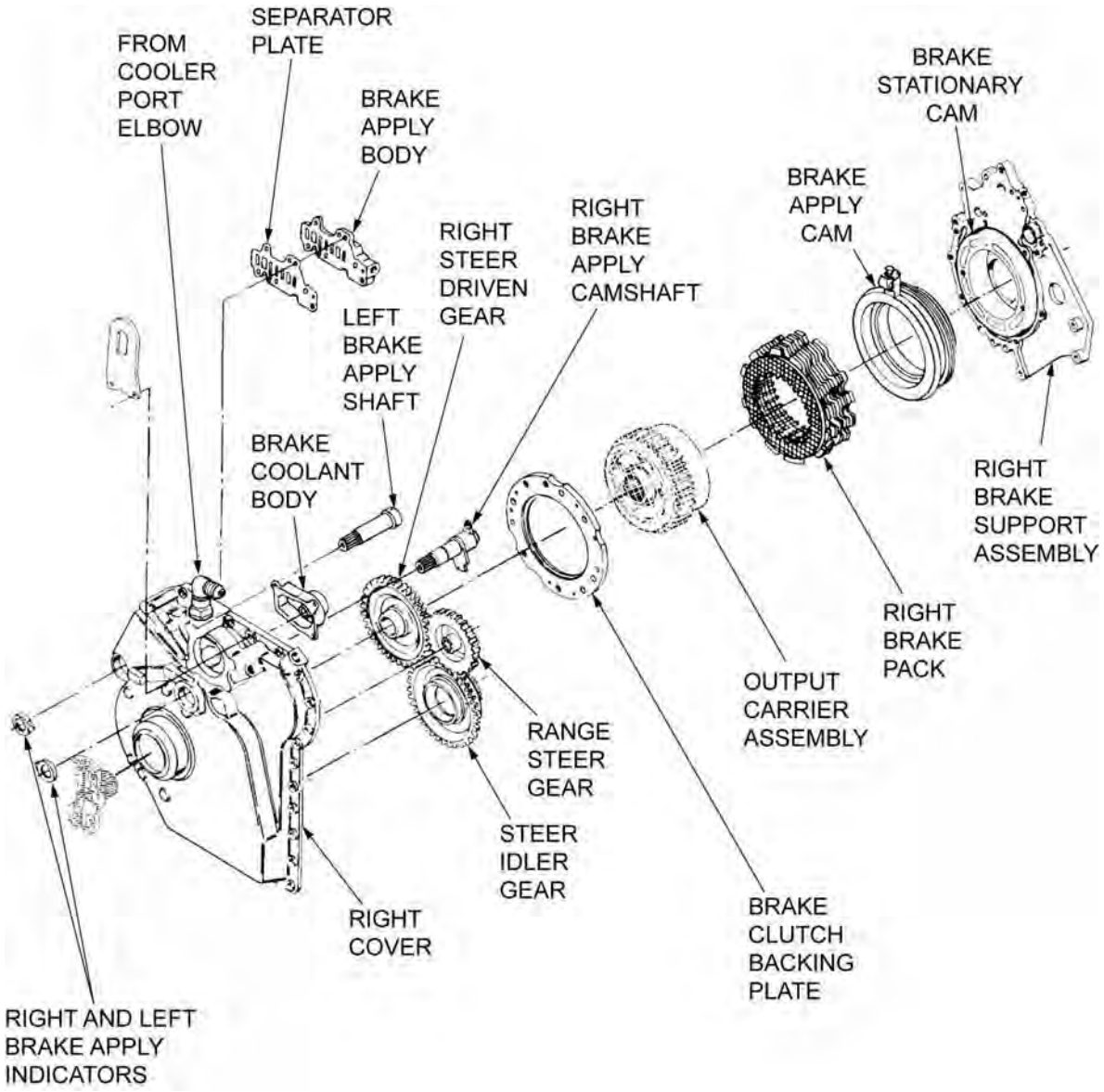


Figure 4. Exploded View of Major Components of Right Cover Assembly.

Torque Converter Components

The torque converter consists of three elements: the pump assembly, the stator assembly, and the turbine assembly. The engine through the f ywheel drives the pump assembly. The turbine assembly is the output element. The stator assembly is the reaction (torque-multiplying) element.

The converter pump cover and ring gear are splined to the f ywheel of the vehicle engine, which transfers power from the engine to the converter components. A turbine shaft extends from the bevel gear assembly through the input housing and into the torque converter. This turbine shaft transmits power from the torque converter to the bevel gear assembly. Refer to Figure 5 for an exploded view of the major components of the torque converter.

Input Housing Assembly

Covers the bevel gear assembly, the hydrostatic pump, and the motor steer control assembly. Houses the torque converter components. Contains port for steer shaft and access port for steering adjustment. Refer to Figure 5 for an exploded view that includes the input housing assembly.

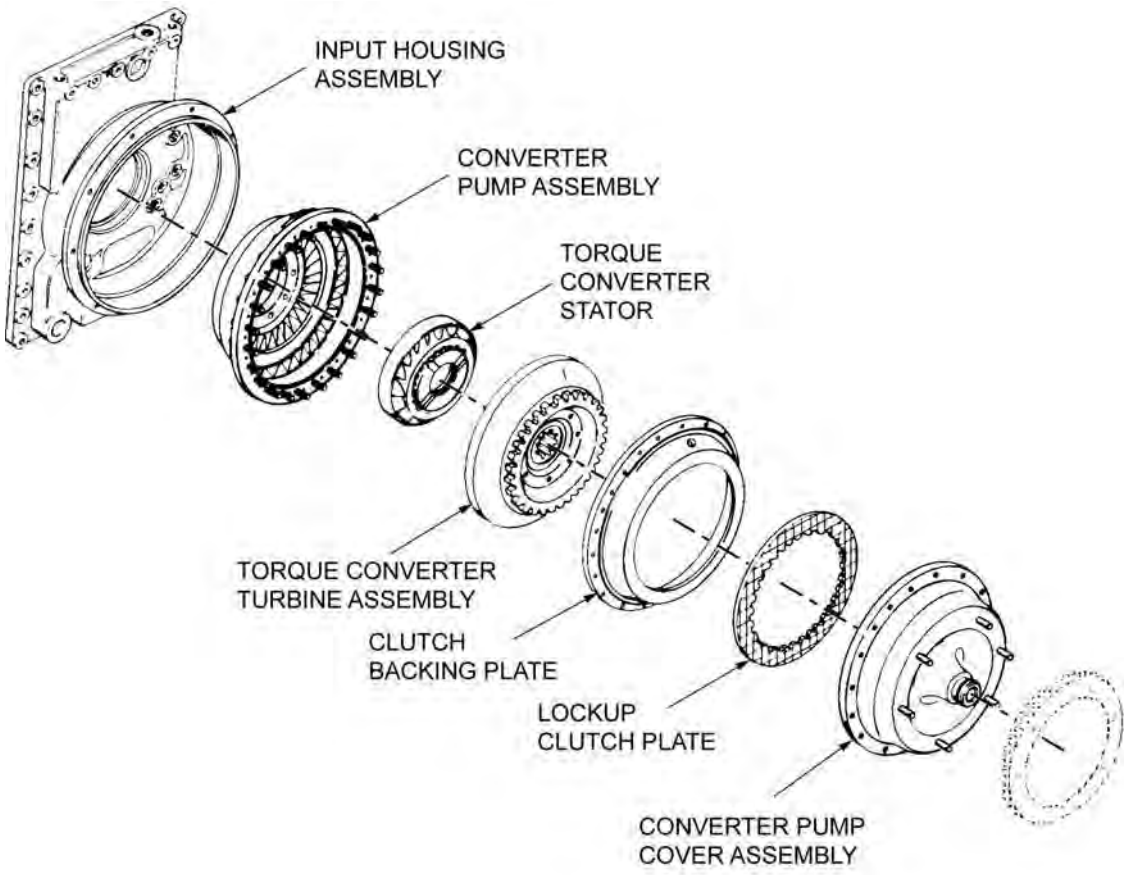


Figure 5. Input Housing and Exploded View of Major Components of the Torque Converter.

Bevel Gear Assembly

Contains the bevel gears for transfer of power to left and right sides in the cross-drive system. Houses and drives the oil pumps. Houses the push-start valve.

Figure 6 shows an exploded view of most of the bevel gear assembly components that are removed and installed at the Sustainment Maintenance level.

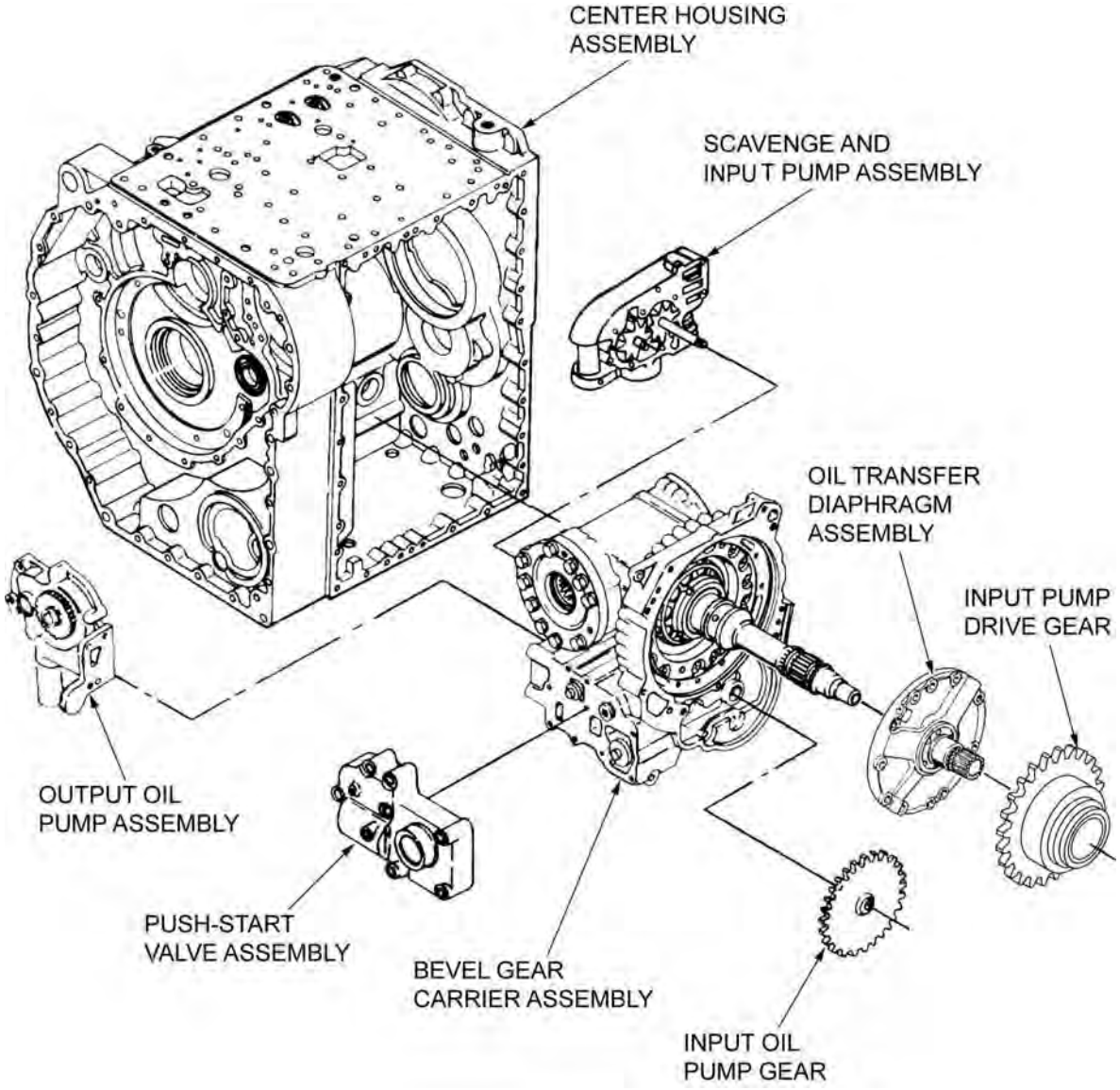


Figure 6. Exploded View of Bevel Gear Assembly.

Center Housing Assembly

The center housing assembly is the main part of the transmission. Channels oil to various assemblies and houses all major transmission assemblies. Contains drilled and tapped bosses on bottom for mounting transmission to maintenance stand.

The main items in the left side of the transmission make up the range pack. The range pack is a group of clutch assemblies and planetary gear assemblies that enable transmission speed and power output to be changed. The range pack also enables the vehicle to move in forward or reverse direction. Refer for Figure 7 for an exploded view of the major components in the left side of the center housing assembly.

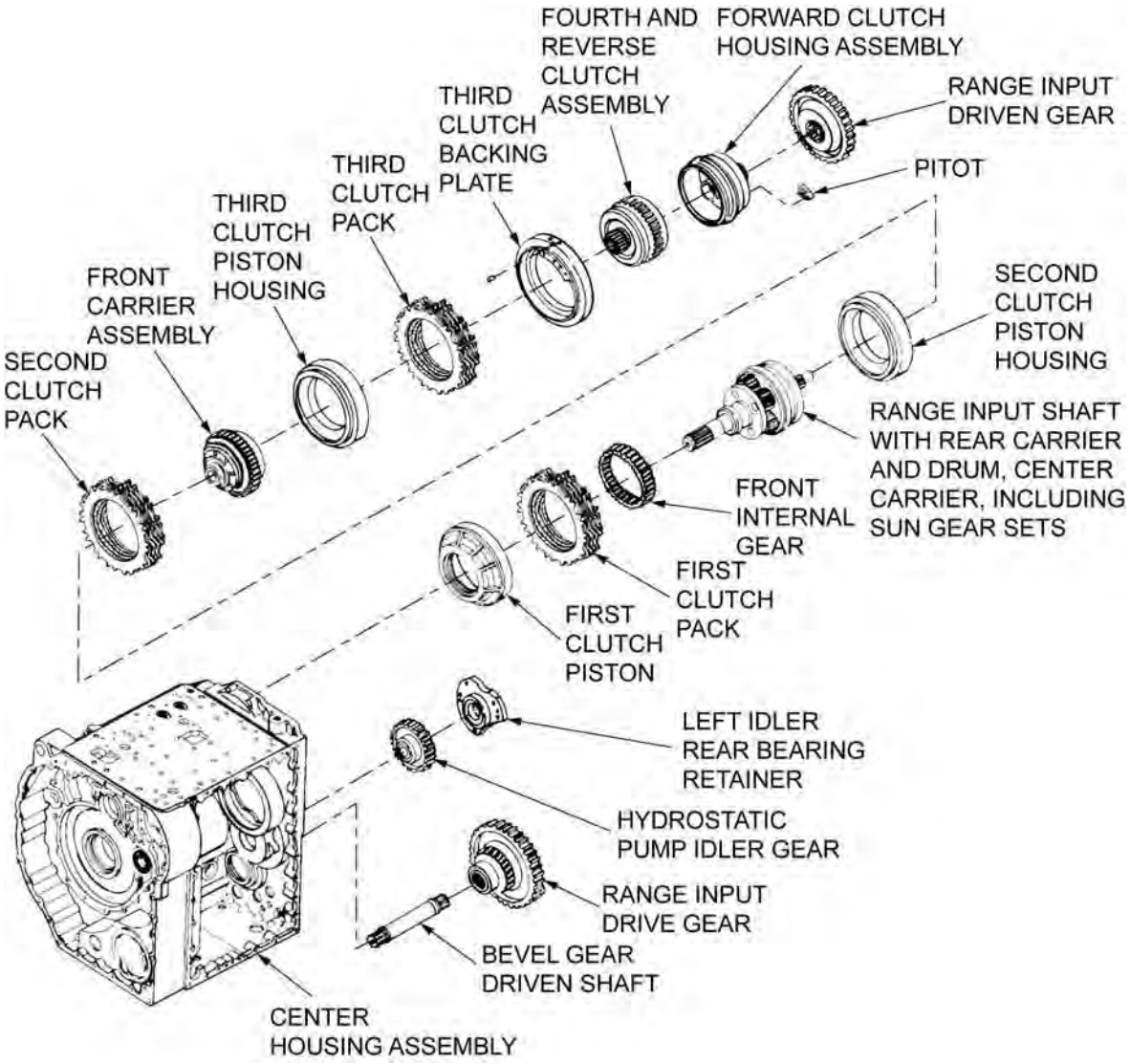


Figure 7. Exploded View of Major Components, Left Side of Center Housing Assembly.

The main item in the right side of the center housing assembly is the left brake assembly. The governor is housed on the right side. The hydrostat, right output shaft, and sump communication tube are removed from this side of the center housing assembly. Refer to Figure 8 for an exploded view of the major components in the right side of the center housing assembly.

Hydrostatic Pump and Motor Assembly

Power steering unit. The steer control assembly must be removed in order to remove the hydrostat from the transmission. External gears are removed when the hydrostat is replaced. Otherwise, the hydrostat is not dealt with at the Sustainment Maintenance level. Figure 8 includes the hydrostatic pump and motor assembly in its exploded view of the major components in the right side of the center housing assembly.

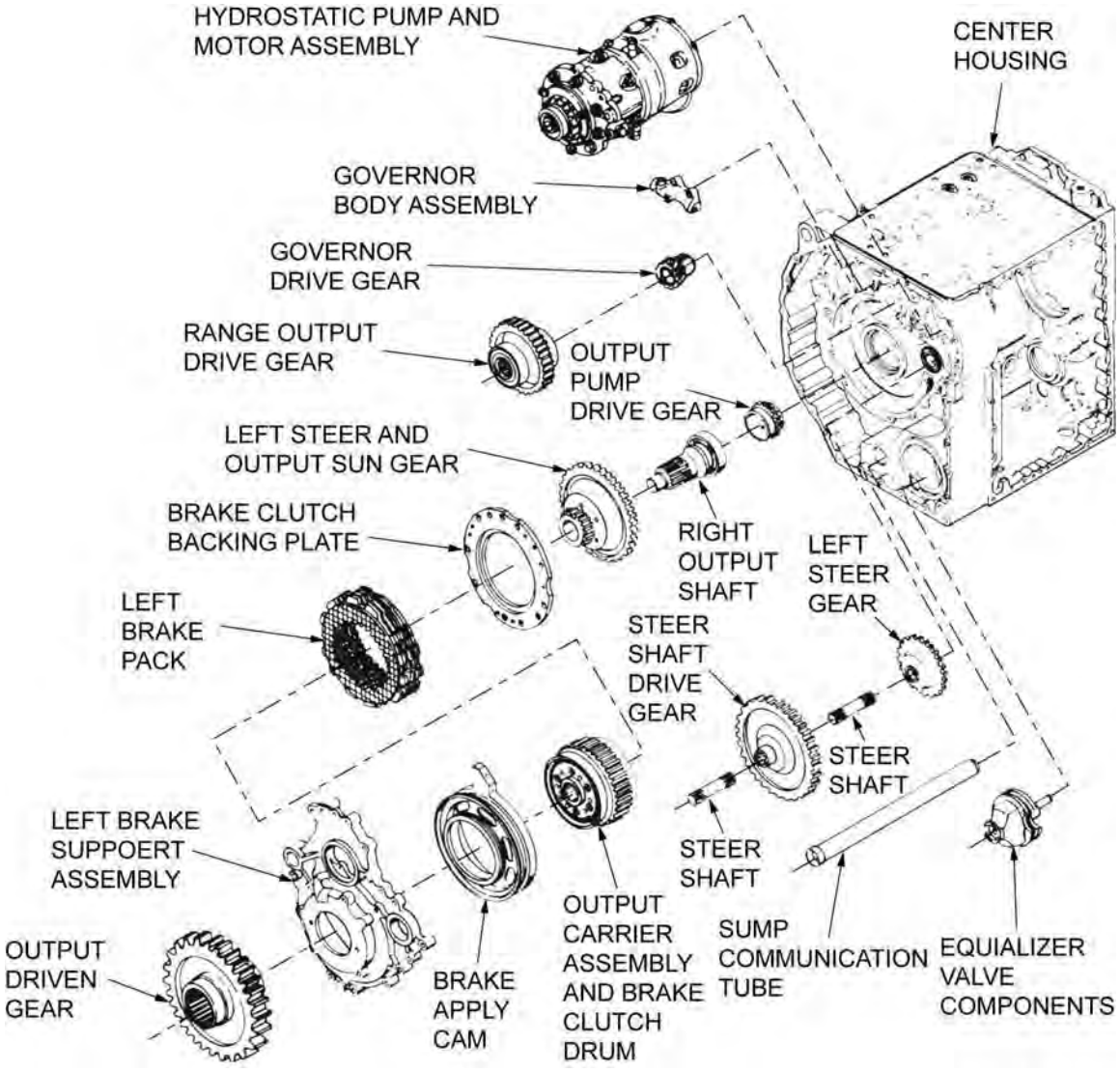


Figure 8. Exploded View of Major Components, Right Side of Center Housing Assembly.

TRANSMISSION IDENTIFICATION PLATE AND IUID DATA PLATE

The transmission identif cation plate is located in the upper right quadrant on the rear side of the transmission. Refer to Figure 9 for an illustration of the location of the transmission Modif cation Work Order (MWO)/Overhaul Data Plate with Item Unique Identif cation (IUID).

The IUID is part of the transmission's data plate. Each transmission overhaul shall be recorded on this data plate. Minimum information to be recorded follows:

Initials of overhaul facility.

Serial number of transmission.

Identif cation of any MWO applied.

Date of MWO or overhaul application.

For instructions on how to remove or install the data plate, refer to TM 9-2350-277-13&P.

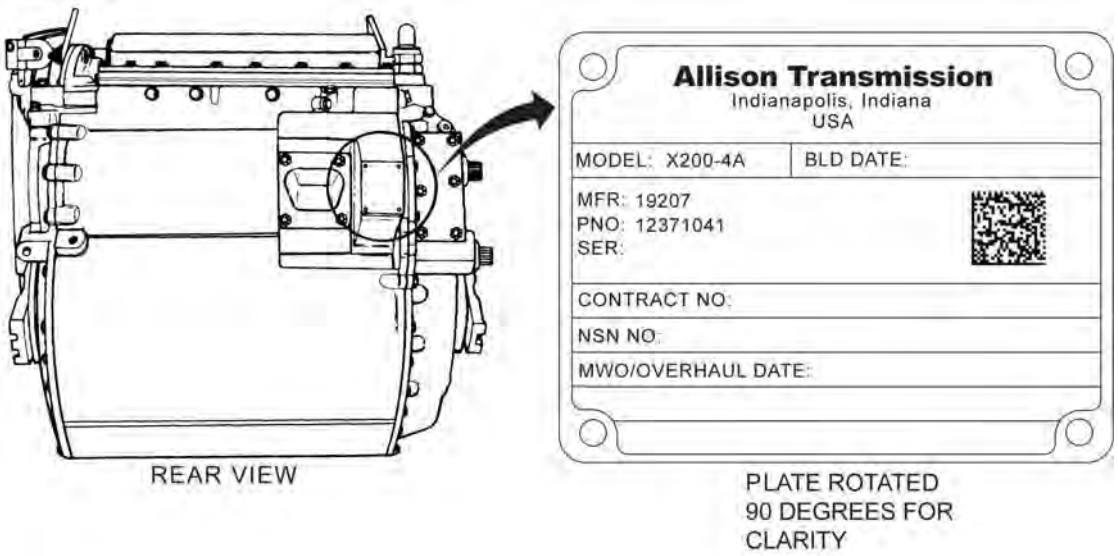


Figure 9. Location and View of MWO/Overhaul Data Plate with IUID.

REUSABLE STORAGE AND SHIPPING CONTAINER DESCRIPTION

The transmission is installed in a protective container for storage or shipment. Transmission installation into and removal from the shipping container by various levels of maintenance personnel is dependent upon the condition of the transmission and the purpose of the installation or removal. Refer to Figure 10 for an illustration of the reusable storage and shipping container.

Desiccant is placed within the container to absorb moisture. The container has a humidity indicator, an air release valve, and a desiccant receptacle. It is equipped for handling by forklift.

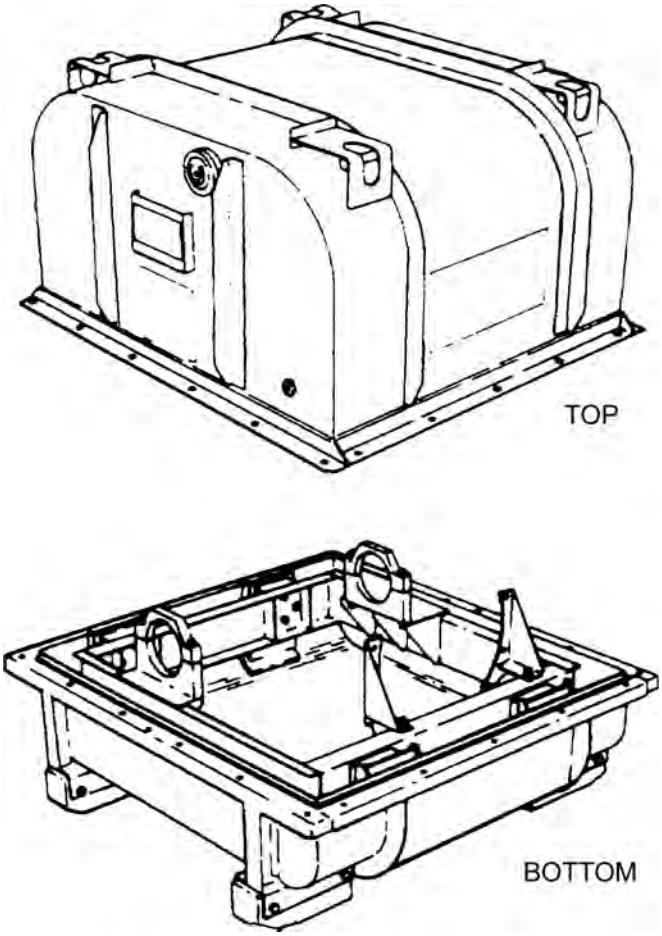


Figure 10. External View of Container Top, Internal View of Container Bottom.

The reusable shipping and storage container should be repaired in accordance with TB 9-289, Reconditioning of Type I and Type II Reusable Metal Containers.

Refer to TM 9-2350-277-13&P for detailed procedures for transmission removal from and installation into container.

EQUIPMENT DATA

Operator's instructions are located in vehicle operation manuals. (Refer to TM 9-2350-277-10 or TM 9-2350-247-10.)

Table 1. X200-4A Transmission System Data.

Manufacturer	**Allison Transmission Division, GMC**
Model	X200-4A
Usable On Code (UOC)	X4A
Ratings	
Input, net (max)	350 HP
Input	2800 RPM
Gross vehicle weight	36,000 pounds at 40 MPH
Converter	
Type	Single stage, three element, polyphase
Stall torque ratio	2.70:1
Lockup clutch	Automatic second through fourth range
Gearing Type	Constant mesh, spur type, planetary
Ranges	**Ratios**
First	4.16:1
Second	2.34:1
Third	1.46:1
Fourth	1.04:1
Reverse	6.62:1
Steering Type	Inf nitely variable, hydrostatically controlled differential
Range	**Minimum Steer Ratio**
First	2.31:1
Second	1.58:1
Third	1.32:1
Fourth	1.22:1
Neutral	Pivot
Brakes	
Type	Multiple wet plate
Service apply	Hydraulic with mechanical actuation
Parking/emergency apply	Mechanical backup service brakes
Deceleration Rate	16 feet/second/second
Oil System	
Capacity	12 gallons
Sump	Integral
Filter	Integral, two-stage with differential pressure warning switch and automatic bypass
Weight (Dry)	
Transmission	975 lb (442 kg) max
Transmission with container	1565 lb (710 kg) appx.

Table 2. Basic Container Data.

Dimension	Measurement
Height	42.64 in. (1083.06 mm)
Width	48.56 in. (1233.42 mm)
Depth	44.75 in. (1136.65 mm)
Weight, empty container	590 lb (267.62 kg)
Weight, transmission installed	1565 lb (709.87 kg)

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

THEORY OF OPERATION

FUNCTIONS OF THE TRANSMISSION

Vehicle Drive Power

Power is transmitted from engine to transmission through the torque converter. The torque converter is a fluid coupling and torque multiplier. The increased torque from the torque converter is extended through selected planetary gears to output shafts.

Left and right output shafts transmit power to the final drive assemblies. The final drive units operate sprocket drive shafts for left and right tracks.

A clutch arrangement in the transmission enables gear selection.

Steering

Steering is accomplished through the transmission.

Braking

Braking is accomplished through the transmission.

TRANSMISSION OPERATION

Transmission operating procedures are included in vehicle operation manuals. Refer to TM 9-2350-247-10 or TM 9-2350-277-10.

TRANSMISSION TROUBLESHOOTING

Transmission troubleshooting procedures are included in vehicle operation manuals. Refer to TM 9-2350-247-20 or TM 9-2350-277-13&P.

TRANSMISSION REMOVAL AND INSTALLATION

Procedures to remove and install the transmission are included in vehicle maintenance manuals. Refer to TM 9-2350-247-34 or TM 9-2350-277-13&P.

THEORY OF ORGANIZATION OF MAINTENANCE PROCEDURES

Manual Organization

This section discusses how to remove, disassemble, repair, assemble, and install the major assemblies of the X200-4A Transmission.

This manual is divided into work packages that cover maintenance tasks pertaining to specific assemblies or groups of parts.

When a part needs to be inspected by a special method, that inspection method is explained in work package maintenance procedures. Reuse good parts and replace bad parts.

Mandatory replacement parts, which are listed in WP 0080, are discarded and are replaced by new parts every time the transmission is disassembled.

Equipment Items

Each work package lists steps that take parts off the transmission, repair parts, or put them back on the transmission.

Suggested Order of Disassembly and Assembly of the Major Assemblies of X200-4A Transmission

The following list is the suggested order for the transmission's disassembly into and assembly from major assemblies. Note that assembly is in reverse order from disassembly.

Remove Transmission Top Components

Install Transmission on Maintenance Stand

Remove Right Cover Assembly

Remove Left Cover Assembly

Remove Converter Element Components

Remove Input Housing Assembly

Remove Bevel Gear Assembly

Remove Hydrostatic Pump and Motor Assembly

Install Hydrostatic Pump and Motor Assembly

Install Bevel Gear Assembly

Install Input Housing Assembly

Install Converter Element Components

Install Left Cover Assembly

Install Right Cover Assembly

Remove Transmission from Maintenance Stand

Install Transmission Top Components

USABLE ON CODE

If multiple models were present in the Repair Parts and Special Tools List (RPSTL), the X200-4A Transmission would be identif ed by a Usable On Code (UOC). X4A is the UOC for the X200-4A Transmission. In each RPSTL f gure that contains multiple UOCs, under (6) Description and Usable on Codes (UOC), you will f nd the UOC for the part, if applicable. If no UOC is listed, the part will be used in all models and all UOCs covered in that RPSTL.

END OF WORK PACKAGE

CHAPTER 2

TROUBLESHOOTING PROCEDURES

FOR

CROSS-DRIVE TRANSMISSION WITH CONTAINER, MODEL X200-4A

SUSTAINMENT MAINTENANCE

TROUBLESHOOTING PROCEDURES

There are no troubleshooting procedures required for the Cross-Drive Transmission with Container, Model X200-4A, at the Sustainment Maintenance level. For Field Maintenance level troubleshooting procedures, see TM 9-2350-277-13&P.

END OF WORK PACKAGE

CHAPTER 3

MAINTENANCE INSTRUCTIONS

FOR

CROSS-DRIVE TRANSMISSION WITH CONTAINER, MODEL X200-4A

SUSTAINMENT MAINTENANCE

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

INITIAL SETUP:

References
TM 9-2350-277-13&P

There are no Preventive Maintenance Checks and Services (PMCS) required for the Cross-Drive Transmission with Container, Model X200-4A, at the Sustainment Maintenance level. For Field Maintenance level PMCS, see TM 9-2350-277-13&P.

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE OIL FILL TUBE ASSEMBLY

INITIAL SETUP:

References
TM 9-2350-277-13&P

For detailed instructions on the replacement of the oil f ll tube assembly, refer to the Field Maintenance manual for the X200-4A Transmission, TM 9-2350-277-13&P.

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE TOP COVER ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 48)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Breather and right and left lifting brackets removed (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)

REMOVE TOP COVER ASSEMBLY

CAUTION

Be careful not to let dirt get into control valve assemblies when top cover is removed. Contamination of control valves can cause transmission failure.

NOTE

Make sure transmission is in an upright position on f oor or work table during maintenance.

1. Remove 15 machine bolts (Figure 1, Item 3), nine machine bolts (Figure 1, Item 2), and two machine bolts (Figure 1, Item 1) from transmission top cover (Figure 1, Item 4).
2. Remove transmission top cover (Figure 1, Item 4) and transmission top cover gasket (Figure 1, Item 5) from transmission. If necessary, tap cover (Figure 1, Item 4) with plastic-faced hammer to loosen. Discard transmission top cover gasket.

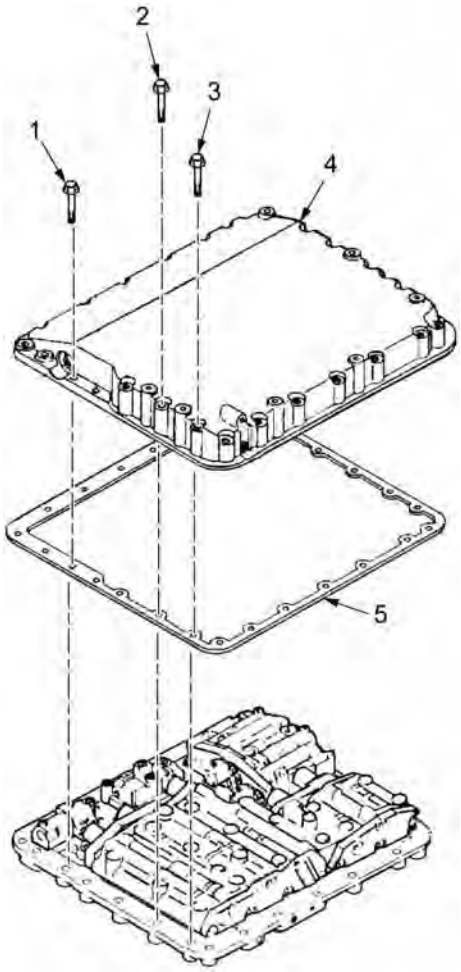


Figure 1. Top Cover Assembly Removal.

END OF TASK

INSTALL TOP COVER ASSEMBLY

1. Install new transmission top cover gasket (Figure 2, Item 5) on transmission.

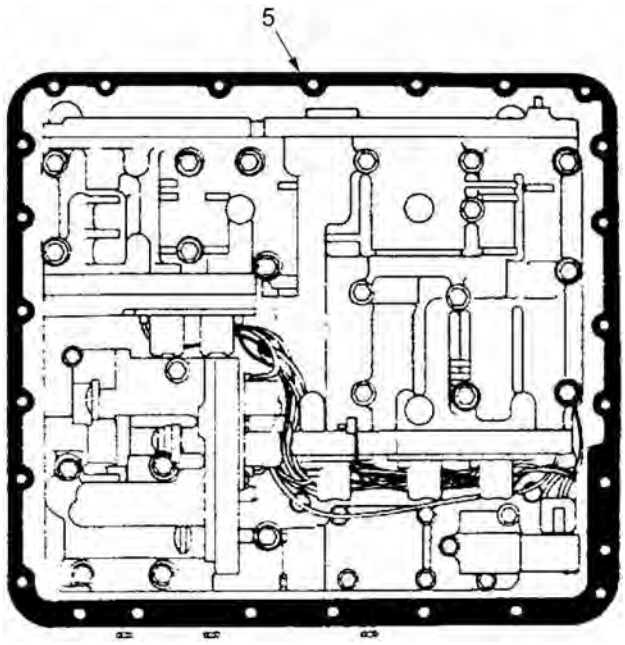


Figure 2. Transmission Top Cover Gasket Installation.

2. Put top cover (Figure 3, Item 4) on transmission.
3. Install fifteen 5/16-18 x 3-1/2-inch machine bolts (Figure 3, Item 3) to attach top cover (Figure 3, Item 4) to transmission.
4. Install two 5/16-18 x 1-3/4-inch machine bolts (Figure 3, Item 1) to attach top cover (Figure 3, Item 4) to transmission.
5. Install nine 5/16-18 x 2-inch machine bolts (Figure 3, Item 2) to attach top cover (Figure 3, Item 4) to transmission.
6. Torque machine bolts (Figure 3, Item 1) and (Figure 3, Item 2) and (Figure 3, Item 3) to 13 to 15 lb-ft (18 to 20 N·m).

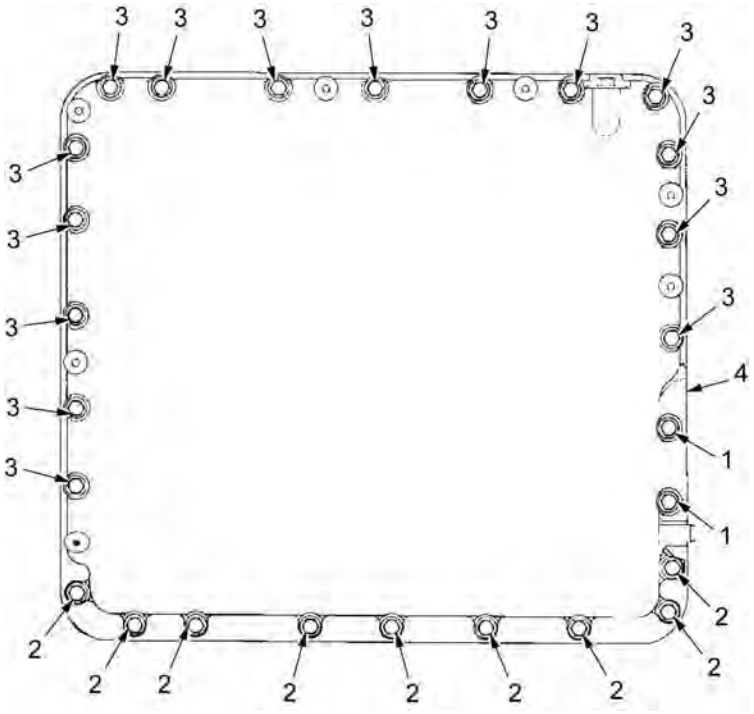


Figure 3. Transmission Top Cover Installation.

FOLLOW-ON MAINTENANCE

1. If transmission is to be installed in a vehicle, install oil fill tube assembly. Reference the Replace Oil Fill Tube Assembly WP in Field Maintenance manual, TM 9-2350-277-13&P.
2. If transmission is to be installed in shipping container, attach oil fill tube assembly to input housing. Reference Remove/Install Transmission Assembly from/into Container WP in Field Maintenance manual, TM 9-2350-277-13&P.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE MAIN CONTROL VALVE ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
WP 0070

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Top cover assembly removed (WP 0007)
Oil transfer plate assembly installed (WP 0015)

CAUTION

Be careful to avoid letting dirt get into the control valve assemblies when top cover assembly is removed. Contamination of control valves can cause transmission failure.

NOTE

Control valve assemblies are removed from transmission with solenoids attached.

Wiring harness does not have to be removed to remove control valve assemblies, except for wiring harness ground connector.

One bolt and washer are removed from control valve assembly when harness ground connector is removed.

Make sure transmission is in upright position on floor or work table.

No solenoid should be removed from control valve assemblies unless test procedures have established that solenoid malfunction exists.

When necessary to replace a solenoid or to repair a solenoid connector, refer to Replace Solenoids and Terminals, WP 0070.

REMOVE MAIN CONTROL VALVE ASSEMBLY

1. Disconnect plastic connectors that attach wiring harness to solenoids.
2. Remove bolt (Figure 1, Item 1) and washer (Figure 1, Item 2) that attach the wiring harness ground connector (Figure 1, Item 4) to the main control valve assembly (Figure 1, Item 3), if necessary.

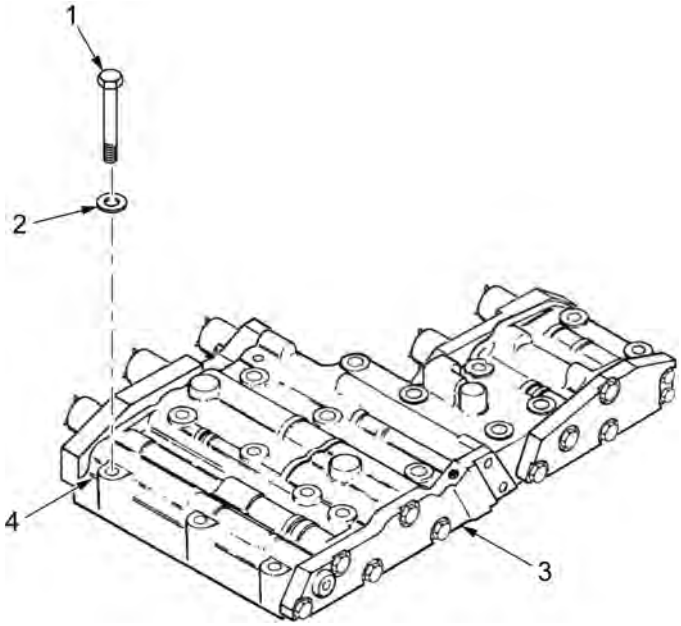


Figure 1. Wiring Harness Ground Connector Hardware Removal.

3. Remove seven 5/16-18 x 2-3/4 inch bolts (Figure 2, Item 5) and washers (Figure 2, item 6) that attach main control valve assembly (Figure 2, Item 3) to transmission.
4. Remove three 5/16-18 x 3 inch bolts (Figure 2, Item 8) and washers (f gure 2, Item 6) that attach main control valve assembly (Figure 2, Item 3) to transmission.
5. Remove four 5/16-18 x 3-1/4 inch bolts (Figure 2, Item 7) and washers (f gure 2, Item 6) that attach main control valve assembly (Figure 2, Item 3) to transmission.
6. Remove main control valve assembly (Figure 1, Item 3) from separator plate (Figure 2, Item 10) by pulling up and away from guide pins (Figure 2, Item 9).

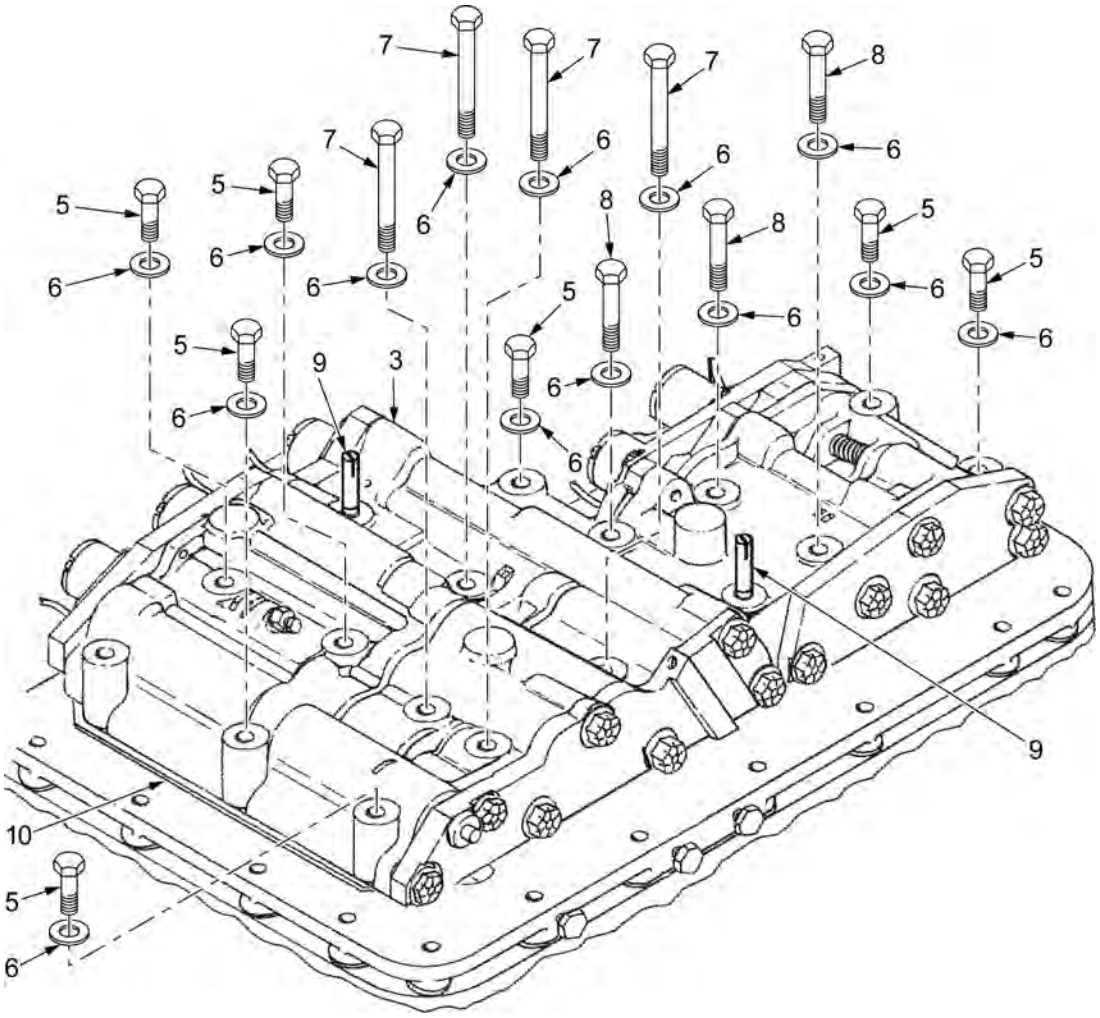


Figure 2. Main Control Valve Assembly Removal.

END OF TASK

INSTALL MAIN CONTROL VALVE ASSEMBLY

CAUTION

Transmission must be in upright position when oil transfer gasket, oil transfer plate assembly, separator plate, and control valve assemblies are installed. If transmission is not in vertical position when these items are installed, misalignment of holes can block oil f ow, causing malfunction of transmission.

Be careful not to let dust get into control valve assemblies. Keep top of transmission center housing assembly clean. Keep all parts clean. Wipe with batiste cloth. Contamination of control valves can cause transmission failure.

1. Clean separator plate (Figure 3, Item 10) and main control valve assembly (Figure 2, Item 4) as necessary, using batiste cloth.

NOTE

Guide pins are installed at time of installation of separator plate. Refer to WP 0015 for details on installation of guide pins.

One 5/16-18 x 2-3/4 inch bolt and washer at wiring harness ground connector location are not installed until after wiring harness has been installed.

2. Install main control valve assembly (Figure 3, Item 3) over two guide pins (Figure 3, Item 9) and onto separator plate (Figure 3, Item 10).
3. Install seven 5/16-18 x 2-3/4 inch bolts (Figure 3, Item 5) and washers (Figure 3, Item 6) holding main control valve assembly (Figure 3, Item 3) to transmission.
4. Install three 5/16-18 x 3 inch bolts (Figure 3, Item 8) and washers (Figure 3, Item 6) holding main control valve assembly (Figure 3, Item 3) to transmission.
5. Install four 5/16-18 x 3-1/4 inch bolts (Figure 3, Item 7) and washers (Figure 3, Item 6) holding main control valve assembly (Figure 3, Item 3) to transmission.
6. Make sure no bolt has been installed in ground connector location (Figure 3, item 4).
7. Torque all 14 bolts (Figure 3, Item 5) and (Figure 3, Item 7) and (Figure 3, Item 8) to 17 to 20 lb-ft (23 to 27 N·m).
8. Remove two guide pins (Figure 3, Item 9).

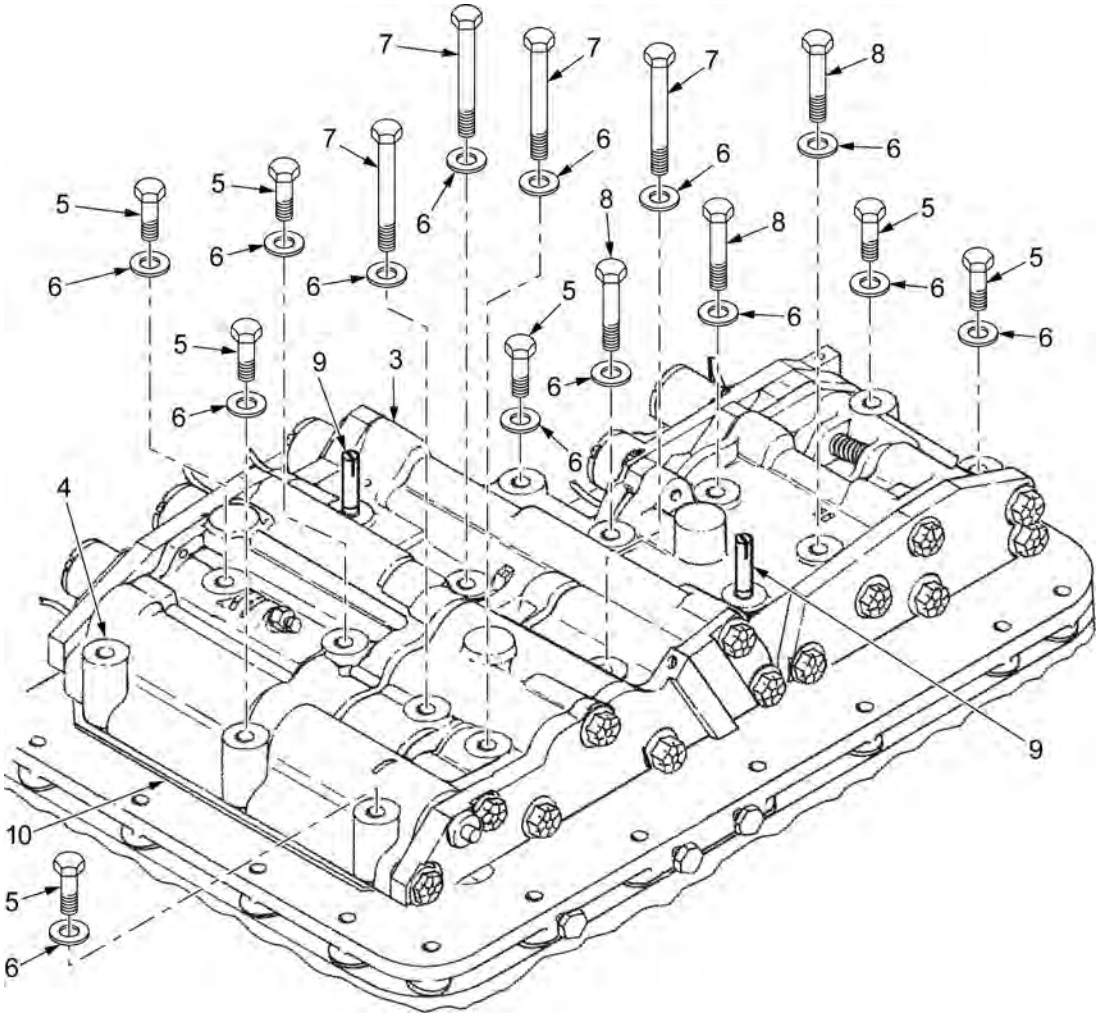


Figure 3. Main Control Valve Assembly Installation.

9. Install 5/16-18 x 3 inch bolt (Figure 4, Item 8) and washer (Figure 4, Item 6.
10. Install 5/16-18 x 3-1/4 inch bolt (Figure 4, Item 7) and washer (Figure 4, Item 6).

NOTE

The f nal retaining 5/16-18 x 2 3/4 inch bolt and washer for the main control valve assembly is installed later with wiring harness ground connector.

11. Make sure no bolt has been installed in ground connector location (Figure 4, Item 4). Torque two bolts (Figure 4, Item 7) and (Figure 4, Item 8) to 17 to 20 lb-ft (23 to 27 N·m).

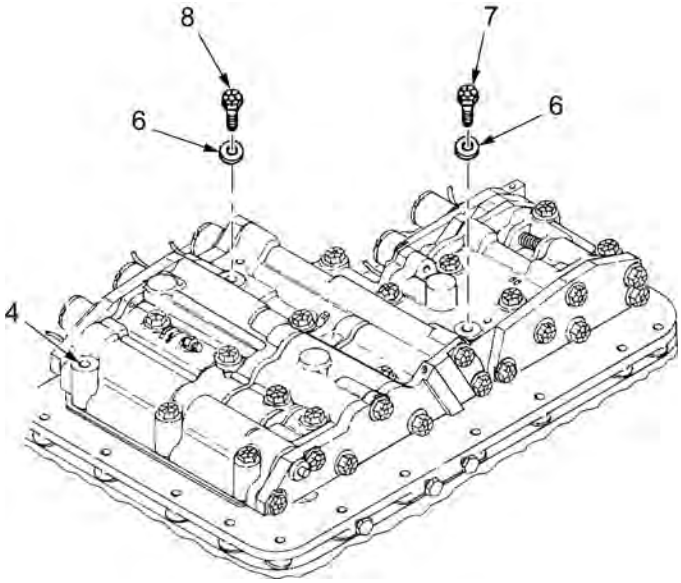


Figure 4. Final Bolts Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR MAIN CONTROL VALVE ASSEMBLY

INITIAL SETUP:

References
WP 0070

To repair the main control valve assembly, refer to Replace Solenoids and Terminals, WP 0070. Repair or replace solenoids and terminals as necessary.

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE LOCKUP CONTROL VALVE ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0070

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Main control valve assembly removed (WP 0008)

REMOVE LOCKUP CONTROL VALVE ASSEMBLY

NOTE

Top cover assembly is removed from transmission.

Control valve assemblies are removed with solenoids attached.

Wiring harness does not have to be removed to remove lockup control valve assembly.

Transmission is upright on f oor or work table.

No solenoid should be removed from control valve assemblies unless procedures have established that solenoid malfunction exists.

When necessary to replace a solenoid or to repair solenoid connector, refer to Replace Solenoids and Terminals, WP 0070.

1. Remove two 5/16-20 x 2-1/4 inch bolts (Figure 1, Item 1) and washers (Figure 1, Item 2) that attach lockup control valve assembly (Figure 1, Item 4) to separator plate (Figure 1, Item 5).
2. Remove four 5/16-18 x 2-3/4 inch bolts (Figure 1, Item 3) and washers (Figure 1, Item 2) that attach lockup control valve assembly (Figure 1, Item 4) to separator plate (Figure 1, Item 5).
3. Disconnect plastic connectors that attach wiring harness to solenoids.
4. Remove lockup control valve assembly (Figure 1, Item 4).

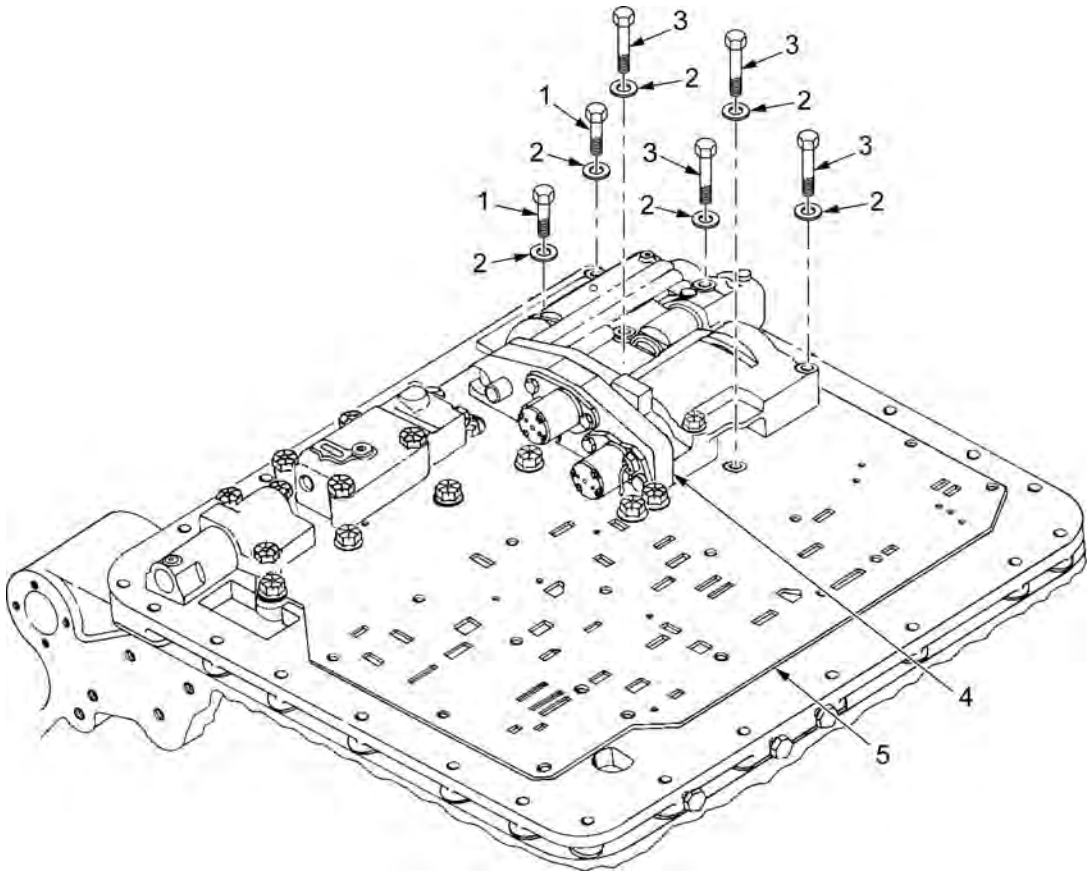


Figure 1. Lockup Control Valve Assembly Removal.

END OF TASK

INSTALL LOCKUP CONTROL VALVE ASSEMBLY

CAUTION

Transmission must be in upright position when oil transfer gasket, oil transfer plate assembly, separator plate, and control valve assemblies are installed. If transmission is not in vertical position when these items are installed, misalignment of holes can block oil f ow, causing malfunction of transmission.

Care should be taken not to let dust get into control valve assemblies. Keep top of transmission center housing assembly clean. Keep all parts clean. Wipe with batiste cloth. Contamination of control valves can cause transmission failure.

1. Install two 5/16-20 x 2-1/4 inch bolts (Figure 2, Item 1) and washers (Figure 2, Item 2) that attach lockup control valve assembly (Figure 2, Item 4) to separator plate (Figure 2, Item 5).
2. Install four 5/16-18 x 2-3/4 inch bolts (Figure 2, Item 3) and washers (Figure 2, Item 2) that attach lockup control valve assembly (Figure 2, Item 4) to separator plate (Figure 2, Item 5).
3. Torque six bolts (Figure 2, Item 1) and (Figure 2, Item 3) to 17 to 20 lb-ft (23 to 27 N·m).

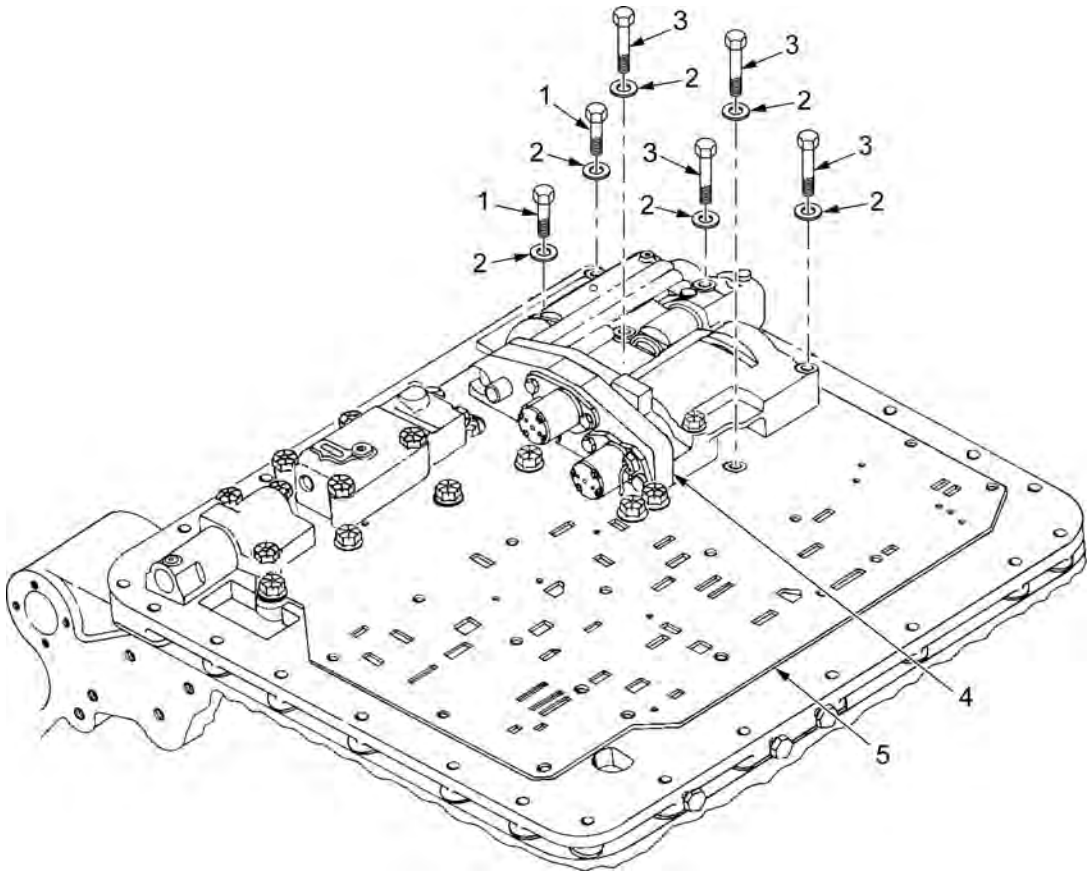


Figure 2. Lockup Control Valve Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR LOCKUP CONTROL VALVE ASSEMBLY

INITIAL SETUP:

References
WP 0070

To repair the lockup control valve assembly, refer to Replace Solenoids and Terminals, WP 0070. Repair or replace solenoids and terminals as necessary.

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE PRIORITY VALVE ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Top cover assembly removed (WP 0007)

REMOVE PRIORITY VALVE ASSEMBLY

NOTE

Wiring harness does not have to be removed to remove priority valve assembly.

Transmission is upright on f oor or work table.

1. Remove two 1/4-18 x 2-1/8 inch bolts (Figure 1, Item 1) and two washers (Figure 1, Item 2) that attach priority valve assembly (Figure 1, Item 5) to separator plate (Figure 1, Item 4).
2. Remove 1/4-18 x 1-3/4 inch bolt (Figure 1, Item 3) and washer (Figure 1, Item 2) that attach priority valve assembly (Figure 1, Item 5) to separator plate (Figure 1, Item 4).
3. Remove priority valve assembly (Figure 1, Item 5).

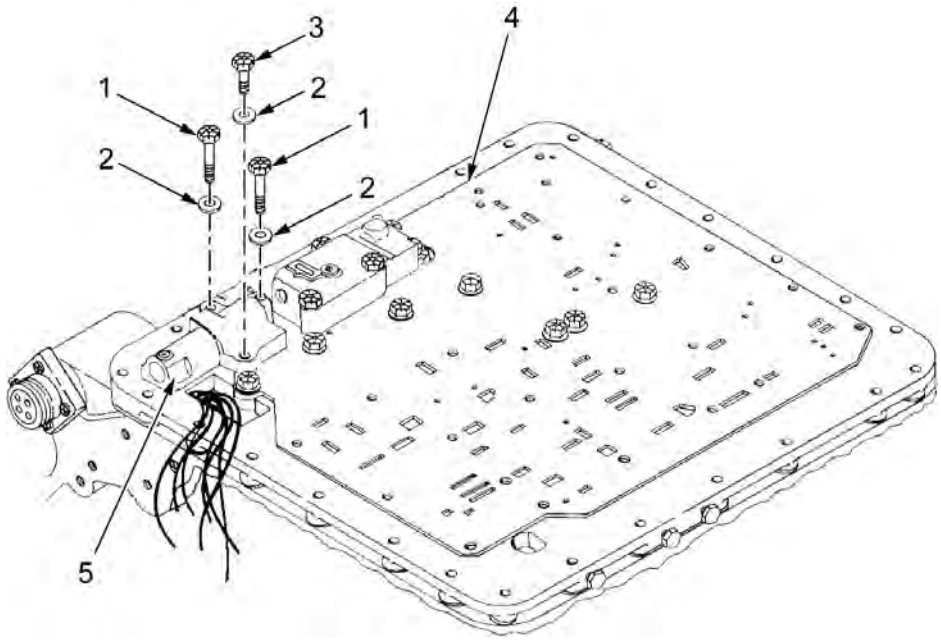


Figure 1. Priority Valve Assembly Removal.

END OF TASK

INSTALL PRIORITY VALVE ASSEMBLY

CAUTION

Transmission must be in upright position when oil transfer gasket, oil transfer plate assembly, separator plate, and control valve assemblies are installed. If transmission is not in vertical position when these items are installed, misalignment of holes can block oil f ow, causing malfunction of transmission.

Care should be taken not to let dust get into control valve assemblies. Keep top of transmission center housing assembly clean. Keep all parts clean. Wipe with batiste cloth. Contamination of control valves can cause transmission failure.

1. Install two 1/4-18 x 2-1/8 inch bolts (Figure 2, Item 1) and two washers (Figure 2, Item 2) that attach priority valve assembly (Figure 2, Item 5) to separator plate (Figure 2, Item 4).
2. Install 1/4-18 x 1-3/4 inch bolt (Figure 2, Item 3) and washer (Figure 2, Item 2) that attach priority valve assembly (Figure 2, Item 5) to separator plate (Figure 2, Item 4).
3. Torque three bolts (Figure 2, Item 1) and (Figure 2, Item 3) to 9 to 11 lb-ft (12 to 15 N·m).

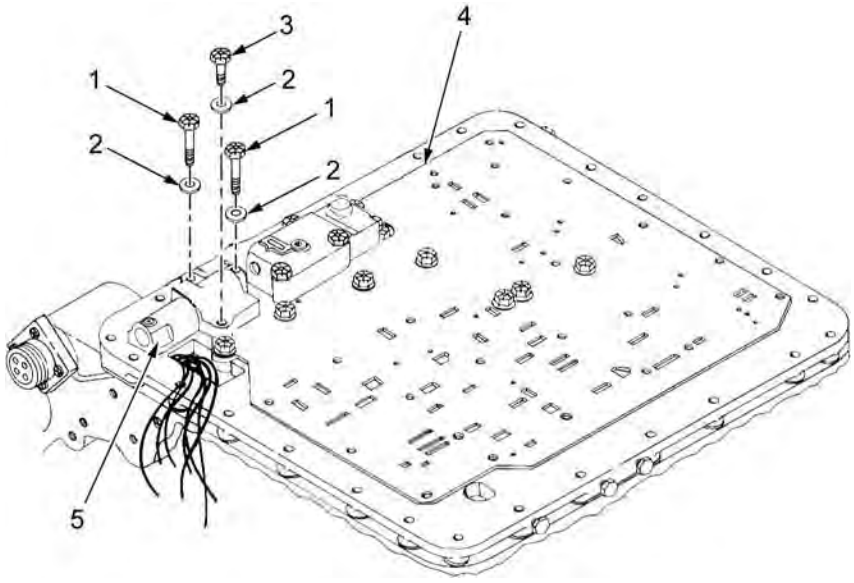


Figure 2. Priority Valve Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE G2 BACKUP VALVE ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Top cover assembly removed (WP 0007)

REMOVE G2 BACKUP VALVE ASSEMBLY

NOTE

Top cover assembly is removed from transmission.

Wiring harness does not have to be removed to remove G2 backup valve assembly.

Transmission is upright on f oor or work table.

1. Disconnect plastic connectors that attach wiring harness to solenoids.
2. Remove two 1/4-18 x 2-1/4 inch bolts (Figure 1, Item 1) and two washers (Figure 1, Item 2) that attach G2 backup valve assembly (Figure 1, item 5) to separator plate (Figure 1, Item 4).
3. Remove two 1/4-18 x 1-3/4 inch bolts (Figure 1, Item 3) and two washers (Figure 1, Item 2) that attach G2 backup valve assembly (Figure 1, item 5) to separator plate (Figure 1, Item 4).
4. Remove G2 backup valve assembly (Figure 1, Item 5).

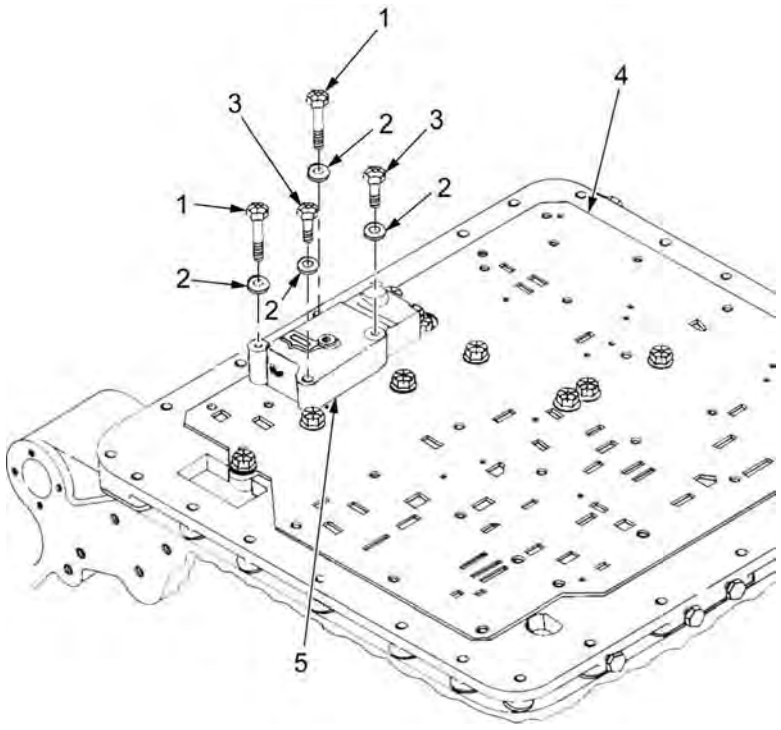


Figure 1. G2 Backup Valve Assembly Removal.

END OF TASK

INSTALL G2 BACKUP VALVE ASSEMBLY

CAUTION

Transmission must be in upright position when oil transfer gasket, oil transfer plate assembly, separator plate and control valve assemblies are installed. If transmission is not in vertical position when these items are installed, misalignment of holes can block oil f ow, causing malfunction of transmission.

Care should be taken not to let dust get into control valve assemblies. Keep top of transmission center housing assembly clean. Keep all parts clean. Wipe with batiste cloth. Contamination of control valves can cause transmission failure.

1. Install two 1/4-18 x 2-1/4 inch bolts (Figure 2, Item 1) and two washers (Figure 2, Item 2) that attach G2 backup valve assembly (Figure 2, Item 5) to separator plate (Figure 2, Item 4).
2. Install two 1/4-18 x 1-3/4 inch bolts (Figure 2, Item 3) and two washers (Figure 2, Item 2) that attach G2 backup valve assembly (Figure 2, Item 5) to separator plate (Figure 2, Item 4).
3. Torque four bolts (Figure 2, Item 1) and (Figure 2, Item 3) to 9 to 11 lb-ft (12 to 15 N·m).

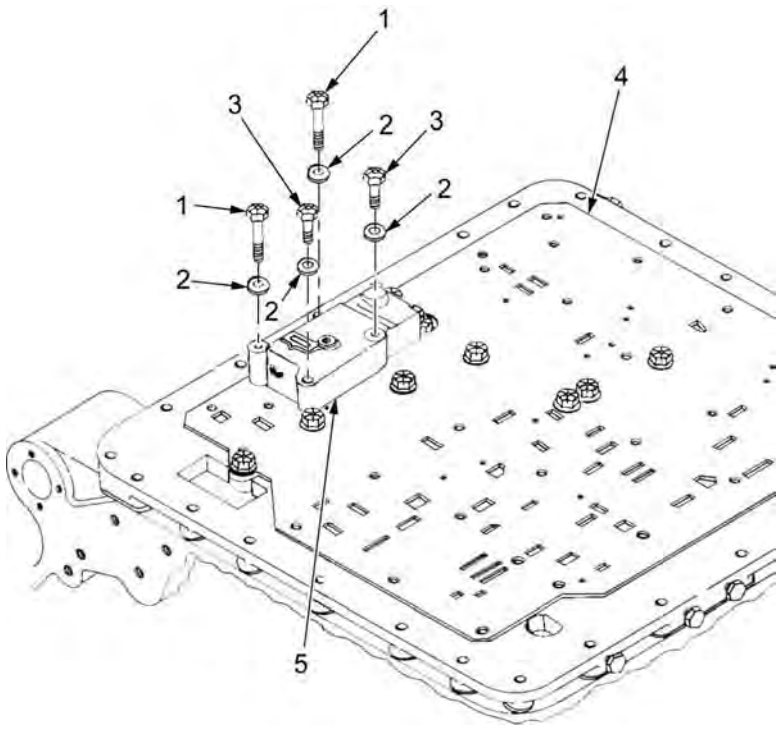


Figure 2. G2 Backup Valve Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE VALVE MANIFOLD MAIN WIRING HARNESS ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Dial, 1/4" Drive, 30 lb-in. (WP 0079, Item 49)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cleaning Compound, Solvent, Detergent (WP 0078, Item 5)
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)
Gasket (WP 0080, Item 12)
Twine, Cotton, 16-Ply, 30 in. (762 mm) (WP 0078, Item 20)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Top cover assembly removed (WP 0007)

REMOVE WIRING HARNESS ASSEMBLY

NOTE

Wiring harness can be removed without removal of solenoids or control valve assemblies.

Wiring harness does not have to be removed to remove control valve assemblies.

Transmission is upright on f oor or work table.

1. Clean wiring harness connector body (Figure 1, Item 5) and transmission area around connector using a clean, lint-free cloth and cleaning compound.
2. Remove four screws (Figure 1, Item 6) that attach wiring harness connector body (Figure 1, Item 5) to transmission. Discard screws (Figure 1, Item 6).
3. Disconnect seven plastic connectors (Figure 1, Item 7) that attach wiring harness (Figure 1, Item 9) to solenoids (Figure 1, Item 8).
4. Remove bolt (Figure 1, Item 2) and washer (Figure 1, Item 3) that attach harness ground connector (Figure 1, Item 4) to main control valve assembly (Figure 1, Item 1).

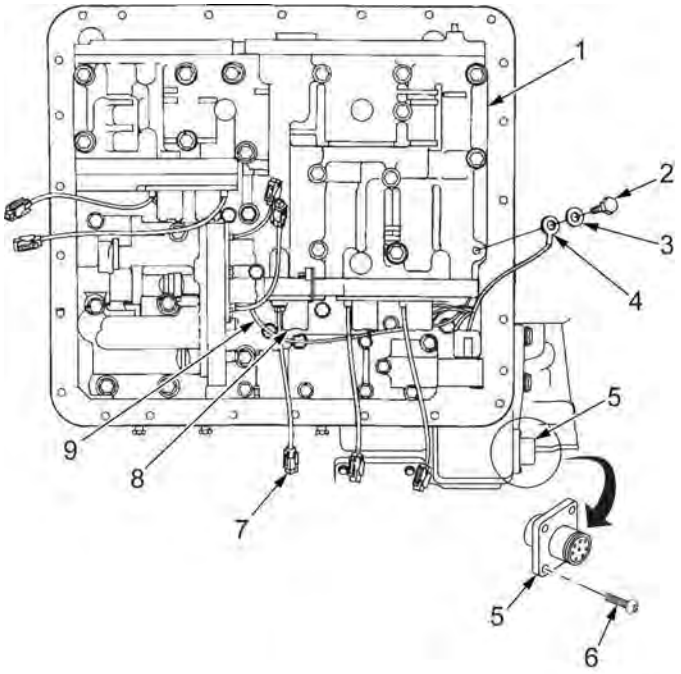


Figure 1. Wiring Harness Connector Body Removal.

NOTE

Connectors on wiring harness are identif ed by stamped letters on connectors. Each connector will have one of the letters A through G.

Use of twine is not necessary if all transmission top components are to be completely removed.

5. Tie a 30 in. (762 mm) piece of twine (Figure 2, Item 11) to harness connector F or G.
6. Remove wiring harness (Figure 2, Item 9). When wiring harness has been removed from the transmission, cut the 30 in. (762 mm) piece of twine (Figure 2, Item 11) off the connector, leaving the twine installed through the harness bore. When installing or replacing the harness, tie the outside end of the twine to connector F or G and use inside end of twine to pull harness through.
7. Remove wiring harness and gasket (Figure 2, Item 10) from transmission by pulling on wiring harness connector body (Figure 2, Item 5) with one hand and feeding wiring harness (Figure 2, Item 5) through transmission with the other hand. Discard gasket (Figure 2, Item 10).

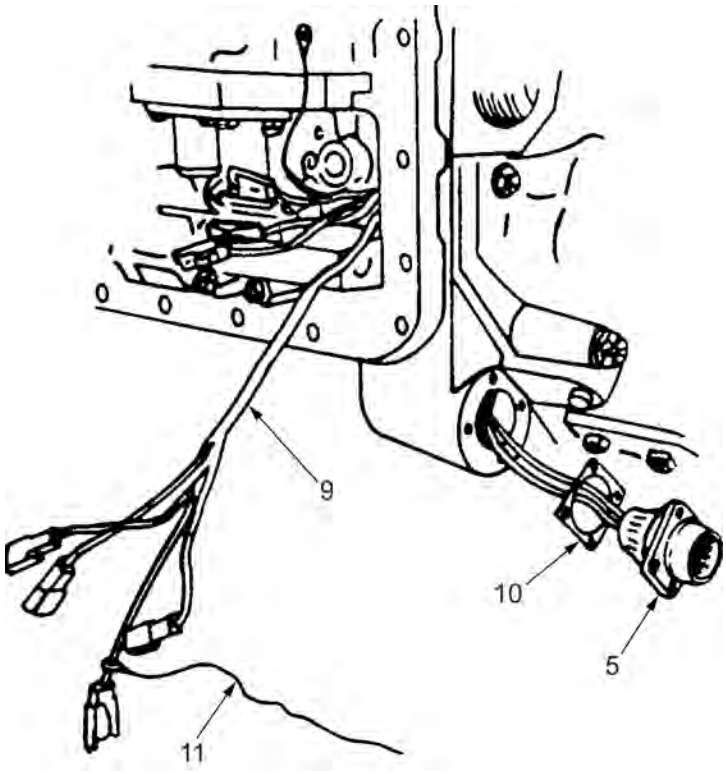


Figure 2. Wiring Harness with Twine Attached for Removal.

END OF TASK

INSTALL WIRING HARNESS ASSEMBLY

NOTE

Wiring harness may be removed/installed whenever the top cover has been removed. However, when all top components of transmission have been removed, for ease of installation install the wiring harness after the separator plate has been installed and before the valve bodies are installed.

Harness should be connected to solenoids and ground after valve assemblies have been installed.

1. Install new gasket (Figure 3, Item 10) on wiring harness (Figure 3, Item 9). Pull wiring through gasket until gasket is under wiring harness connector body (Figure 3, Item 5).

NOTE

When the wiring harness was removed, a 30 in. (762 mm) length of twine may have been installed as an aid to installation. If twine is still tied to connector F or G, pull twine and feed wiring harness through oil transfer plate assembly. If there is no twine, continue to Step 2.

2. Feed wiring harness (Figure 3, Item 9) into center housing opening (Figure 3, Item 12) and pull wiring harness (Figure 3, Item 9) through oil transfer plate opening (Figure 3, Item 13).

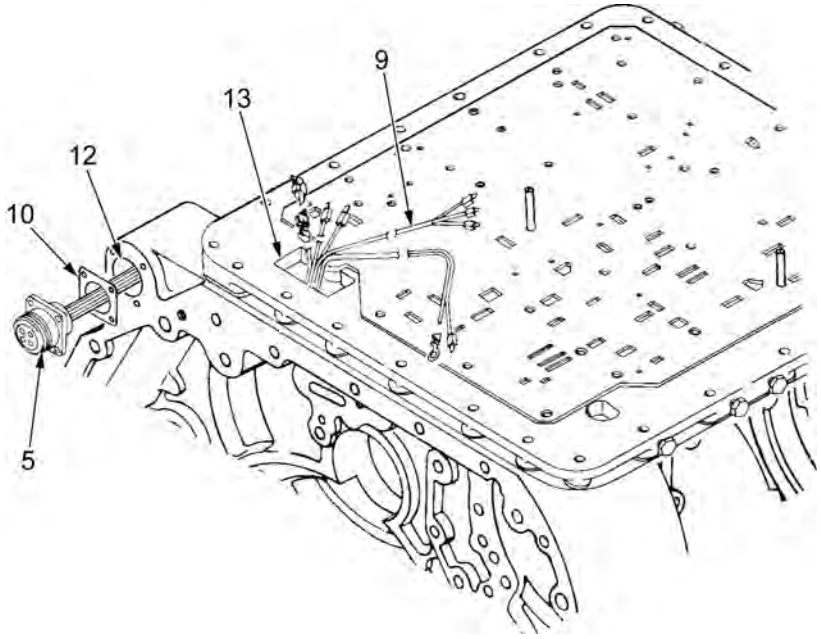


Figure 3. Wiring Harness Installation Through Oil Transfer Plate.

3. Install wiring harness connector body (Figure 4, Item 5) into transmission center housing opening (Figure 4, Item 12) with key (Figure 4, Item 14) in receptacle (Figure 4, Item 15) located at bottom.
4. Install four new No. 4-40 x 7/16 inch screws (Figure 4, Item 6) holding wiring harness connector body (Figure 4, Item 5) and new gasket (Figure 4, Item 10) to transmission.
5. Torque four screws (Figure 4, Item 6) to 3 to 5 lb-in. (0.3 to 0.6 N·m).

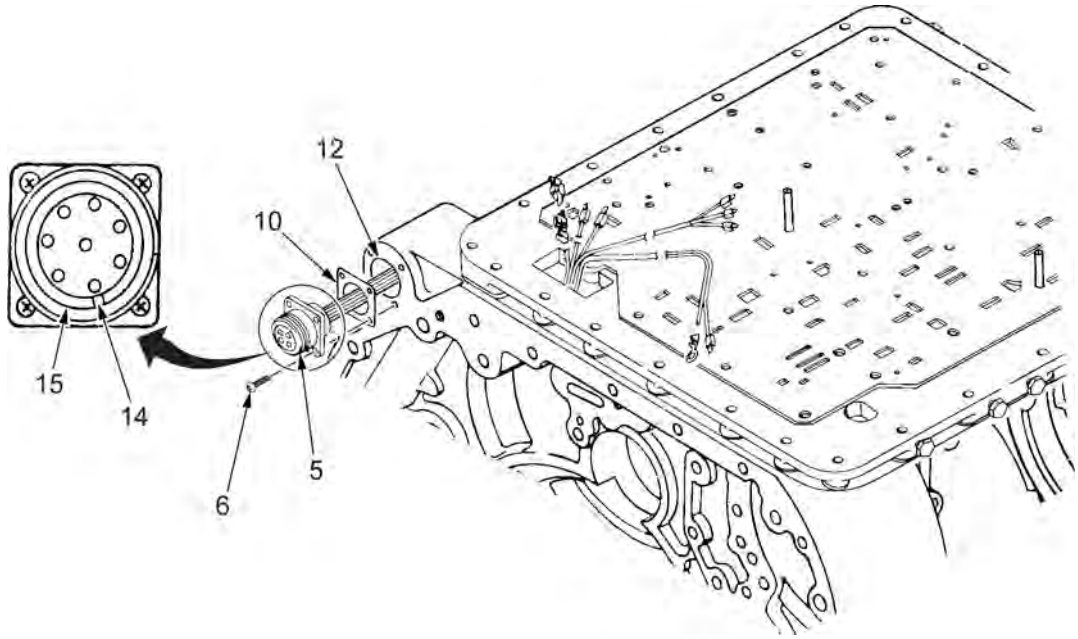


Figure 4. Wiring Harness Connector Body Installation.

END OF TASK

INSTALL WIRING HARNESS

NOTE

Connectors on solenoids and connectors on wiring harness look the same except for color. Connectors are mated by pushing them together with connector loops over bayonets. Connectors are locked in place when ends of loops are down behind bayonets.

All solenoids are the same and they are interchangeable. For that reason, solenoid connectors are not marked with solenoid identif cation. However, each lead of the wiring harness must go to a specif c solenoid location. The letter stamped on the wiring harness connector indicates location of solenoid to be connected.

Locations of solenoid A (Figure 5, Item 20), solenoid B (Figure 5, Item 19), solenoid C (Figure 6, Item 21), solenoid D (Figure 5, Item 22), solenoid E (Figure 5, Item 18), solenoid F (Figure 5, Item 17), and solenoid G (Figure 5, Item 16) are shown in Figure 5.

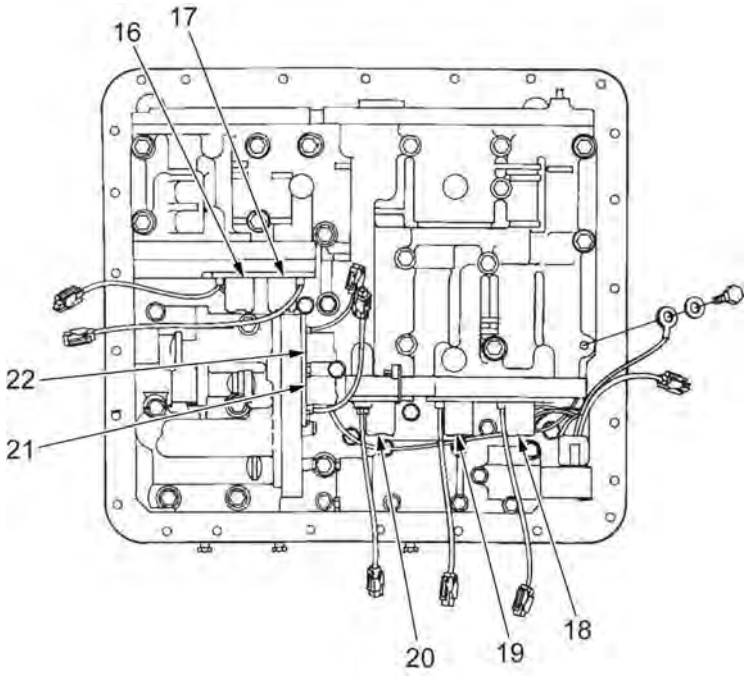


Figure 5. Solenoid Locations.

1. Look for letters A, B, C, D, E, F, and G stamped on wiring harness connectors (Figure 6, Item 7).
2. Locate solenoids A, B, E, F, and G (Figure 7, Item 20) and (Figure 7, Item 19) and (Figure 7, Item 18) and (Figure 7, Item 17) and (Figure 7, Item 16) on main control valve assembly (Figure 7, Item 1) and locate solenoids C and D (Figure 7, Item 21) and (Figure 7, Item 22) on lockup control valve assembly (Figure 7, Item 26).
3. Match wiring harness connectors (Figure 6, Item 7) and (Figure 7, Item 7) with solenoid connectors (Figure 6, Item 25) and (Figure 7, Item 25).
4. Hold wiring harness connector (Figure 6, Item 7) and (Figure 7, Item 7) and solenoid connector (Figure 6, Item 25) and (Figure 7, Item 25) with ends of connectors facing each other.
5. Align connectors (Figure 6, Item 7) and (Figure 6, Item 25) so that connector loops (Figure 6, Item 24) will f t over bayonets (Figure 6, Item 23).

6. Push connectors (Figure 6, Item 7) and (Figure 6, Item 25) together until ends of connector loops (Figure 6, Item 24) are down behind ends of bayonets (Figure 6, Item 23).
7. Install 5/16-18 x 2-3/4 inch bolt (Figure 7, Item 2) through washer (Figure 7, Item 3) and through eye of harness ground connector (Figure 7, Item 4).
8. Install bolt (Figure 7, Item 2) and washer (Figure 7, Item 3) through main control valve assembly (Figure 7, Item 1).
9. Torque bolt (Figure 7, Item 2) to 17 to 20 lb-ft (23 to 27 N·m).

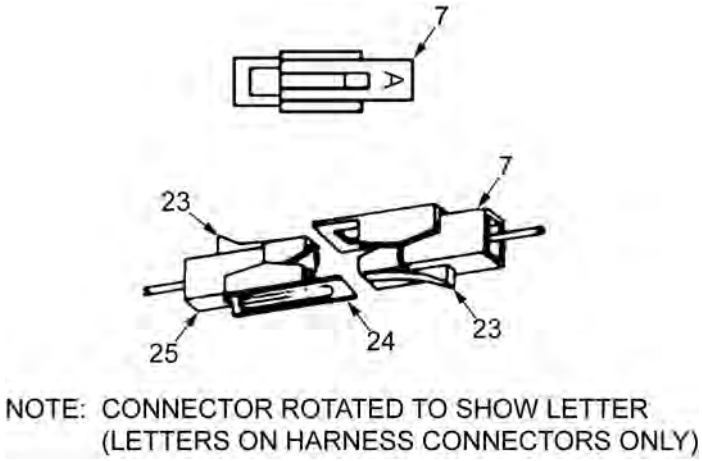


Figure 6. Wiring Harness Connector with Stamped Letter Location, Detail View.

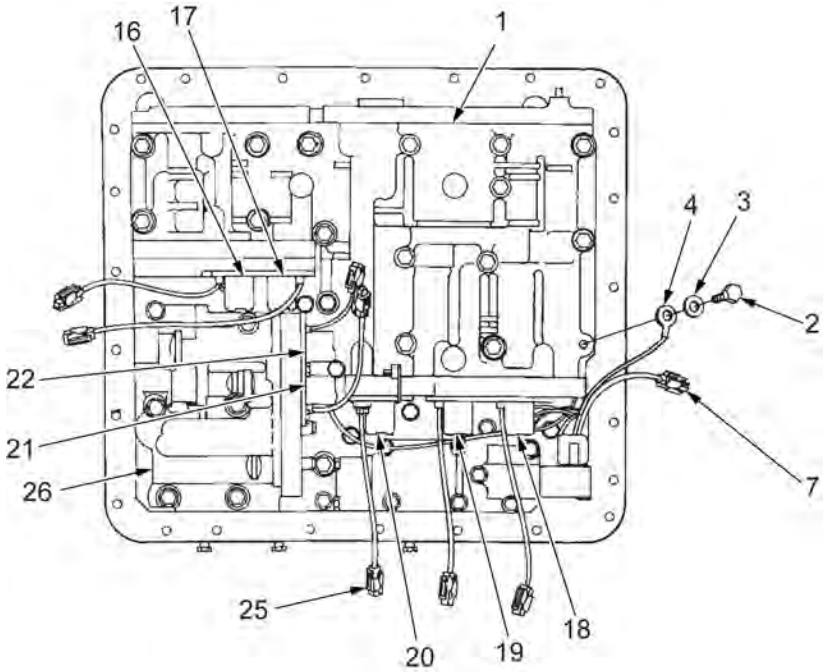


Figure 7. Harness Connectors.

10. Arrange wiring harness (Figure 8, Item 9) and solenoids (Figure 8, Item 16) and (Figure 8, Item 17) and (Figure 8, Item 18) and (Figure 8, Item 19) and (Figure 8, Item 20) wires so that all wiring is tucked neatly under or between solenoids.

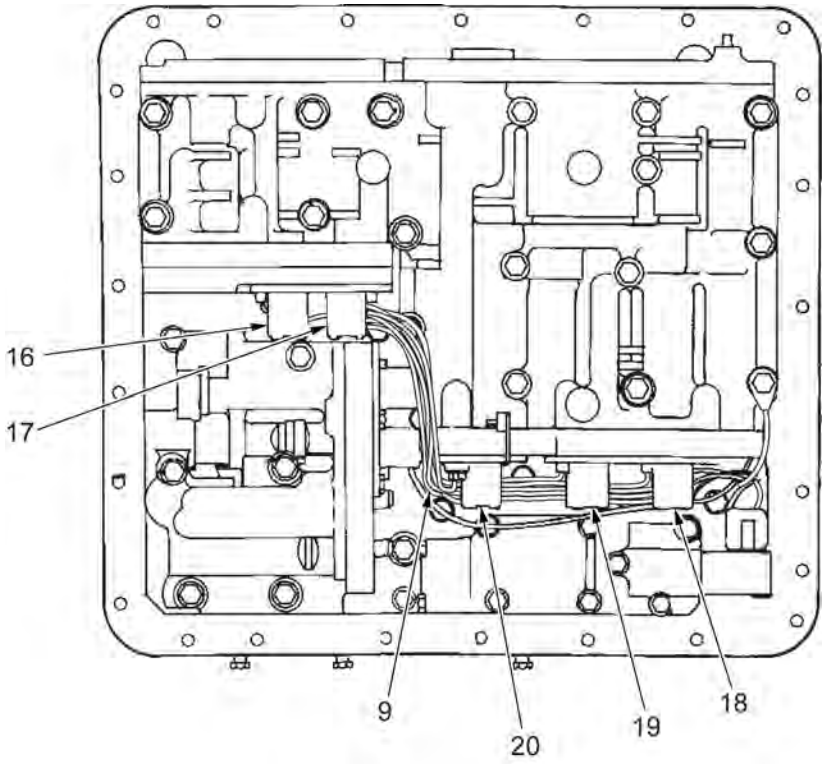


Figure 8. Wiring Harness and Solenoids Correctly Installed.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE GOVERNOR SCREEN ASSEMBLY, SEPARATOR PLATE, AND OIL TRANSFER PLATE

INITIAL SETUP:

Tools and Special Tools
Guide Pin (5/16-18 x 3 inch) (WP 0075, Item 2) (4)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)
Gasket (WP 0080, Item 52)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Main control valve assembly removed (WP 0008)
Lockup control valve assembly removed (WP 0010)
Priority valve assembly removed (WP 0012)
G2 backup valve assembly removed (WP 0013)

REMOVE SEPARATOR PLATE

NOTE

Transmission is upright on f oor or work table.

1. Remove two f anged-head bolts (Figure 1, Item 4) from separator plate (Figure 1, Item 3).
2. Remove f ve bolts (Figure 1, Item 6) and f ve washers (Figure 1, Item 5) from separator plate (Figure 1, Item 3).
3. Remove bolt (Figure 1, Item 1) and washer (Figure 1, Item 2) from separator plate (Figure 1, Item 3).
4. Remove separator plate (Figure 1, Item 3).

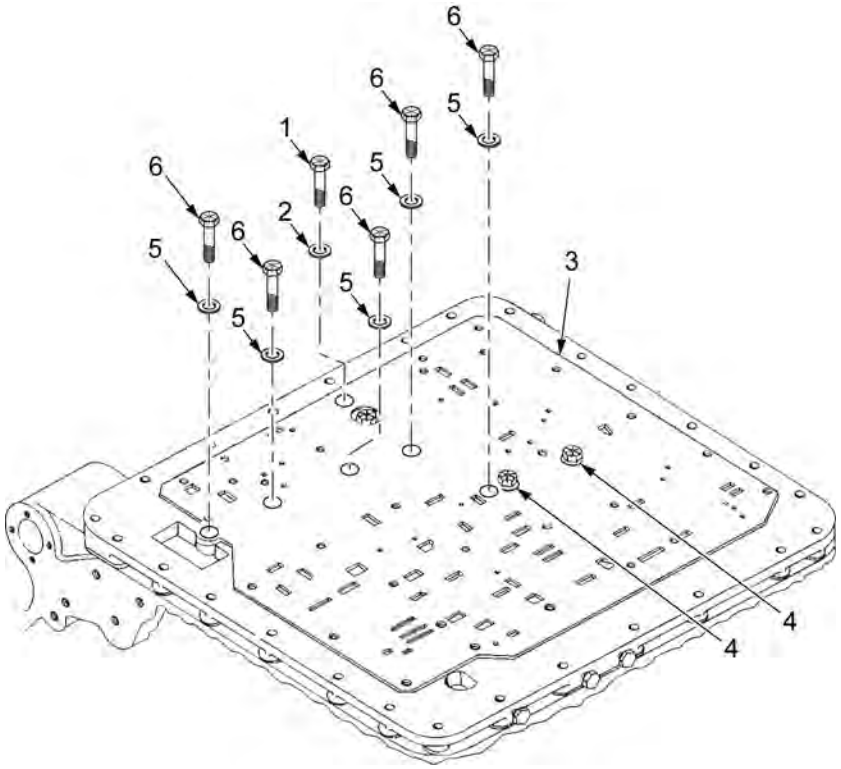


Figure 1. Separator Plate Removal.

END OF TASK

REMOVE OIL TRANSFER PLATE

1. Remove bolt (Figure 2, Item 8) and washer (Figure 2, Item 9) from oil transfer plate assembly (Figure 2, Item 10).

CAUTION

A 5/16-inch diameter nylon check ball bearing is located in a bore on the top side of the oil transfer plate assembly, beneath the location of the G2 backup valve assembly. Care should be taken not to turn the oil transfer plate assembly over and drop the ball into the transmission. The ball could damage the transmission if it drops into transmission and is not removed.

2. Remove oil transfer plate assembly (Figure 2, Item 10) and place on a work surface away from the transmission.
3. Remove nylon check ball bearing (Figure 2, Item 7) from oil transfer plate assembly (Figure 2, Item 10).
4. Inspect ball bearing (Figure 2, Item 7) and replace if damaged. Put ball bearing (Figure 2, Item 7) in a secure location.

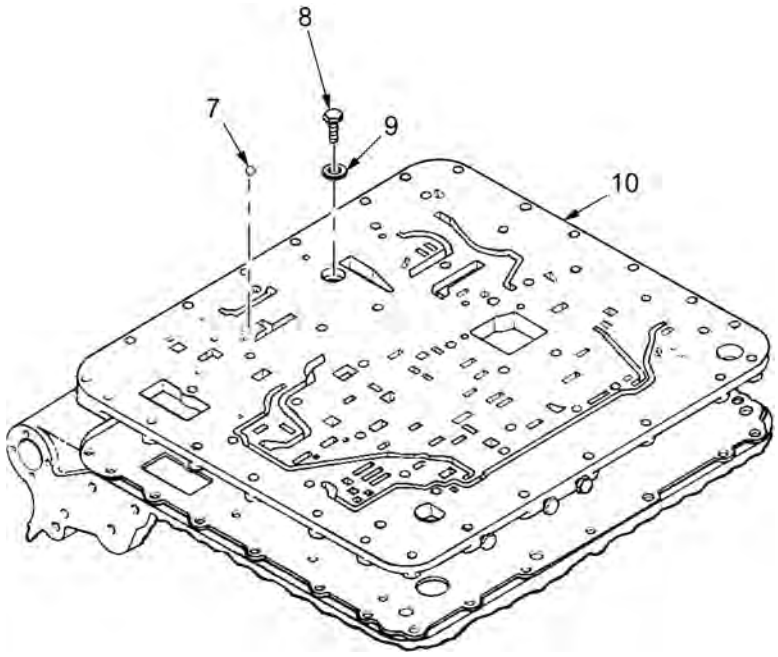


Figure 2. Oil Transfer Plate Removal.

5. Remove oil transfer plate gasket (Figure 3, Item 12) from top of center housing assembly (Figure 3, Item 11). Discard gasket (Figure 3, Item 12).

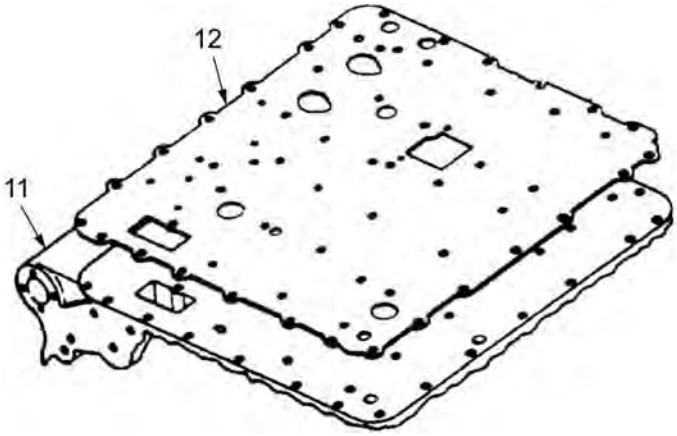


Figure 3. Oil Transfer Plate Gasket Removal.

END OF TASK

REMOVE GOVERNOR FILTER SCREEN

1. Remove strainer element (governor filter screen) (Figure 4, Item 13) from port in top of center housing assembly (Figure 4, Item 11).
2. Inspect strainer element (governor filter screen) (Figure 4, Item 13) for tears and holes. Replace if damaged.

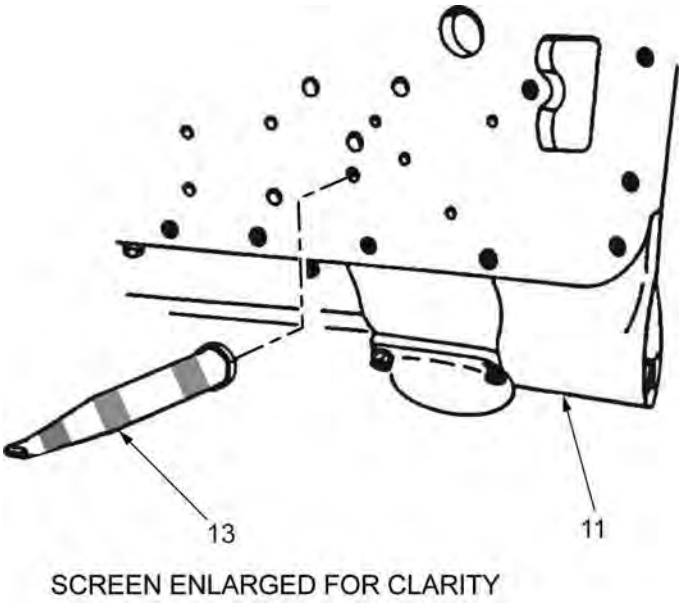


Figure 4. Governor Filter Screen Removal.

END OF TASK

INSTALL GOVERNOR SCREEN ASSEMBLY, OIL TRANSFER PLATE, AND SEPARATOR PLATE

1. Install clean strainer element (governor screen assembly) (Figure 5, Item 13), open end first, into bore in top of center housing assembly (Figure 5, Item 11).

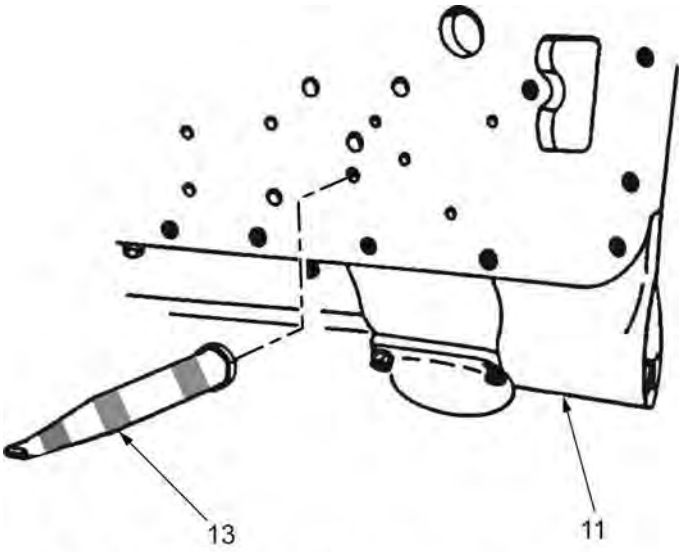


Figure 5. Governor Filter Screen Installation.

2. Install four 5/16-18 x 3 inch guide pins (Figure 6, Item 14) in four bolt holes (Figure 6, Item 15).

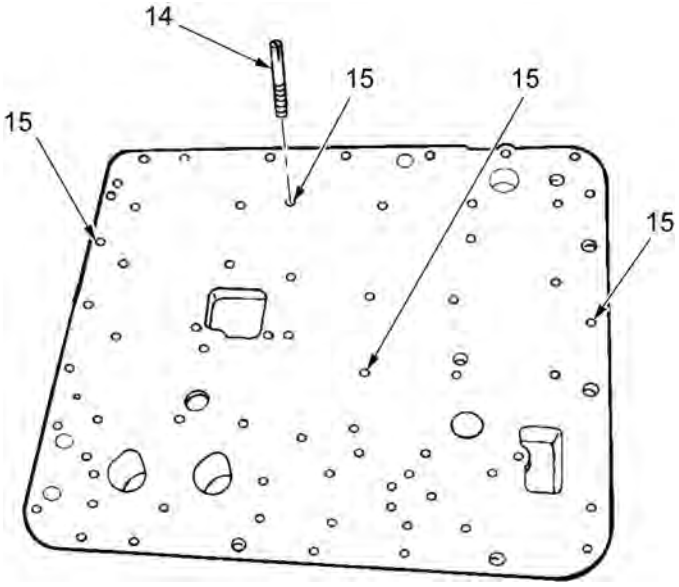


Figure 6. Guide Pins Installation.

3. Install new oil transfer plate gasket (Figure 7, Item 12) on center housing assembly (Figure 7, Item 11) over four guide pins (Figure 7, Item 14).

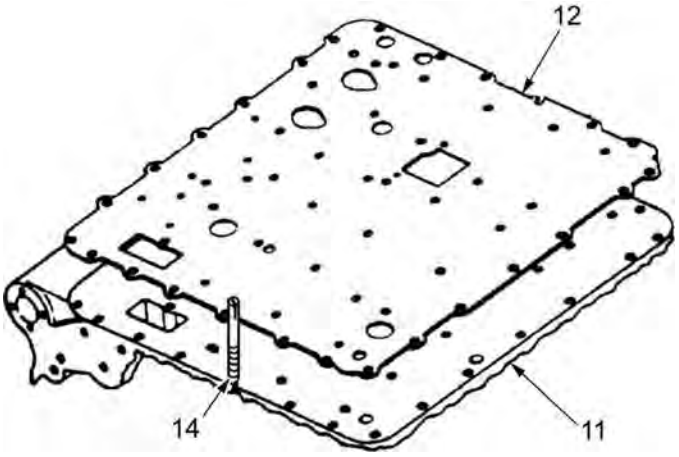


Figure 7. Oil Transfer Plate Gasket Installation.

4. Align oil transfer plate assembly (Figure 8, Item 10) with four guide pins (Figure 8, Item 14), and install oil transfer plate assembly (Figure 8, Item 10) on oil transfer plate gasket (Figure 8, Item 12).
5. Install 5/16-18 x 1-1/4 inch bolt (Figure 8, Item 8) and washer (Figure 8, Item 9) in oil transfer plate assembly (Figure 8, Item 10).
6. Torque bolt (Figure 8, Item 8) to 17 to 20 lb-ft (23 to 27 N·m).
7. Install nylon check ball bearing (Figure 8, Item 7) in hole on oil transfer plate assembly (Figure 8, Item 10).

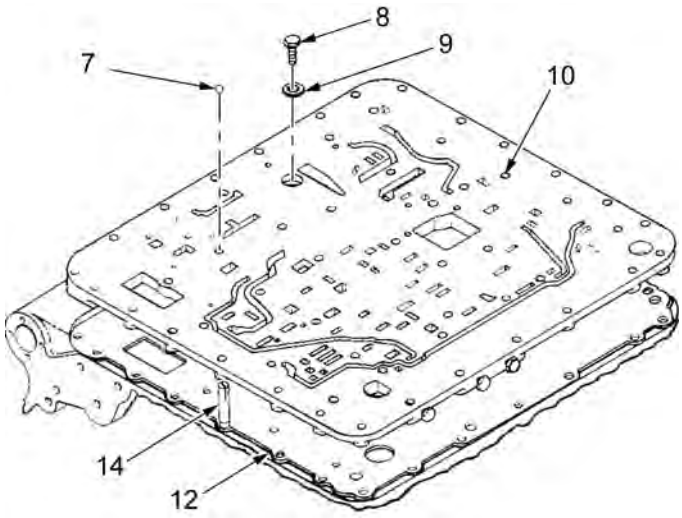


Figure 8. Oil Transfer Plate Installation.

8. Install separator plate (Figure 9, Item 3) over four guide pins (Figure 9, Item 14) and on oil transfer plate assembly (Figure 9, Item 10).
9. Install five 5/16-18 x 1-1/2 inch bolts (Figure 9, Item 6) and five washers (Figure 9, Item 5) that attach separator plate (Figure 9, Item 3), oil transfer plate assembly (Figure 9, Item 10), and new gasket (Figure 9, Item 12) to transmission.
10. Torque five bolts (Figure 9, Item 6) to 17 to 20 lb-ft (23 to 27 N·m).
11. Install two 1/4-18 x 1-1/4 inch flanged-head bolts (Figure 9, Item 4) that attach separator plate (Figure 9, Item 3), oil transfer plate assembly (Figure 9, Item 10), and new gasket (Figure 9, Item 12) to transmission.
12. Torque two flanged-head bolts (Figure 9, Item 4) to 9 to 11 lb-ft (12 to 15 N·m).
13. Install 1/4-18 x 1-1/2 inch bolt (Figure 9, Item 1) and washer (Figure 9, Item 2) that attach separator plate (Figure 9, Item 3), oil transfer plate assembly (Figure 9, Item 10), and new gasket (Figure 9, Item 12) to transmission.
14. Torque bolt (Figure 9, Item 1) to 9 to 11 lb-ft (12 to 15 N·m).
15. Remove two 5/16-18 x 3 inch guide pins (Figure 9, Item 14) located outside the edges of the separator plate (Figure 9, Item 3). Two guide pins (Figure 9, Item 14) that go through the separator plate (Figure 9, Item 3) will stay installed.

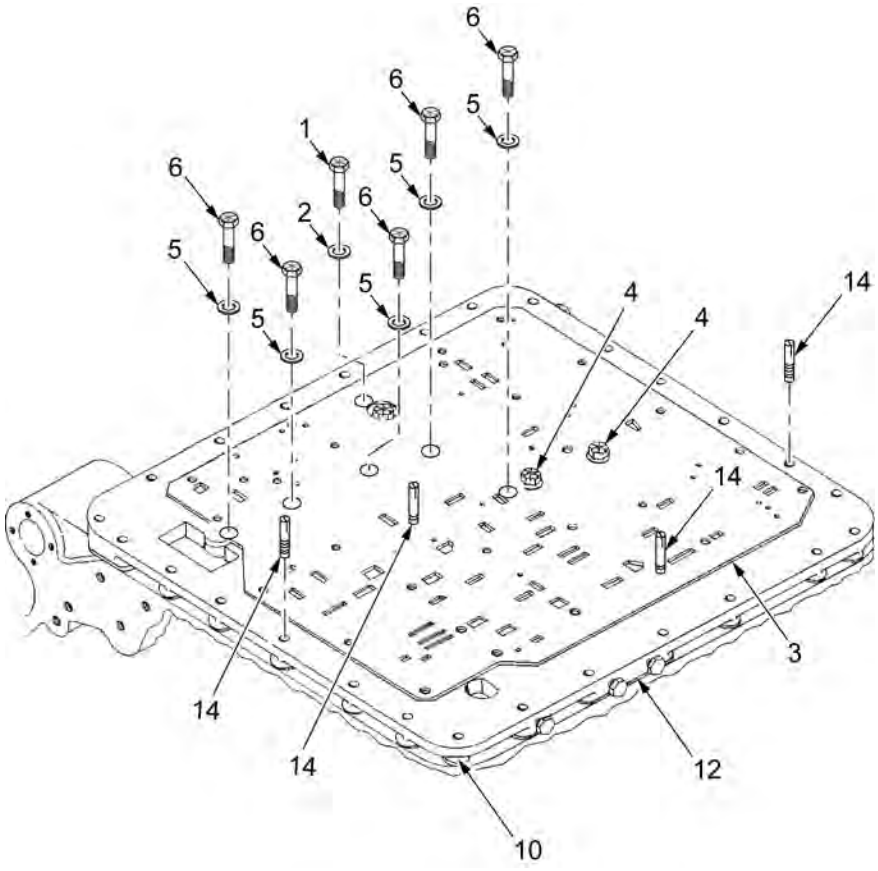


Figure 9. Oil Transfer Plate Bolts Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RIGHT COVER ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Sling, Multiple-Leg (3 Legs) (WP 0079, Item 36)
Socket, Socket Wrench, 1/2” Drive, 1-1/2” Spline (WP 0079, Item 38)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 31)
Gasket (WP 0080, Item 30)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Transmission mounted on adapter plate on maintenance stand, right cover assembly up (WP 0069)

OVERVIEW

It is necessary to remove the right cover assembly to do the maintenance tasks listed in this overview:

Remove components from below the right cover assembly.

Remove components from within the right cover assembly.

Remove the bevel gear assembly. Remove the sump communication tube, lube tube, oil transfer tube, and scavenge tube before the bevel gear assembly can be pulled from the transmission. To get access to these tubes, remove the right cover assembly. (You must also remove the left cover assembly to allow removal of other tubes that install into the bevel gear assembly.)

Remove the range pack (located below the left cover assembly), including the range input shaft. Remove the shaft and bushing assembly from the left of the transmission with the range input shaft. The range output gear spacer and the governor drive gear will be loose in the right of the transmission. Upon assembly, you cannot put this spacer and gear onto the range input shaft if the right cover assembly is installed.

REMOVE RIGHT COVER ASSEMBLY

NOTE

Make sure that the transmission is mounted on the maintenance stand, with right cover assembly facing up.

1. Clean right cover assembly (Figure 1, Item 1).
2. Remove right lifting bracket. Refer to instructions in TM 9-2350-277-13&P.

NOTE

Before you remove the right brake adjusting cover, note the location of the chain in relation to the bolt.

3. Remove six bolts (Figure 1, Item 2) and washers (Figure 1, Item 3) from the right brake adjusting cover (Figure 1, Item 4).
4. Remove the right brake adjusting cover (Figure 1, Item 4).
5. Remove the right brake adjusting cover gasket (Figure 1, Item 5). Discard gasket.

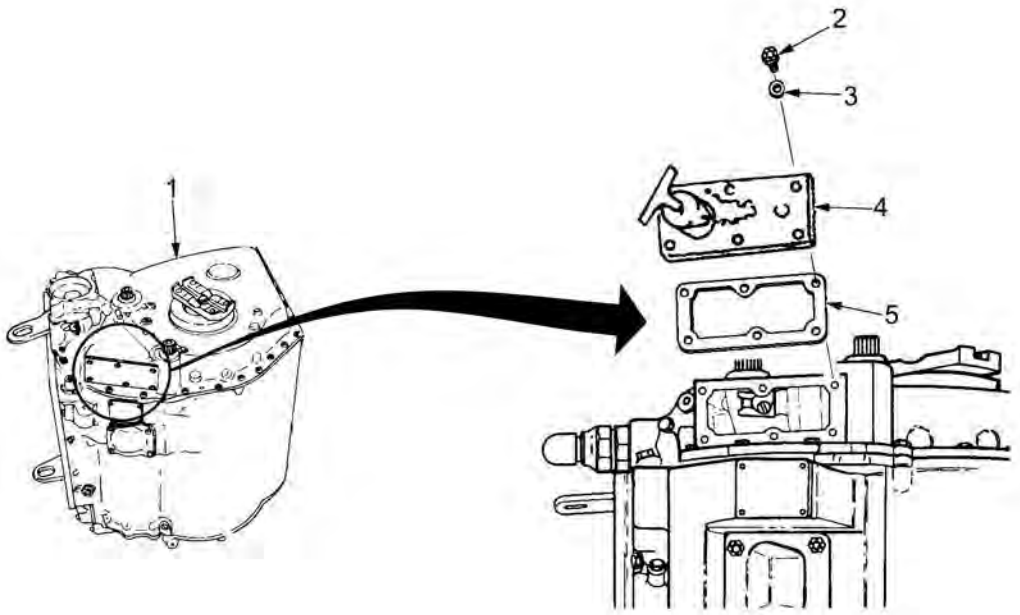


Figure 1. Right Brake Adjusting Cover and Gasket Removal.

6. Remove 26 remaining bolts (Figure 2, Item 6) and 26 washers (Figure 2, Item 7), and one bolt (Figure 2, Item 8) and one washer (Figure 2, Item 9) from right cover assembly (Figure 2, Item 1).

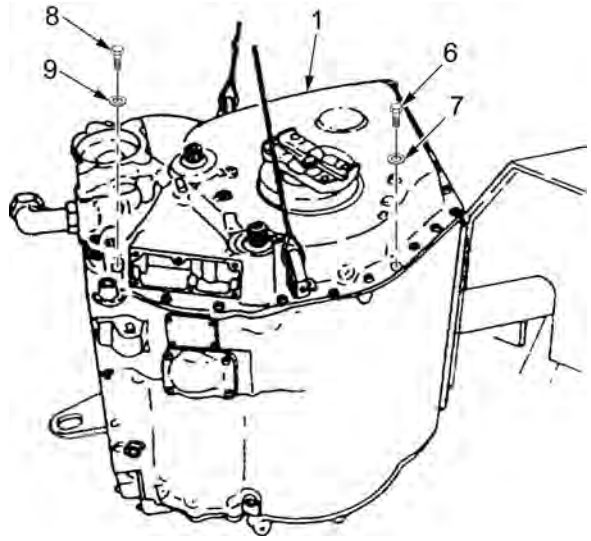


Figure 2. Right Cover Assembly Hardware Removal.

NOTE

Two legs of the multiple-leg sling are used in this task. When the sling bolts are tightened, they loosen the right cover from transmission.

7. Install one 3/8-inch washer (Figure 3, Item 11) on each of two 3/8-16 x 2 inch bolts (Figure 3, Item 10), and install bolts (Figure 3, Item 10) through lugs of multiple-leg sling (Figure 3, Item 12).
8. Install one bolt (Figure 3, Item 10) protruding from sling lug (Figure 3, Item 12) into each hole (Figure 3, Item 13) on right cover assembly (Figure 3, Item 1).
9. Tighten one bolt (Figure 3, Item 10) then the other bolt (Figure 3, Item 10) until right cover assembly (Figure 3, Item 1) loosens.
10. Strike elbow (Figure 3, Item 15) lightly to loosen right cover assembly (Figure 3, Item 1).

WARNING

Check sling and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

You must lift right cover assembly using sling, hoist, and trestle. To avoid injury, keep clear of right cover at all times. Do not let right cover assembly swing freely during lift.

11. Remove right cover assembly (Figure 3, Item 1) using lifting hoist, trestle, and multiple-leg sling.

NOTE

Outer steer shaft, lube tube, and brake coolant tube may also be lifted out when right cover assembly is removed.

Stow right cover assembly before removing multiple-leg sling.

12. Remove two bolts (Figure 3, Item 10), two washers (Figure 3, Item 11), and multiple-leg sling from right cover assembly (Figure 3, Item 1).
13. Remove right cover gasket (Figure 3, Item 14). Discard gasket (Figure 3, Item 14).

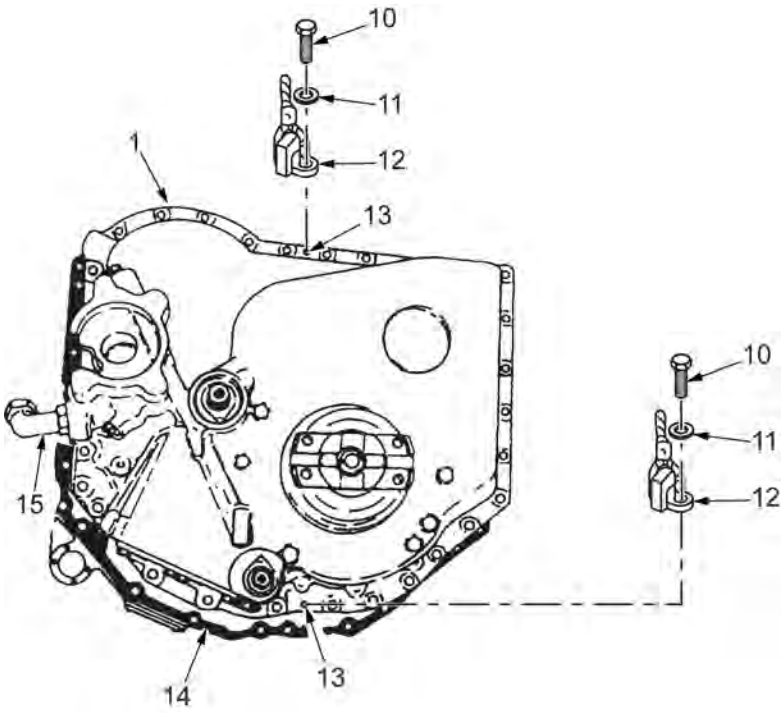


Figure 3. Right Cover Assembly and Gasket Removal.

END OF TASK

INSTALL RIGHT COVER ASSEMBLY

NOTE

Make sure the right brake adjusting cover has been removed. The brake adjusting cover restricts access to right cover bolt when installing cover.

1. Install new right cover gasket (Figure 4, Item 14) on transmission (Figure 4, Item 16).
2. Install 3/8 inch f at washers (Figure 4, Item 11) on each of two 3/8-16 x 3-1/2 bolts (Figure 4, Item 10), and put bolts through lugs of multiple-leg sling (Figure 4, Item 12).

NOTE

Bolts must not extend beyond the inside surface of the right cover. If tips of the bolts extend beyond the surface of the right cover, the right cover will not install correctly on the new gasket.

3. Install two bolts (Figure 4, Item 10) in two threaded holes (Figure 4, Item 13) in right cover assembly (Figure 4, Item 1).

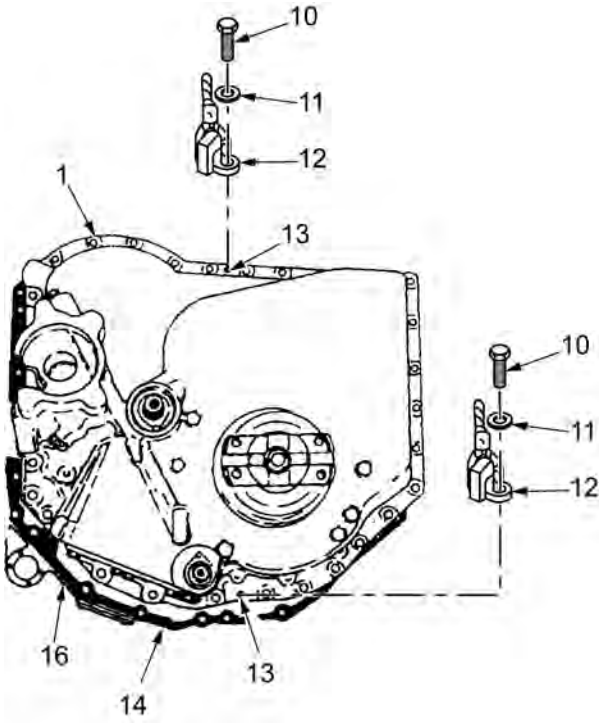


Figure 4. Right Cover Assembly Gasket Installation.

WARNING

Check sling and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

The weight of the right cover assembly exceeds safe limits without use of sling, hoist, and trestle. Lift right cover with sling, hoist, and trestle to avoid bodily injury.

You must lift right cover assembly using sling, hoist, and trestle. To avoid injury, keep clear of the right cover at all times. Do not let right cover assembly swing freely during lift.

4. Lift right cover assembly (Figure 5, Item 1) over transmission (Figure 5, Item 16) using sling, hoist, and trestle.
5. Lower the right cover assembly (Figure 5, Item 1) carefully so that it is on the transmission (Figure 5, Item 16).

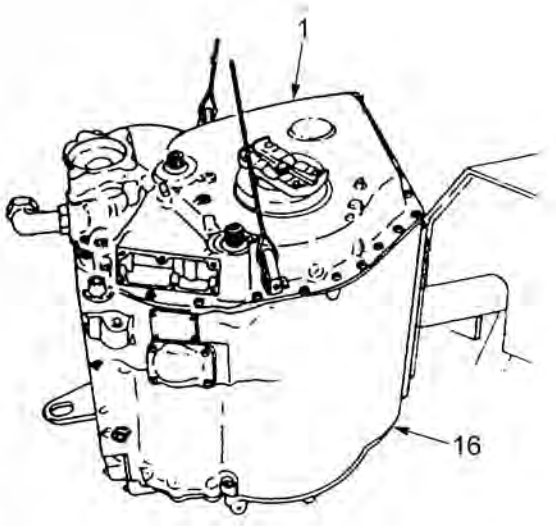


Figure 5. Right Cover Assembly Lowering on Transmission.

CAUTION

Do not tighten cover bolts unless right cover assembly is fully installed. Damage to right cover assembly could result.

NOTE

As you lower the right cover, turn the output f ange left and right again and again to align gear and shaft splines.

Use brake adjust adapter on left and right brake adjust shafts to turn shafts as necessary to align splines at hidden ends of shafts.

It may be necessary to slightly turn right cover assembly while you lower it.

It may be necessary to use plastic-faced hammer to help install right cover on transmission.

When properly aligned, the right cover will drop nearer to the transmission. Cover may not install completely until it is bolted.

6. Lower the right cover assembly (Figure 6, Item 1) while turning the output f ange (Figure 6, Item 18) using the socket wrench socket on brake shafts (Figure 6, Item 17). Lower the right cover assembly (Figure 6, Item 1) until it is installed over new gasket (Figure 6, Item 14).
7. Remove two bolts (Figure 6, Item 10), two washers (Figure 6, Item 11), and multiple-leg sling (Figure 6, Item 12) from the right cover assembly (Figure 6, Item 1).
8. Install right lifting bracket on right cover assembly. Refer to TM 9-2350-277-13&P for instructions.
9. Install 3/8-16 x 3-1/2 inch bolt (Figure 7, Item 8) and washer (Figure 7, Item 9) in the right cover assembly (Figure 7, Item 1).
10. Install 26 3/8-16 x 1-1/4 inch bolts (Figure 7, Item 6) and 26 washers (Figure 7, Item 7) around the perimeter of the right cover assembly (Figure 7, Item 1).

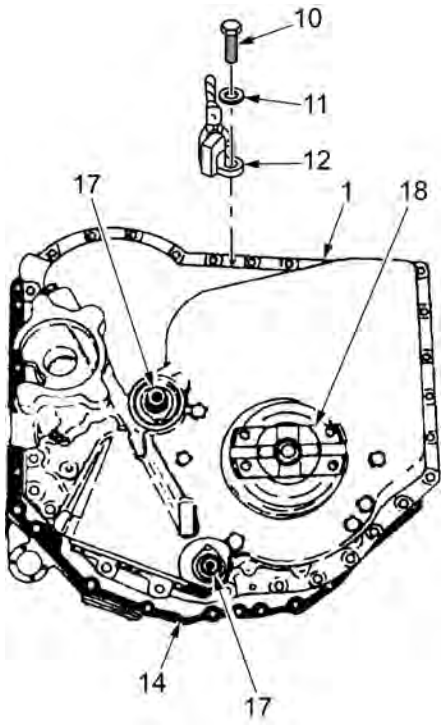


Figure 6. Right Cover Assembly Sling Removal.

11. Torque all 27 bolts (Figure 7, Item 8) and (Figure 7, Item 6) to 27 to 32 lb-ft (37 to 43 N·m).

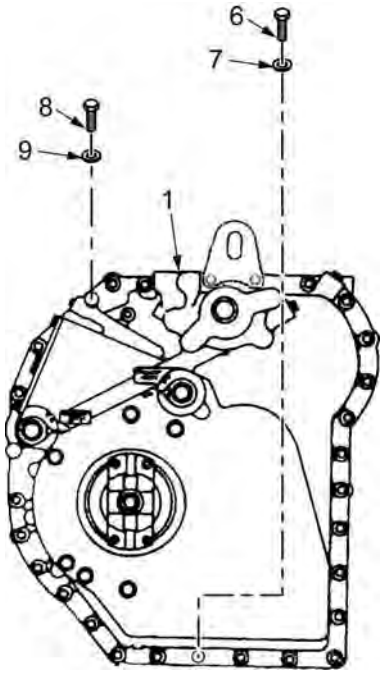


Figure 7. Right Cover Assembly Hardware Installation.

12. Install the new right brake adjusting cover gasket (Figure 8, Item 5) and the right brake adjusting cover (Figure 8, Item 4) on the right cover assembly (Figure 8, Item 1).

NOTE

Of the six bolts and washers that attach the brake adjusting cover to the end cover, the chain for oil filler cap is bolted under the top outside bolt and washer. The bolt is installed at the hole closest to the filler cap.

13. Install six bolts (Figure 8, Item 2) and six washers (Figure 8, Item 3) in the right brake adjusting cover (Figure 8, Item 4).
14. Torque six bolts (Figure 8, Item 2) to 13 to 15 lb-ft (17 to 20 N·m).

NOTE

The right adjusting brake cover should have a pipe plug installed at the oil drain line location (shipping).

15. Install new pipe plug (Figure 8, Item 20) (TM 9-2350-277-13&P) if the pipe plug (Figure 8, Item 20) is missing and transmission is to be put in storage.
16. Torque pipe plug (Figure 8, Item 20) to 18 to 22 lb-ft (24 to 30 N·m).

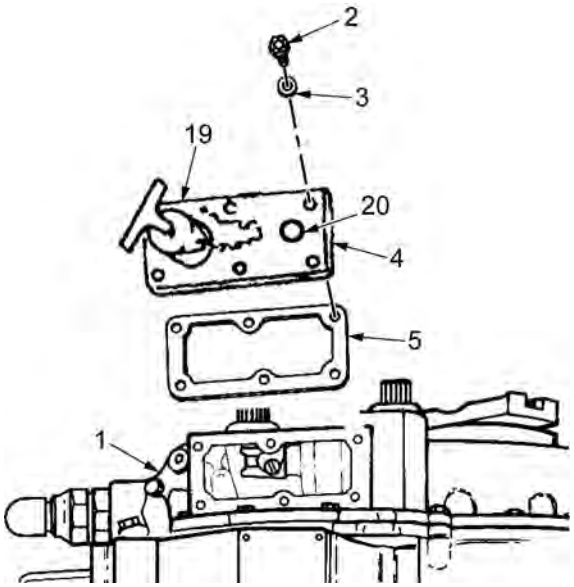


Figure 8. Right Adjusting Brake Cover and Gasket Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR RIGHT COVER ASSEMBLY

INITIAL SETUP:

Tools and Special Tools

Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Chisel, Cold, 3/8”, Flat (WP 0079, Item 7)
Drill, Electric, Portable, 3/8” Chuck (WP 0079, Item 13)
Drill Bit, 1/4”, Twist (WP 0079, Item 14)
Drill Set, Twist, 3/8” Shank, 3/4” Drill (WP 0079, Item 15)
Gage, Vernier Caliper, 0-6” (WP 0079, Item 18)
Heater, Gun-Type, Electric (WP 0079, Item 20) (2)
Inserter and Remover, Seal (WP 0079, Item 24)
Inserter, Seal (WP 0079, Item 23)
Insert Installer, Remover (WP 0075, Item 6)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Puller Set, Mechanical, Gear and Bearing, 3-Jaw (WP 0079, Item 30)
Sander/Grinder, 4-1/2” (WP 0079, Item 31)
Slide Hammer Puller (WP 0079, Item 34)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts

Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Cloth, Abrasive, Crocus (WP 0078, Item 6)
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Sealant, Lubricating, Thread-Locking (WP 0078, Item 15)

Personnel Required

Track Vehicle Repairer, 91H10 (2)

References

TM 9-2520-272-40P

Equipment Condition

Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

DISASSEMBLE RIGHT COVER ASSEMBLY

NOTE

Right cover assembly is mounted on two wooden blocks, inside up.

1. Put pin punch in left brake apply bore beyond bearing (Figure 1, Item 3) so that edge of punch is seated behind edge of seal (Figure 1, Item 4).
2. Remove seal (Figure 1, Item 4) from bore in right cover assembly (Figure 1, Item 1).
3. Remove seal (Figure 1, Item 5) from beyond bearing (Figure 1, Item 2) in right brake apply cam shaft bore.
4. Turn right cover assembly (Figure 1, Item 1) over, outside up.
5. Remove bearings (Figure 1, Item 2) and (Figure 1, Item 3) from right cover assembly (Figure 1, Item 1).

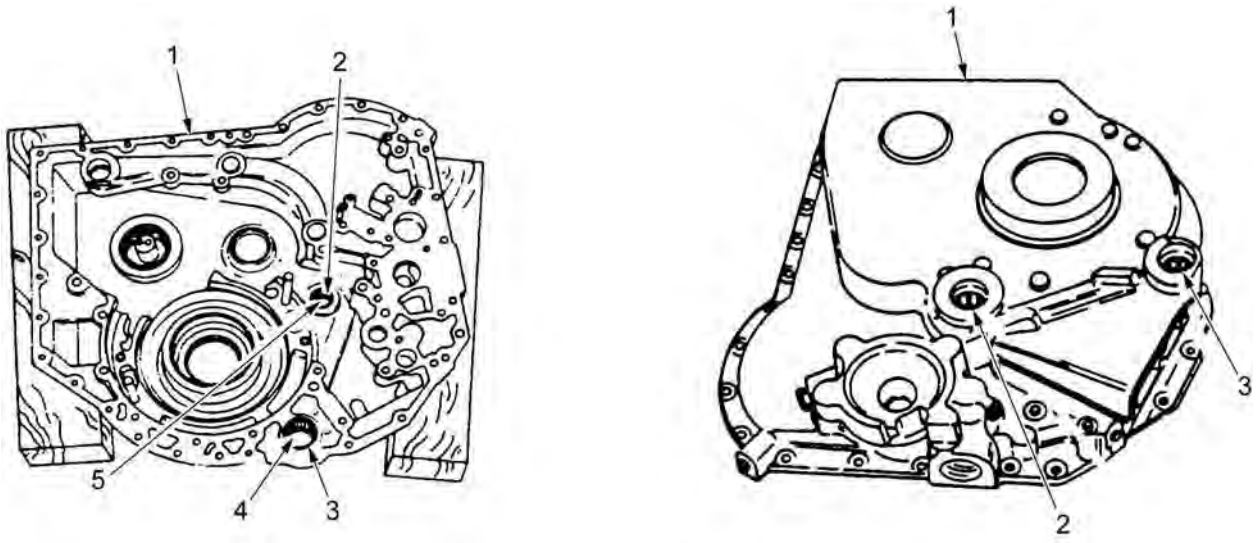


Figure 1. Seals and Bearings Removal.

6. Turn right cover assembly (Figure 2, Item 1) over, without wood blocks.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

NOTE

Steer idler gear bearing consists of cage and outer race. Inner race remains on gear.

7. Apply heat to right cover assembly (Figure 2, Item 1) around steer idler bearing (Figure 2, Item 6). Apply heat for one hour to approximately 300°F (149°C).
8. Remove bearing (Figure 2, Item 6).

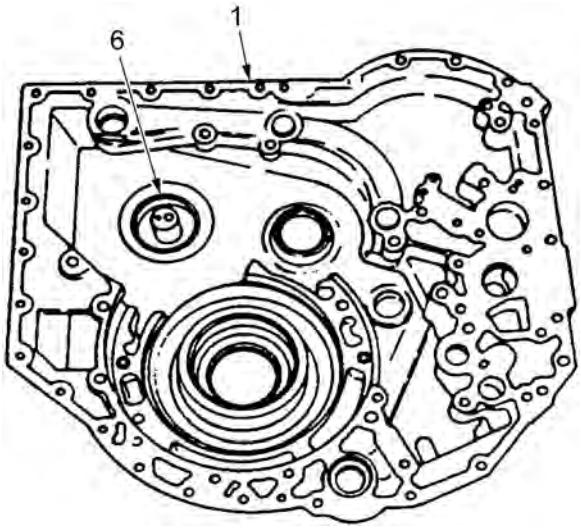


Figure 2. Steer Idler Bearing Removal.

CAUTION

Use care not to cut into end cover when using sander/grinder to cut slots in bearing race.

9. Using a sander/grinder cut two slots 180 degrees apart at base of bearing race (Figure 3) and (Figure 4, Item 7). Offset slots slightly so that pry bars will overlap. Cut slots deep enough to catch the lip of the pry bar, but not deep enough to cut into end cover.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

10. Apply heat to right cover assembly with heat gun around bearing race (Figure 4, Item 7) for 15 minutes.
11. Insert two pry bars in slots to loosen bearing race (Figure 4, Item 7).

CAUTION

Use care not to damage end cover when using pry bars to remove race.

12. Move two pry bars under bearing race (Figure 4, Item 7) and remove bearing race.
13. Remove two long brake reaction pins (Figure 4, Item 9) from right cover assembly (Figure 4, Item 1).
14. Remove two dowel pins (Figure 4, Item 8) from right cover assembly (Figure 4, Item 1).
15. Pinch spring pin (Figure 4, Item 10) just enough to hold onto spring pin. Tilt tip of pliers onto boss and use leverage to remove spring pin (Figure 4, Item 10).

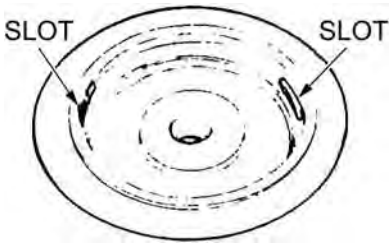


Figure 3. Bearing Race Slots.

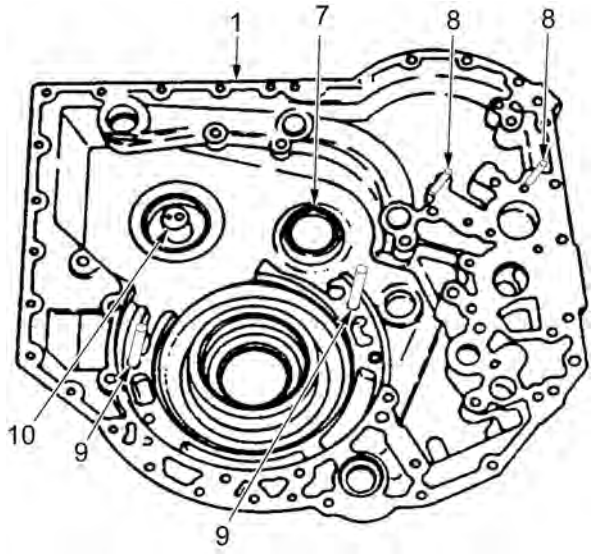


Figure 4. Bearing Race and Pins Removal.

16. Punch a dimple in center of two plugs (Figure 5, Item 12) in right cover assembly (Figure 5, Item 1).

WARNING

Use caution when operating a drill. Keep hands clear of drill bit. Do not wear loose-f tting clothing. Wear safety goggles. Injury to personnel could occur from improper use of drill.

CAUTION

Carefully drill through plugs and stop drilling when drill pierces plug to avoid damage to the right cover assembly. Clearance between bottom of plug and housing is approximately 1.0 in. (25.4 mm).

17. Drill a 1/4 in. (6.35 mm) hole through center of plugs (Figure 5, Item 12).
18. Widen hole in center of plugs (Figure 5, Item 12) to 3/4 in. (19.05 mm).
19. Remove plugs (Figure 5, Item 12) from right cover assembly (Figure 5, Item 1).
20. Tilt right cover assembly (Figure 5, Item 1) on edge with plug (Figure 5, Item 12) holes down.

WARNING

Compressed air used for cleaning purposes will not exceed 30 psi (207 kPa) in pressure. To avoid injury, use with effective chip-guarding and personal protective equipment (goggles, face shield, gloves, etc.). Never point a compressed air hose toward another person.

21. Put air hose at port (Figure 5, Item 11) and then at plug (Figure 5, Item 12) holes to blow out all particles with compressed air.

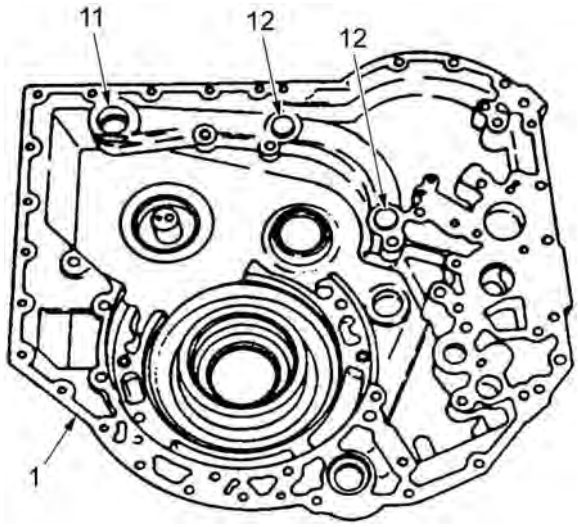


Figure 5. Plugs Removal.

NOTE

Position right cover assembly on wooden blocks inside up.

22. Assemble insert installer, remover tool (Figure 6) to remove four inserts (Figure 7, Item 13) from right cover assembly (Figure 7, Item 1).

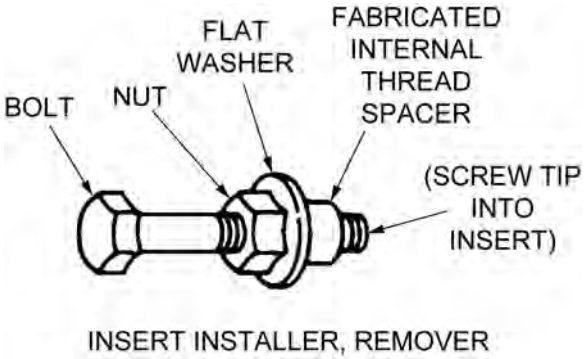


Figure 6. Insert Installer, Remover Tool.

23. Turn tip of bolt into one insert (Figure 7, Item 13) in right cover assembly (Figure 7, Item 1).
24. Lock nut against washer and hold nut so that insert (Figure 7, Item 13) will turn with bolt.
25. Turn bolt to the left (counterclockwise) and remove insert (Figure 7, Item 13).
26. Remove three remaining inserts (Figure 7, Item 13).

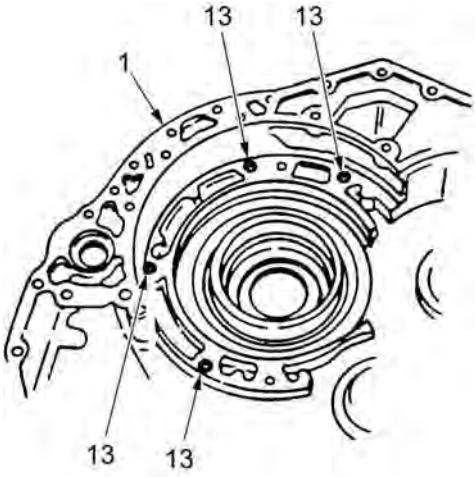


Figure 7. Inserts Removal.

27. Turn right cover assembly (Figure 8, Item 1) over, outside up.
28. Remove 3/8 in. pipe plug (Figure 8, Item 18).
29. Remove two 1/8 in. pipe plugs (Figure 8, Item 16) and (Figure 8, Item 17).
30. Remove 1/4 in. pipe plug (Figure 8, Item 15).
31. Remove 3/8 in. pipe plug (Figure 8, Item 19).
32. Check right cover assembly bearing bore for damage. Smooth out scratches with crocus cloth. If grinding damage is present, replace right cover assembly.

CAUTION

When using grinder, use care as not to damage housing when cutting slots into sleeve.

NOTE

Remove sleeve only if sleeve is visibly damaged or when reworking housing due to damage to the output seal area.

33. Cut two slots 180 degrees apart in sleeve (Figure 8, Item 14).
34. Break sleeve (Figure 8, Item 14) at slots. Discard sleeve (Figure 8, Item 14).

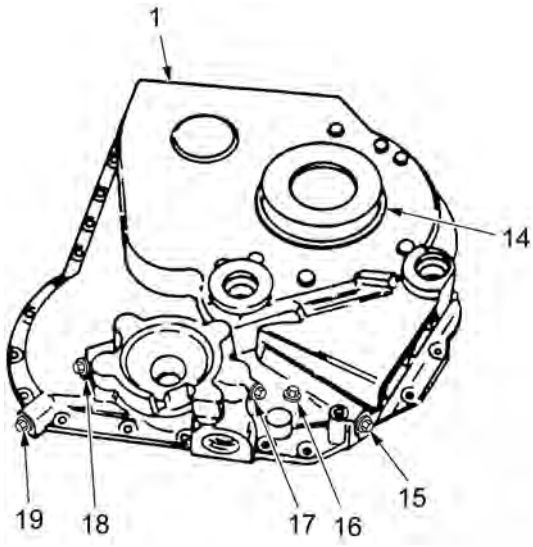


Figure 8. Pipe Plugs and Sleeve Removal.

END OF TASK

ASSEMBLE RIGHT COVER ASSEMBLY

NOTE

Some pipe plugs are precoated and do not require thread-locking lubricating sealant compound.

1. Apply sealant to pipe plugs (Figure 9, Item 15), (Figure 9, Item 16), (Figure 9, Item 17), (Figure 9, Item 18), and (Figure 9, Item 19).
2. Install 3/8 in. pipe plug (Figure 9, Item 19) in right cover assembly (Figure 9, Item 1).
3. Torque plug (Figure 9, Item 19) to 12 to 16 lb-ft (16 to 22 N·m).
4. Install 1/4 in. pipe plug (Figure 9, Item 15) in right cover assembly (Figure 9, Item 1).
5. Torque plug (Figure 9, Item 15) to 96 to 120 lb-in. (11 to 13 N·m).
6. Install 1/8 in. pipe plugs (Figure 9, Item 16) and (Figure 9, Item 17) in right cover assembly (Figure 9, Item 1).
7. Torque plugs (Figure 9, Item 16) and (Figure 9, Item 17) to 50 to 60 lb-in. (6 to 7 N·m).
8. Install 3/8 in. pipe plug (Figure 9, Item 18) in right cover assembly (Figure 9, Item 1).
9. Torque plug (Figure 9, Item 18) to 12 to 16 lb-ft (16 to 22 N·m).
10. Turn right cover assembly (Figure 9, Item 1) over, inside up.

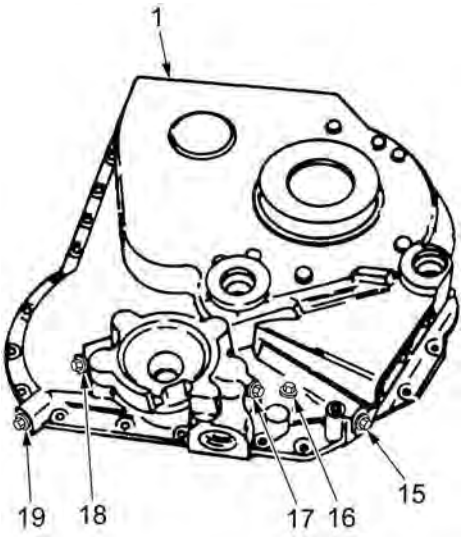


Figure 9. Pipe Plugs Installation.

11. Turn insert (see Figure 10) onto bolt of insert installer, remover tool until insert is against nut.

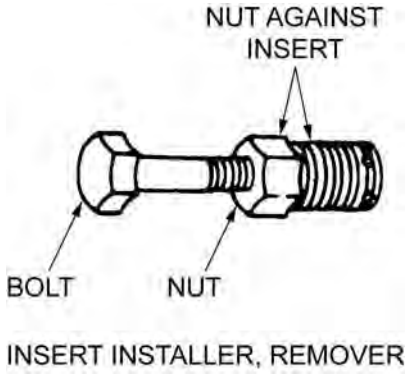


Figure 10. Insert Installer Tool.

12. Install insert (Figure 11, Item 13) in right cover assembly (Figure 11, Item 1) to 0.005 to 0.062 in. (0.127 to 0.157 mm) below surface of housing.
13. Repeat Steps 11 and 12 to install three remaining inserts (Figure 11, Item 13) in right cover assembly (Figure 11, Item 1).

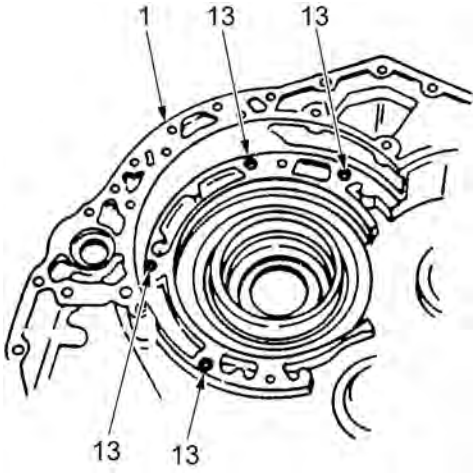


Figure 11. Inserts Installation.

14. Install two aluminum plugs (Figure 12, Item 12) flush to 0.010 in. (0.254 mm) below surface of right cover assembly (Figure 12, Item 1).
15. Install spring pin (Figure 12, Item 10) in boss on right cover assembly (Figure 12, Item 1). Push to height of 0.100 to 0.140 in. (2.540 to 3.556 mm) above surface.
16. Install two dowel pins (Figure 12, Item 8) in right cover assembly (Figure 12, Item 1). Push to height of 0.340 in. (8.636 mm) above surface.
17. Install two long brake reaction pins (Figure 12, Item 9) in right cover assembly (Figure 12, Item 1). Press to height of 3.100 to 3.140 in. (78.740 to 79.756 mm) above surface.

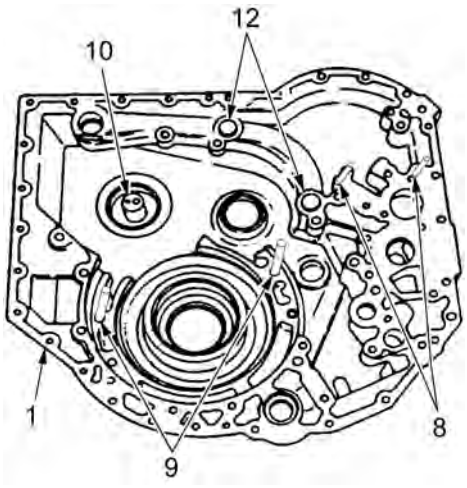


Figure 12. Plugs and Pins Installation.

WARNING

Frozen parts can stick to your f ngers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

18. Freeze steer idler bearing (Figure 13, Item 6) and bearing race (Figure 13, Item 7).
19. Apply petrolatum and lubricating oil to steer idler bearing (Figure 13, Item 6) housing in right cover assembly (Figure 13, Item 1).
20. Install steer idler bearing (Figure 13, Item 6) in right cover assembly (Figure 13, Item 1). Push steer idler bearing to shoulder.
21. Apply petrolatum and lubricating oil to bearing race (Figure 13, Item 7) housing in right cover assembly (Figure 13, Item 1).
22. Install bearing race (Figure 13, Item 7) in right cover assembly (Figure 13, Item 1). Push bearing race until seated in right cover assembly.

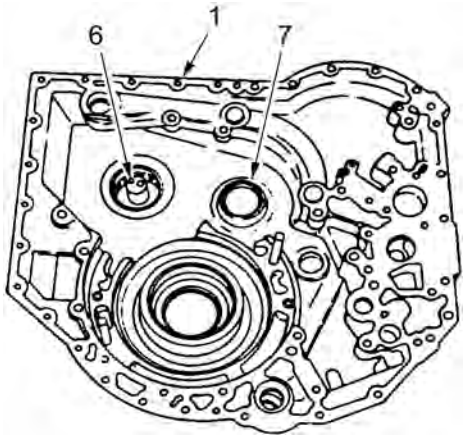


Figure 13. Bearing Race and Steer Idler Bearing Installation.

23. Turn right cover assembly (Figure 14, Item 1) over, outside up.
24. Apply petrolatum and lubricating oil to outer diameter of two brake apply shaft bearings (Figure 14, Item 2) and (Figure 14, Item 3).

NOTE

Press brake apply shaft bearings with driver against numbered side of bearings.

25. Install two brake apply shaft bearings (Figure 14, Item 2) and (Figure 14, Item 3) in right cover assembly (Figure 14, Item 1). Push brake apply shaft bearings 0.030 to 0.040 in. (0.762 to 1.016 mm) in from brake apply shaft seal (Figure 14, Item 4) and (Figure 14, Item 5) shoulders.

NOTE

Install brake apply shaft seal with numbered side of seal against seal inserter.

Small end of seal inserter tool is used for brake apply shaft seals.

Brake apply shaft seal contains dry-type sealer on outer edge.

26. Install brake apply shaft seals (Figure 14, Item 4) and (Figure 14, Item 5) in right cover assembly (Figure 14, Item 1) using seal inserter. Push brake apply shaft seals to 0.080 in. (2.032 mm) below surface of right cover assembly.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

27. Apply heat to new sleeve (Figure 14, Item 14). Heat for 15 minutes to 300°F (149°C).

28. Install new sleeve (Figure 14, Item 14) on right cover assembly (Figure 14, Item 1). Install chamfered inner diameter of sleeve to shoulder of right cover assembly.

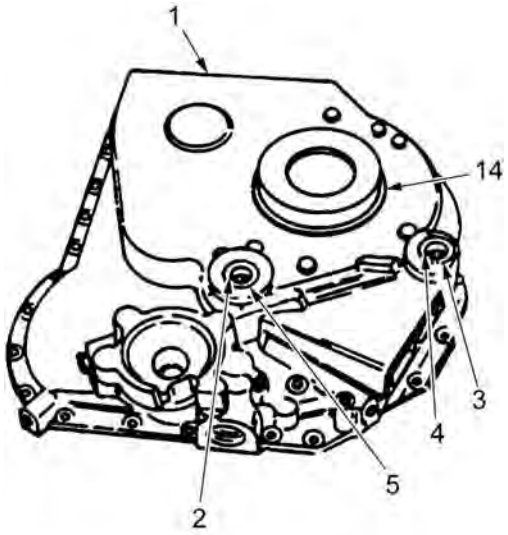


Figure 14. Bearings and Seals Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE COOLER LINE ELBOW

INITIAL SETUP:

Tools and Special Tools
Crowfoot, Open End, 1-7/8", 1/2" Drive (WP 0079, Item 10)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Adjustable, 18" (for 1-9/16" Nut) (WP 0079, Item 48)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
O-Ring (WP 0080, Item 3)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
TM 9-2350-277-13&P

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Top cover assembly removed (WP 0007)

REMOVE COOLER LINE ELBOW

WARNING

Check slings and trestle for cuts, breaks, or wear before and during lift. Slings and trestle can break and cause injury or death.

Right cover assembly weighs approximately 125 lb (57.1 kg). When lifting right cover assembly, you must use a hoist and trestle to avoid bodily injury.

NOTE

X200-4A Transmissions have a one-piece elbow conf guration and no separate connector (adapter).

To remove or install the elbow on an assembled transmission, it is necessary to f rst remove the right lifting bracket and top cover assembly (WP 0007).

Make sure the right cover assembly is turned so that the external side is up.

1. Remove the elbow (Figure 1, Item 1) and the O-ring (Figure 1, Item 2) from the right cover assembly (Figure 1, Item 3).

2. Remove the O-ring (Figure 1, Item 2) from the elbow (Figure 1, Item 1). Discard O-ring (Figure 1, Item 2).

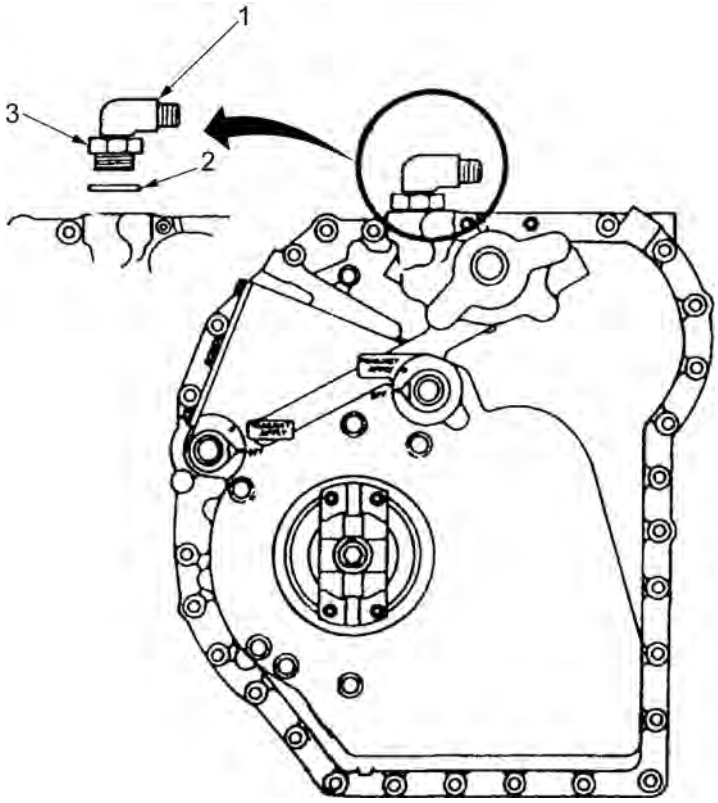


Figure 1. Cooler Line Elbow and O-Ring Removal.

END OF TASK

INSTALL COOLER LINE ELBOW

NOTE

X200-4A Transmissions have a one-piece elbow conf guration and no separate connector (adapter).

To remove or install the elbow on an assembled transmission, it is necessary to f rst remove the right lifting bracket and top cover assembly (WP 0007).

Make sure the right cover assembly is turned so that the external side is up.

1. Using your hands, in the direction of the bend in the elbow (Figure 2, Item 1), loosen the locknut on elbow. Loosen the locknut as far as possible.
2. Inspect backup washer on elbow (Figure 2, Item 1). Replace the elbow if the backup washer is damaged, loose, or bent.
3. Install new O-ring (Figure 2, Item 2) onto elbow (Figure 2, Item 1). Install O-ring (Figure 2, Item 2) so that it touches backup washer on elbow (Figure 2, Item 1).
4. Lubricate O-ring (Figure 2, Item 2) with petrolatum.
5. Inspect elbow (Figure 2, Item 1) to ensure that backup washer and O-ring are pushed up, in the direction of the bend in the elbow, as far as possible.
6. Using your hands, screw elbow (Figure 2, Item 1) and O-ring (Figure 2, Item 2) into the right cover assembly (Figure 2, Item 3) until the backup washer and O-ring touch the right cover assembly. It may be necessary to lightly use a wrench to correctly install the backup washer and O-ring.

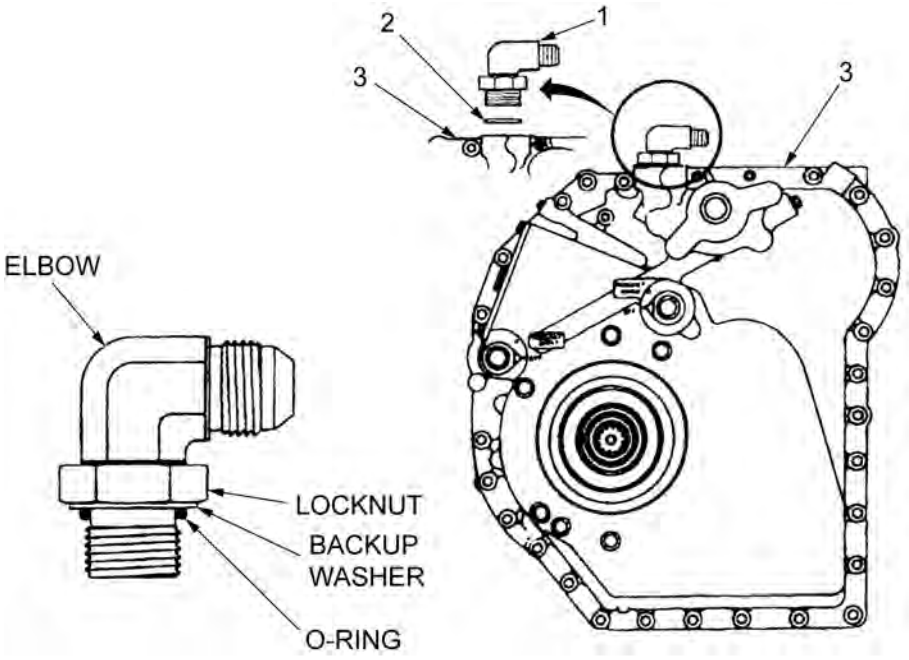


Figure 2. Backup Washer Inspection and O-Ring Installation.

7. Tighten nut on elbow (Figure 3, Item 1) against right cover assembly (Figure 3, Item 3).
8. Torque elbow (Figure 3, Item 1) to 50 to 60 lb-ft (68 to 81 N·m). Index elbow to 30 degrees of position shown in Figure 4.

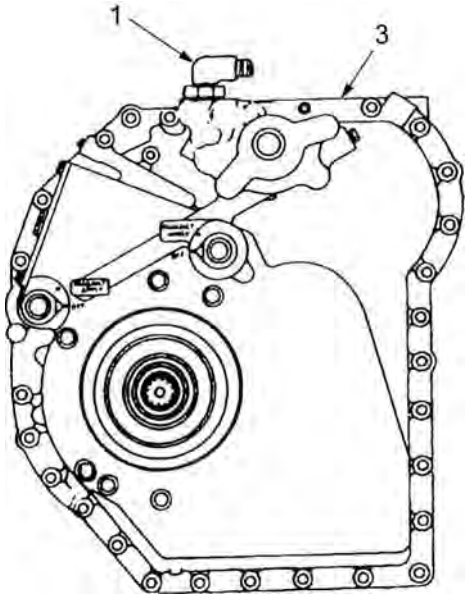


Figure 3. Elbow Nut Tightening.

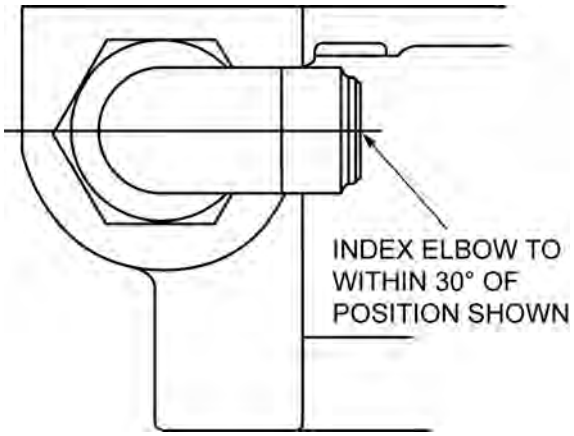


Figure 4. Cooler Line Elbow Index.

END OF TASK

REMOVE/INSTALL RIGHT OUTPUT FLANGE

Detailed instructions for the replacement of the right output f ange can be found in TM 9-2350-277-13&P.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BRAKE APPLY REGULATOR VALVE COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Lubricating Oil, Engine (WP 0078, Item 10)
Shim, Stock, 1/32 in. Thick by 1/2 in. Wide by 4 in. Long (WP 0078, Item 16)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE BRAKE APPLY REGULATOR VALVE COMPONENTS

WARNING

Spring-loaded parts can f y and cause you injury. Always obey specif ed instructions when you remove bolts from covers that are attached to valve assemblies.

NOTE

Make sure that the right cover assembly is turned so that the internal side points up.

1. Push on the brake apply regulator valve assembly (Figure 1, Item 2) head to move the brake apply regulator valve assembly toward brake apply valve body (Figure 1, Item 8) and to compress the spring (Figure 1, Item 3). Use one hand to hold the valve in.
2. Using the other hand, insert a 1/32-in. stock shim (Figure 1, Item 7) behind the nut (Figure 1, Item 6) to hold the brake apply regulator valve assembly (Figure 1, Item 2). Release brake apply regulator valve assembly.
3. Remove f ve bolts (Figure 1, Item 5) and washers (Figure 1, Item 4) from the valve body (Figure 1, Item 8).
4. Remove the valve body (Figure 1, Item 8) and the separator plate (Figure 1, Item 9) from the right cover assembly (Figure 1, Item 1).
5. Push on brake apply regulator valve assembly (Figure 1, Item 2) head to compress spring (Figure 1, Item 3) and remove stock shim (Figure 1, Item 7) from behind nut (Figure 1, Item 6). Release valve slowly.
6. Remove brake apply regulator valve assembly (Figure 1, Item 2) and spring (Figure 1, Item 3) from valve body (Figure 1, Item 8).

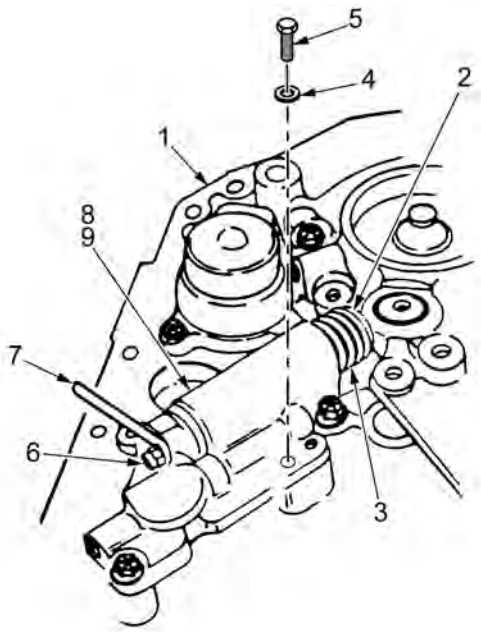


Figure 1. Brake Apply Regulator Valve Assembly Removal.

NOTE

Product improvement added a separator plate under the brake apply body assembly. Not all transmissions have this plate. If the brake apply valve body assembly is removed during maintenance, a separator plate must be installed.

7. Remove the separator plate (Figure 2, Item 9) from the right cover assembly (Figure 2, Item 1) if installed.

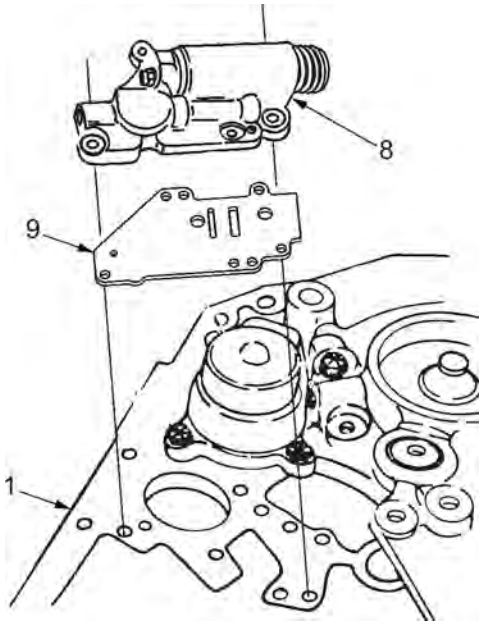


Figure 2. Separator Plate Removal.

8. If no separator plate (Figure 3, Item 9) was installed on the right cover assembly (Figure 3, Item 1), discard the entire brake apply valve body assembly (Figure 3, Item 2), which includes the valve body (Figure 3, Item 8) and the spring (Figure 3, Item 3), and replace it with a new assembly and separator plate.

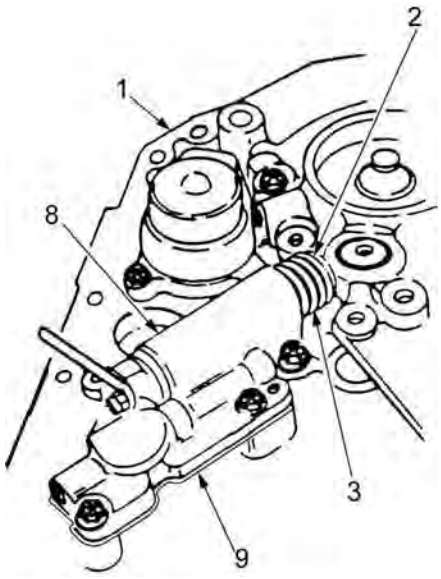


Figure 3. Product Improvement Adds Separator Plate.

END OF TASK

INSTALL BRAKE APPLY REGULATOR VALVE COMPONENTS

NOTE

Make sure that the right cover assembly is turned so that the internal side points up.

1. Install the spring (Figure 4, Item 3) on the brake apply valve body (Figure 4, Item 8).

NOTE

Make sure that the brake apply regulator valve assembly moves freely in the body by its own weight.

2. Apply lubricating oil to the brake apply regulator valve assembly (Figure 4, Item 2).
3. Install the spring (Figure 4, Item 3) and the brake apply regulator valve assembly (Figure 4, Item 2) in the brake apply valve body (Figure 4, Item 8).

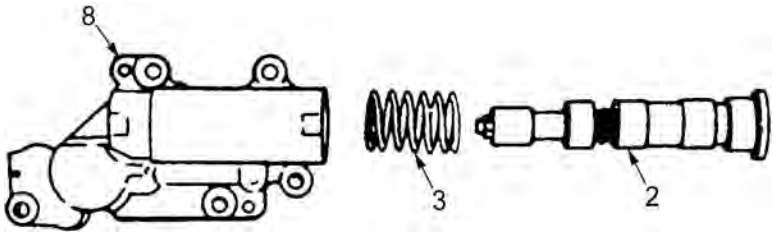


Figure 4. Brake Apply Regulator Valve Components Installation.

WARNING

Spring-loaded parts can f y and cause you injury. Always obey specif ed instructions when you remove bolts from covers that are attached to valve assemblies.

4. Push the brake apply regulator valve assembly (Figure 5, Item 2) through the brake apply valve body (Figure 5, Item 8) so that the nut (Figure 5, Item 6) on the end of the valve assembly extends out of the body.

5. Install the 0.025-in. thickness gage (Figure 5, Item 10) behind the nut (Figure 5, Item 6) to keep the brake apply regulator valve assembly (Figure 5, Item 2) and the spring (installed in Step 1) in the brake apply valve body (Figure 5, Item 8).

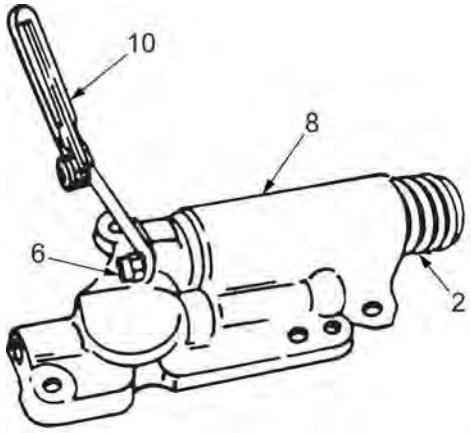


Figure 5. Brake Apply Regulator Valve Installation.

6. Install the separator plate (Figure 6, Item 9) and (Figure 7, Item 9) on the two dowel pins (Figure 7, Item 11) located on the right cover assembly (Figure 6, Item 1) and (Figure 7, Item 1).
7. Install the brake apply valve body (Figure 6, Item 7) and (Figure 7, Item 7) on the separator plate (Figure 7, Item 9) and (Figure 7, Item 9) and the two dowel pins (Figure 7, Item 11) located on right cover assembly (Figure 6, Item 1) and (Figure 7, Item 1).
8. Install f ve bolts (Figure 7, Item 5) and f ve washers (Figure 7, Item 4) in the brake apply valve body (Figure 7, Item 8).

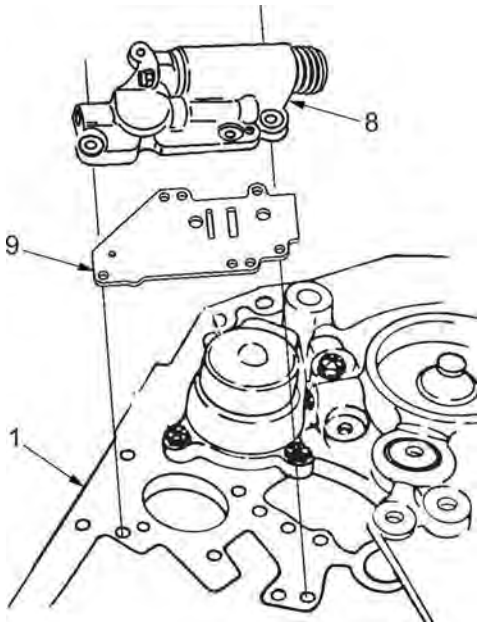


Figure 6. Separator Plate Installation.

9. Torque bolts (Figure 7, Item 5) to 17 to 20 lb-ft (23 to 27 N·m).
10. Remove thickness gage (Figure 7, Item 10) from nut (Figure 7, Item 6).

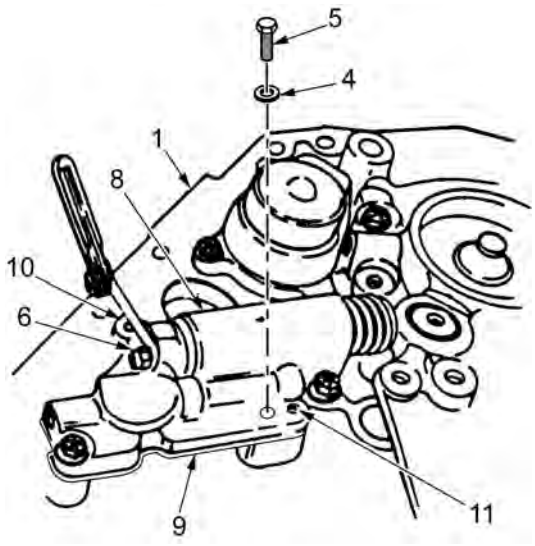


Figure 7. Brake Apply Regulator Valve Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BRAKE COOLANT VALVE ASSEMBLY COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Retainer, Packing (WP 0080, Item 39)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE BRAKE COOLANT VALVE ASSEMBLY COMPONENTS

WARNING

Spring-loaded parts can f y and cause you injury. Always obey specif ed instructions when you remove bolts from covers that are attached to valve assemblies.

NOTE

Make sure that the right cover assembly is turned so that the internal side points up.

1. Push f rmly down on brake coolant valve body (Figure 1, Item 1) with your hand.
2. Remove three bolts (Figure 1, Item 3) and three washers (Figure 1, Item 2) from brake coolant valve body (Figure 1, Item 1).
3. Release valve body (Figure 1, Item 1) slowly. Remove valve body (Figure 1, Item 1).

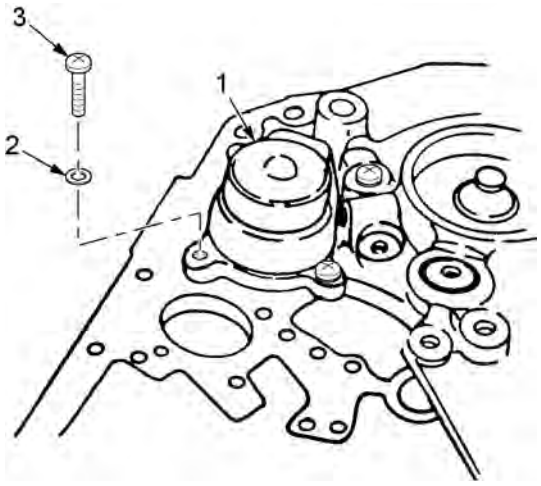


Figure 1. Brake Coolant Valve Body Removal.

4. Remove large spring (Figure 2, Item 4).

NOTE

Early models of the X200-4A Transmission have a two-piece brake coolant valve that has a brake coolant valve stem (Figure 2, Item 7) and a coolant valve (Figure 2, Item 8). Later models of the X200-4A Transmission have a product-improved, one-piece brake coolant valve (Figure 2, Item 5). Each time a two-piece conf guration is found (Figure 2, Item 7) and (Figure 2, Item 8), you must replace it with the newer one-piece brake coolant valve conf guration (Figure 2, Item 5).

5. Two-Piece Conf guration:
   a. Remove brake coolant valve stem (Figure 2, Item 7) that has a coolant valve (Figure 2, Item 8) and packing retainer (Figure 2, Item 6) attached. Discard brake coolant valve stem (Figure 2, Item 7), coolant valve (Figure 2, Item 8), and packing retainer (Figure 2, Item 6).
6. One-Piece Conf guration:
   a. Remove brake coolant valve (Figure 2, Item 5) with packing retainer (Figure 2, Item 6) attached.
   b. Remove packing retainer (Figure 2, Item 6) from brake coolant valve (Figure 2, Item 5). Discard packing retainer (Figure 2, Item 6).

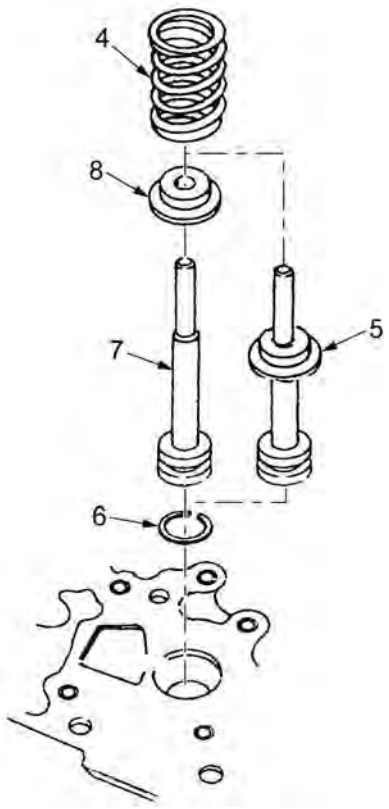


Figure 2. Two-Piece or One-Piece Brake Coolant Valve Removal.

END OF TASK

INSTALL BRAKE COOLANT VALVE ASSEMBLY COMPONENTS

NOTE

Make sure that the right cover assembly is turned so that the internal side points up.

Early models of the X200-4A Transmission have a two-piece brake coolant valve that has a brake coolant valve stem (Figure 2, Item 7) and a coolant valve (Figure 2, Item 8). Later models of the X200-4A Transmission have a product-improved, one-piece brake coolant valve (Figure 2, Item 5). Each time a two-piece conf guration is found (Figure 2, Item 7) and (Figure 2, Item 8), you must replace it with the newer one-piece brake coolant valve conf guration (Figure 2, Item 5).

1. Install new packing retainer (Figure 3, Item 6) on one-piece brake coolant valve (Figure 3, Item 5).
2. Apply petrolatum on packing retainer (Figure 3, Item 6).
3. Install one-piece brake coolant valve (Figure 3, Item 5) in bore (Figure 3, Item 9) of end cover housing, packing retainer end f rst. Push brake coolant valve until it touches the bottom of the bore.
4. Install large spring (Figure 3, Item 4) on one-piece brake coolant valve (Figure 3, Item 5).

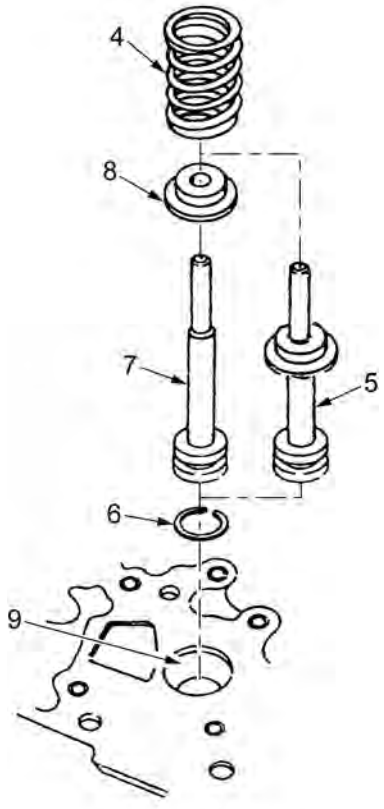


Figure 3. One-Piece Brake Coolant Valve Installation.

WARNING

Spring-loaded parts can f y and cause you injury. Always obey specif ed instructions when you remove bolts from covers that are attached to valve assemblies.

5. Install three bolts (Figure 4, Item 3) and three washers (Figure 4, Item 2) on brake coolant valve body (Figure 4, Item 1).
6. Install brake coolant valve body (Figure 4, Item 1) with three bolts (Figure 4, Item 3) and three washers (Figure 4, Item 2) on spring (Figure 4, Item 4), and hold brake coolant valve body f rmly down while starting to install bolts (Figure 4, Item 1) by turning them with f ngers.
7. Tighten three bolts (Figure 4, Item 3) and three washers (Figure 4, Item 2) on brake coolant valve body (Figure 4, Item 1).
8. Torque three bolts (Figure 4, Item 3) to 17 to 20 lb-ft (23 to 27 N·m).

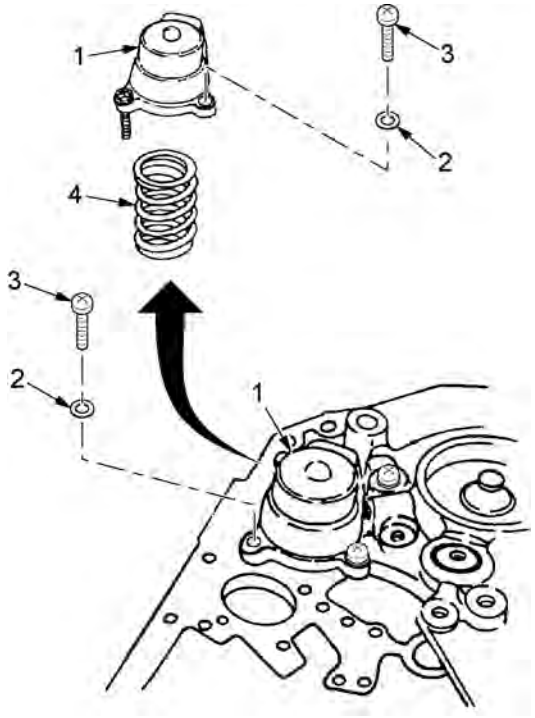


Figure 4. Brake Coolant Valve Body Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BRAKE APPLY INDICATORS AND LEFT BRAKE APPLY SHAFT

INITIAL SETUP:

Tools and Special Tools
Pliers Set, Retaining Ring (WP 0079, Item 27)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Tape, Masking (WP 0078, Item 19)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE BRAKE APPLY INDICATORS AND LEFT BRAKE APPLY SHAFT

NOTE

Make sure that the right cover assembly is turned so that the internal side points up.

Outer retaining rings may or may not be on the left brake apply shaft and the right brake apply cam shaft. These retaining rings are supplied to keep external brake linkage.

You must hold the left brake apply shaft in position with a wooden block or by hand to keep it from falling out of the end cover after removal of retaining rings and indicator.

1. Put a wooden block under the right cover assembly (Figure 1, Item 5) and another under the left brake apply shaft (Figure 1, Item 1).
2. Remove four retaining rings (Figure 1, Item 3), two from left brake apply shaft (Figure 1, Item 1) and two from right brake apply cam shaft (Figure 1, Item 4).
3. Remove two indicators (Figure 1, Item 2), one from left brake apply shaft (Figure 1, Item 1) and one from right brake apply shaft (Figure 1, Item 4).

CAUTION

Put protective material, such as masking tape, on the splines unless the seal is to be replaced. If the shaft goes through the seal without protection, the splines on the shaft will cause damage to the seal.

4. Clean the left brake apply shaft (Figure 1, Item 1) and the right brake apply shaft (Figure 1, Item 4).
5. Put masking tape on splines and on the end of the left brake apply shaft (Figure 1, Item 1) and the right brake apply shaft (Figure 1, Item 4).
6. Put petrolatum on tape on the left brake apply shaft (Figure 1, Item 1) and also on the right brake apply shaft (Figure 1, Item 4).

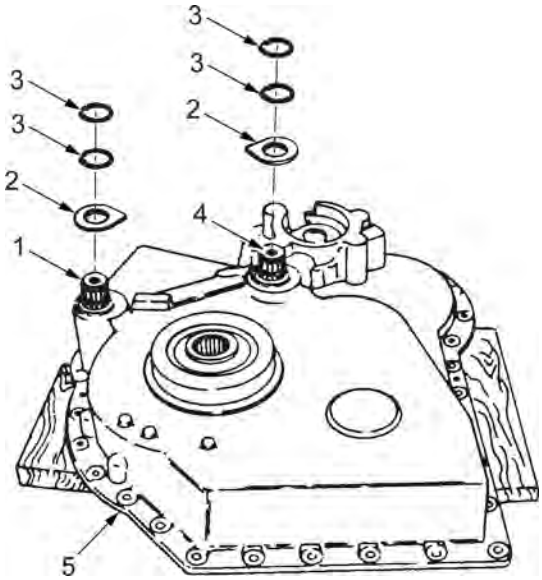


Figure 1. Retaining Rings and Indicators Removal.

7. Raise the right cover assembly (Figure 2, Item 5) at the left brake apply shaft location (Figure 2, Item 6) with one hand.
8. Reach under the right cover assembly (Figure 2, Item 5) with the other hand and turn the left brake apply shaft (Figure 2, Item 1) to left or right while pulling on it.
9. Remove the left brake apply shaft (Figure 2, Item 1) from the right cover assembly (Figure 2, Item 5).
10. Remove washer (Figure 2, Item 7) from left brake apply shaft (Figure 2, Item 1) or right cover assembly (Figure 2, Item 5).

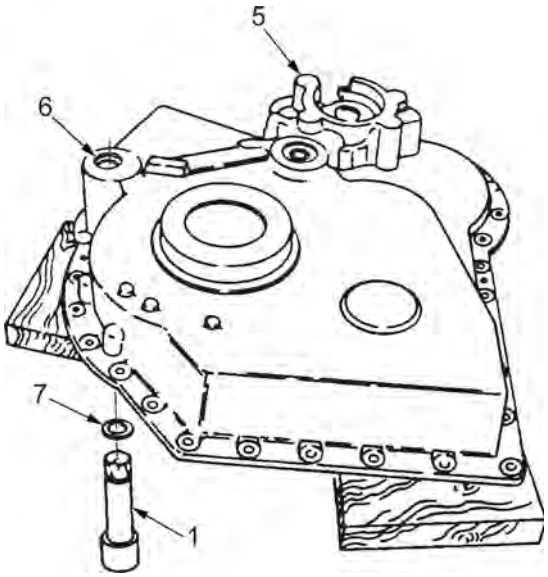


Figure 2. Left Brake Apply Shaft Removal.

END OF TASK

INSTALL LEFT BRAKE APPLY SHAFT

CAUTION

Put protective material, such as masking tape, on the splines. If the shaft goes through the seal without protection, the splines on the shaft will cause damage to the seal.

NOTE

Make sure that the right cover assembly is turned so that the internal side points up. Put the right cover assembly on wooden blocks.

If there is tape on splines, put petrolatum on tape before you install shafts.

1. Apply petrolatum to washer (Figure 4, Item 7).
2. Install washer (Figure 4, Item 7) on the left brake apply shaft (Figure 4, Item 1).
3. Clean the spline end of the left brake apply shaft (Figure 4, Item 1).
4. Wind masking tape around the spline and end of left brake apply shaft (Figure 4, Item 1).
5. Apply petrolatum on tape on the left brake apply shaft (Figure 4, Item 1).
6. Put the taped end of the left brake apply shaft (Figure 4, Item 1) above the bearing (Figure 4, Item 8) in the right cover assembly (Figure 4, Item 5).

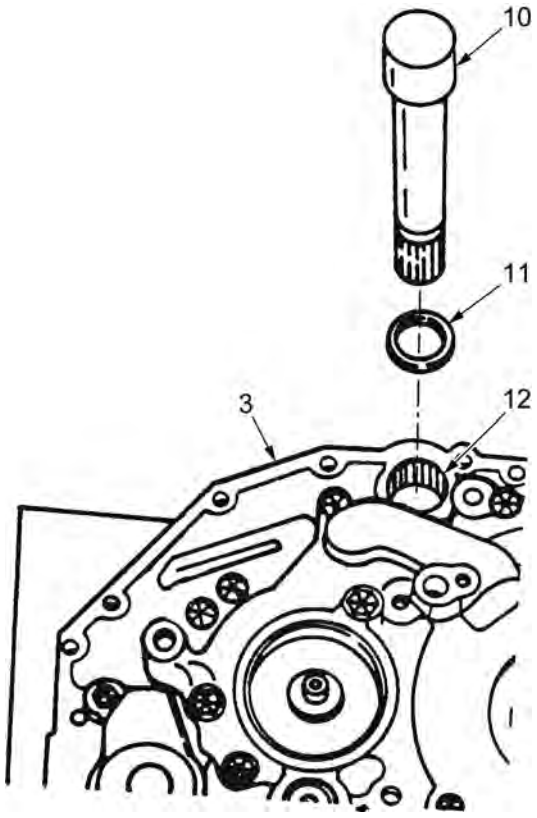


Figure 3. Left Brake Apply Shaft Prepared for Installation.

CAUTION

When you push the brake apply shaft through the seal, make sure that the spring in the seal stays in place. Put one hand on the exterior of the right cover on the brake apply shaft bore with one f nger on the spring in the seal to keep the spring in place while the end of the shaft goes through. If the spring moves out of its correct position, it may cause leaks in the seal.

7. Put one hand on the exterior of the right cover assembly (Figure 6, Item 5) on the left brake apply shaft (Figure 6, Item 1) bore with one f nger on the spring (Figure 5, Item 10) in the seal (Figure 5, Item 9) until the end of the left brake apply shaft (Figure 6, Item 1) that has tape on it goes through.

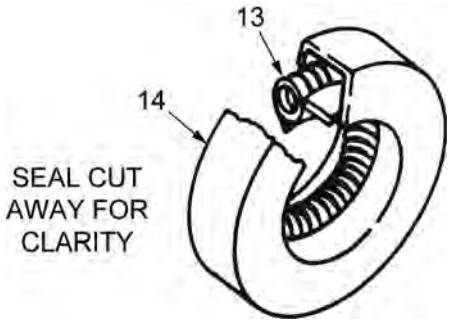


Figure 4. Seal and Spring.

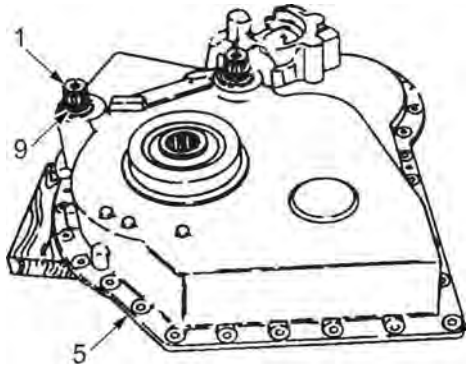


Figure 5. Left Brake Apply Shaft Installation.

8. Turn the left brake apply shaft (Figure 7, Item 1) to the left or right while you insert it. Carefully push the shaft into the bore until the left brake apply shaft is installed in the right cover assembly (Figure 7, Item 5).

NOTE

When you turn over the right cover, hold the left brake apply shaft in position to keep it from falling out.

9. Hold the left brake apply shaft (Figure 7, Item 1) in position and turn the right cover assembly (Figure 7, Item 5) over so that the external side points up. Put a wooden block under the right cover assembly so that it holds up the left brake apply shaft.
10. Remove the protective tape from the end of the left brake apply shaft (Figure 7, Item 1) and the right brake apply cam shaft (Figure 7, Item 4).

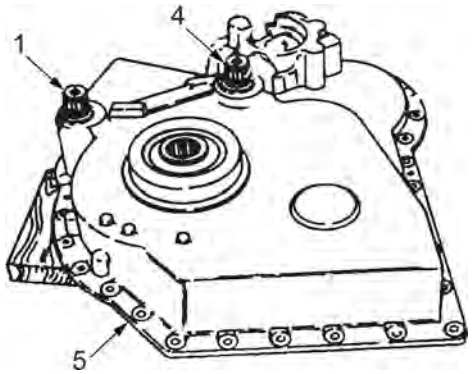


Figure 6. Right Cover Assembly External Side Up.

END OF TASK

INSTALL RIGHT AND LEFT BRAKE APPLY INDICATORS

NOTE

The indicator and the shaft have one tooth missing from spline. Align them using this point.

Install the indicator with the beveled side of the pointer out.

1. Install indicators (Figure 8, Item 2) on the left brake apply shaft (Figure 8, Item 1) and the right brake apply cam shaft (Figure 8, Item 4) in the right cover assembly (Figure 8, Item 5). Make sure that you install the indicators (Figure 8, Item 2) so that they are below the inner retaining ring groove (Figure 8, Item 11) in the two brake apply shafts.

NOTE

Outer retaining rings may or may not be present. These retaining rings are supplied to keep external brake linkage.

2. Install four retaining rings (Figure 8, Item 3).

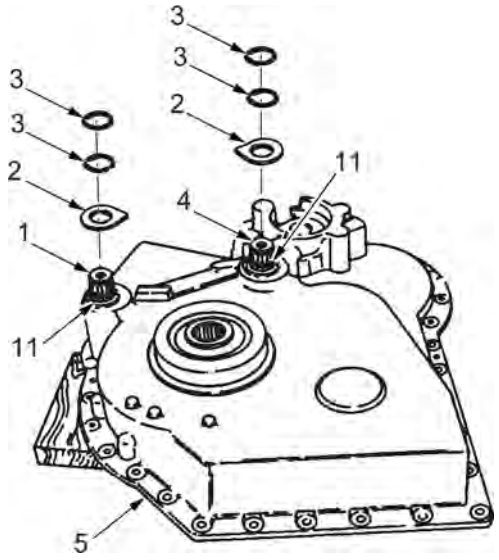


Figure 7. Retaining Rings and Indicators Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR LEFT BRAKE APPLY SHAFT ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Gage, Vernier Caliper, 0-6” (WP 0079, Item 18)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)

Materials/Parts
Pin, Spring (WP 0080, Item 23)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left brake apply shaft assembly removed (WP 0021)

REPAIR LEFT BRAKE APPLY SHAFT ASSEMBLY

Remove Pin

1. Remove spring pin (Figure 1, Item 1) from left brake apply shaft (Figure 1, Item 2). Discard pin (Figure 1, Item 1).

Install Pin

1. Install new spring pin (Figure 1, Item 1) in left brake apply shaft (Figure 1, Item 2) to a depth of 0.027 to 0.047 in. (0.68 to 1.19 mm) below external surface of left brake apply shaft (Figure 1, Item 2).

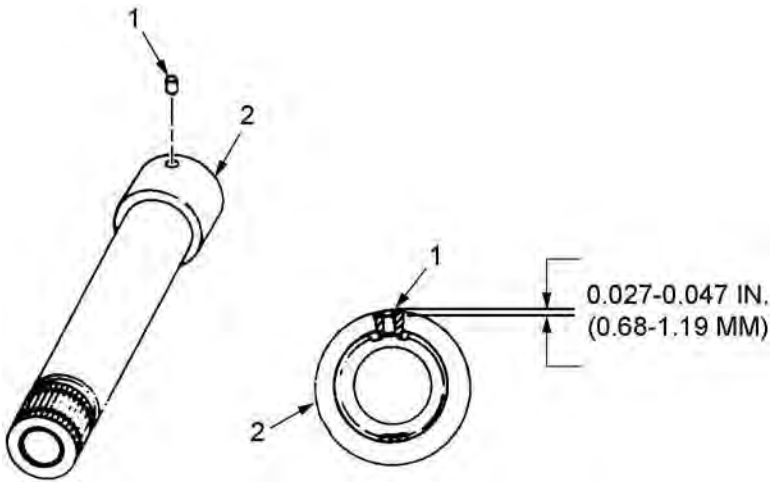


Figure 1. Left Brake Apply Shaft Assembly.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RIGHT BRAKE SUPPORT ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
O-Ring (WP 0080, Item 38)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal Ring, Metal (WP 0080, Item 13)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0024

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Brake apply indicators and left brake apply shaft removed (WP 0021)

REMOVE RIGHT BRAKE SUPPORT ASSEMBLY

NOTE

Make sure that the right cover assembly is turned upside down.

When the right brake support assembly is removed, the following parts may come out with the support, or they may remain in the right cover assembly: rotating cam, eight balls, brake adjusting links, cam seal rings, and right brake apply cam shaft.

Two bearing races and a needle bearing will remain in right brake support assembly after completion of this task. The races require application of heat for removal. Refer to Repair Right Brake Support Assembly (WP 0024) for removal of races and needle bearings.

1. Remove two bolts (Figure 1, Item 4) and two washers (Figure 1, Item 5) from right brake support assembly (Figure 1, Item 8).
2. Remove 12 remaining bolts (Figure 1, Item 6) and 12 washers (Figure 1, Item 7) from around perimeter of right brake support assembly (Figure 1, Item 8).
3. Pry right brake support assembly (Figure 1, Item 8) off right cover assembly (Figure 1, Item 9) using two pry bars (Figure 1, Item 1) positioned approximately 180 degrees apart.
4. Remove right brake support assembly (Figure 1, Item 8) from right cover assembly (Figure 1, Item 9).
5. Remove O-ring (Figure 1, Item 3) from oil transfer (lube) tube (Figure 1, Item 2). Discard O-ring (Figure 1, Item 3).

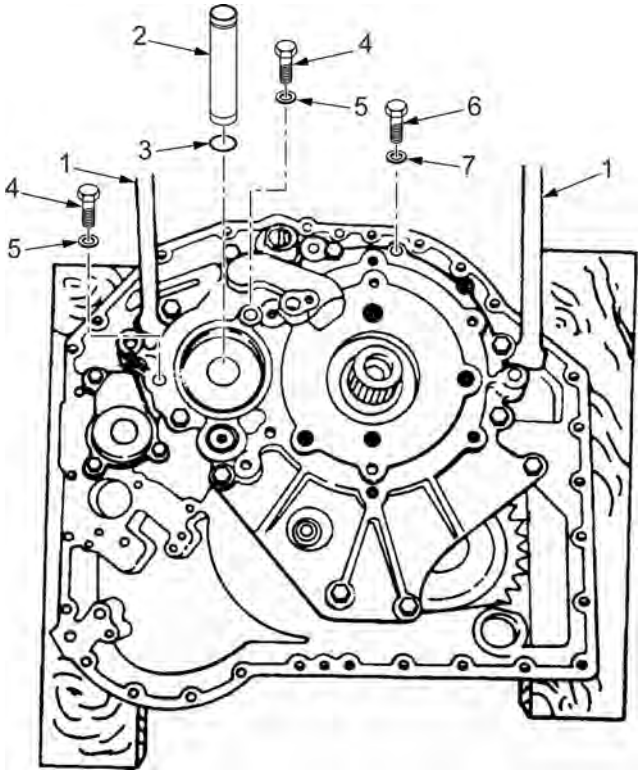


Figure 1. Right Brake Support Assembly Removal.

6. Place right brake support assembly (Figure 2, Item 8) on two wooden blocks with outside of support assembly pointed up.
7. Unscrew two bolts (Figure 2, Item 10) until bolt heads are approximately 0.25 in. (6.35 mm) above surface of right brake support assembly (Figure 2, Item 8).
8. Tap down bolt heads (Figure 2, Item 10) to touch surface of right brake support assembly (Figure 2, Item 8).
9. Remove two bolts (Figure 2, Item 10), using 7/16 inch socket, and two washers (Figure 2, Item 11) from right brake support assembly (Figure 2, Item 8).

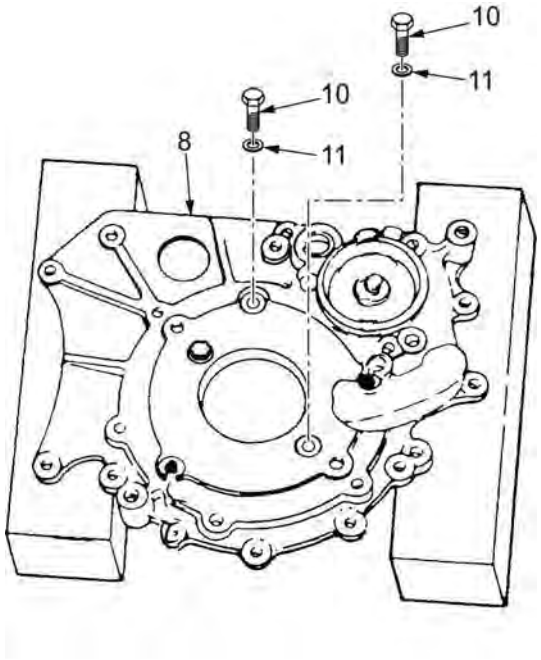


Figure 2. Right Brake Support Assembly Hardware Removal.

10. Turn the right brake support assembly (Figure 3, Item 8) over so that the inside points up.
11. Remove the seal retainer (Figure 3, Item 13) and the seal ring (Figure 3, Item 12) from right brake support assembly (Figure 3, Item 8).
12. Remove seal ring (Figure 3, Item 12) from seal retainer (Figure 3, Item 13). Discard seal ring (Figure 3, Item 12).

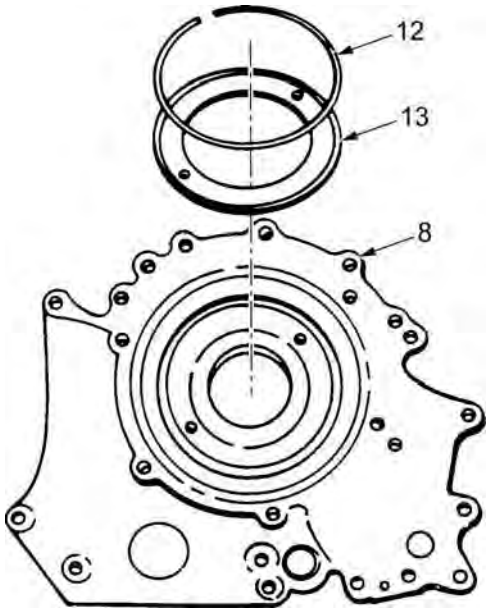


Figure 3. Seal Retainer and Seal Ring Removal.

NOTE

If stationary cam is to be replaced, refer to Step 18.

Do not remove the stationary cam unless:

You must replace the cam or support.

You must repair the support.

13. Turn right brake support assembly (Figure 4, Item 8) over so that the outside points up. Put on wooden blocks (Figure 4, Item 14).
14. Unscrew three bolts (Figure 4, Item 15) and (Figure 4, Item 17) until bolt heads are approximately 0.25 in. (6.35 mm) above the surface of the right brake support assembly (Figure 4, Item 8).
15. Tap down bolt heads (Figure 4, Item 15) and (Figure 4, Item 17) to touch surface of right brake support assembly (Figure 4, Item 8).
16. Remove two bolts (Figure 4, Item 15) and two washers (Figure 4, Item 16) from right brake support assembly (Figure 4, Item 8).
17. Remove bolt (Figure 4, Item 17) and washer (Figure 4, Item 18) from right brake support assembly (Figure 4, Item 8).

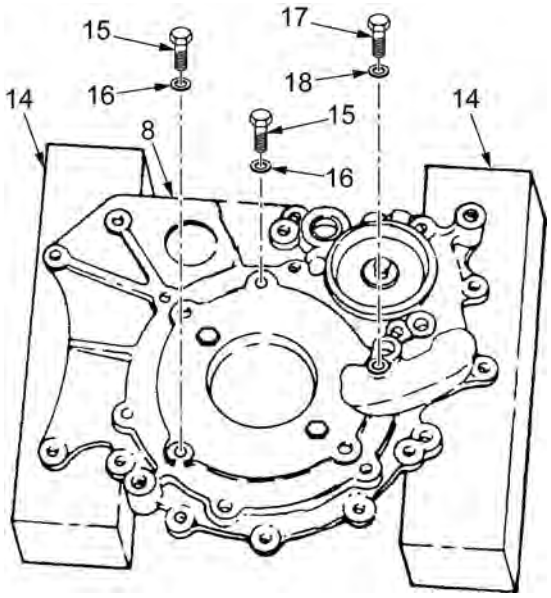


Figure 4. Bolts and Washers Removal.

18. Turn right brake support assembly (Figure 5, Item 8) over so that the inside of the support assembly points up.
19. Remove the stationary cam (Figure 5, Item 19) from right brake support assembly (Figure 5, Item 8).

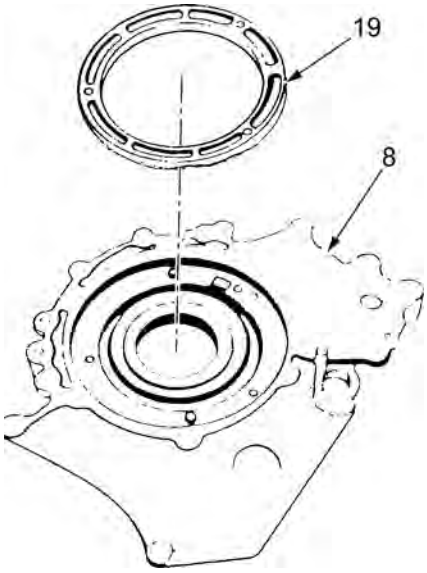


Figure 5. Stationary Cam Removal.

END OF TASK

INSTALL RIGHT BRAKE SUPPORT ASSEMBLY

NOTE

Turn right brake support assembly so that the inside of the support assembly points up.

1. Install the stationary cam (Figure 6, Item 19) on two dowel pins (Figure 6, Item 20) in right brake support assembly (Figure 6, Item 8).
2. Lightly tap down the stationary cam (Figure 6, Item 19) onto the dowel pins (Figure 6, Item 20) until the stationary cam is installed.

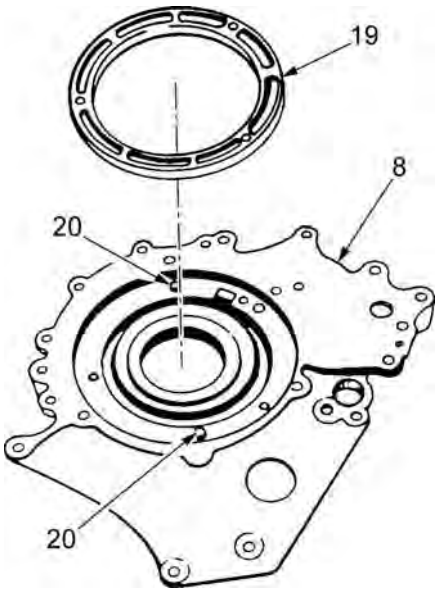


Figure 6. Stationary Cam Installation.

3. Turn right brake support assembly (Figure 7, Item 8) over so that the outside of the support assembly points up. Put assembly on wooden blocks (Figure 7, Item 14).
4. Install one 5/16-18 x 2 inch bolt (Figure 7, Item 17) and one washer (Figure 7, Item 18).
5. Install two 5/16-18 x 1 inch bolts (Figure 7, Item 15) and two washers (Figure 7, Item 16).
6. Torque three bolts (Figure 7, Item 15) and (Figure 7, Item 16) to 17 to 20 lb-ft (23 to 27 N·m).
7. Turn right brake support assembly (Figure 7, Item 8) over so that the inside of the support assembly points up. Put assembly on wooden blocks (Figure 7, Item 14).

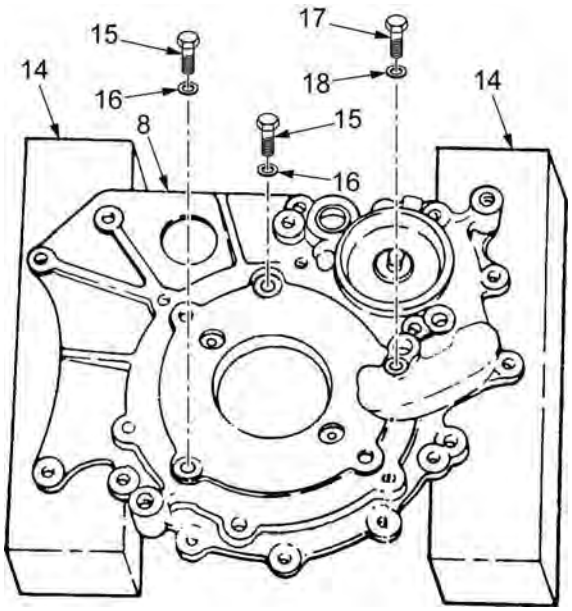


Figure 7. Bolts and Washers Installation.

8. Install new hook-type metal seal ring (Figure 8, Item 12) onto retainer (Figure 8, Item 13).

NOTE

Petrolatum applied to a hook-type seal ring can reduce the possibility of breakage by helping the seal ring move into place with less friction.

9. Coat seal ring (Figure 8, Item 12) with petrolatum.

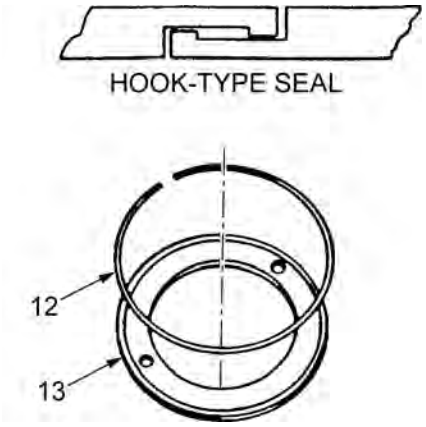


Figure 8. Seal Ring Installation.

10. Put right brake support assembly (Figure 9, Item 8) on its side.
11. Install seal retainer (Figure 9, Item 13), f at side toward right brake support assembly (Figure 9, Item 8) with seal retainer (Figure 9, Item 13) bolt holes (Figure 9, Item 22) and right brake support assembly (Figure 9, Item 8) bolt holes (Figure 9, Item 21) aligned.

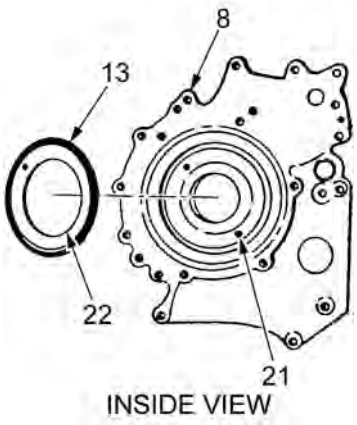


Figure 9. Seal Retainer Installation.

12. Start, by hand, two bolts (Figure 10, Item 10) and two washers (Figure 10, Item 11) into right brake support assembly (Figure 10, Item 8).
13. Torque bolts (Figure 10, Item 10) to 10-12 lb-ft (14-16 N·m).
14. Turn right brake support assembly (Figure 10, Item 8) over so that the outside of the support assembly points up. Put the assembly on two wooden blocks (Figure 10, Item 14).

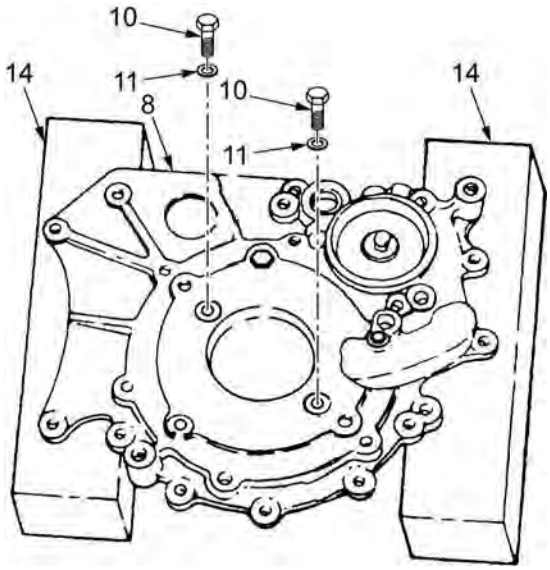


Figure 10. Right Brake Support Assembly Hardware Installation.

15. Put the right cover assembly (Figure 11, Item 9) on two wooden blocks (Figure 11, Item 14) so that the inside of the right cover assembly points up.

CAUTION

When you push the brake apply shaft through the seal, be sure that the spring in the seal stays in place. Put one hand on outside of right cover, over the brake apply shaft bore, and run a f nger around the spring in the seal to keep the spring in place while the end of the shaft comes through. If the spring does not remain in its proper position, the seal will leak.

NOTE

If they have been previously removed, brake apply cam and brake adjusting links should be installed in right cover assembly before f nal installation steps of right brake support assembly are performed.

When installing right brake support assembly on right cover assembly, the following alignments should be checked:

• Splined (taped) end of right brake apply cam shaft goes through thrust washer on right cover assembly and into needle bearing.

• Two long brake reaction pins go into pin holes in right brake support assembly.

• Four short brake reaction pins go into pin holes in right brake support assembly.

16. Turn right brake support assembly (Figure 11, Item 8) over so that the outside points up. Put right brake support assembly on right cover assembly (Figure 11, Item 9).
17. Check that the two long brake reaction pins (Figure 11, Item 24) and four short reaction pins (Figure 11, Item 23) are aligned with the pin holes in the right brake support assembly (Figure 11, Item 8).

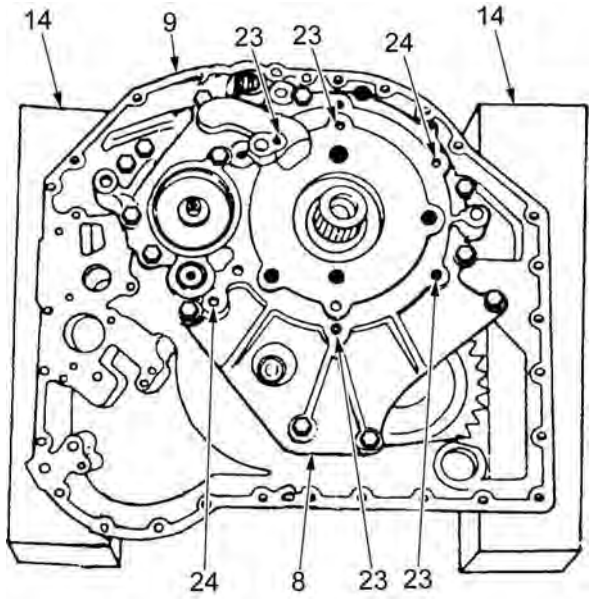


Figure 11. Right Brake Support Assembly Placement on Right Cover Assembly.

18. Place one hand on the outside of the right cover assembly (Figure 13, Item 9) over the right brake apply cam shaft (Figure 13, Item 27) bore and run f nger around and over the spring (Figure 12, Item 25) in the seal (Figure 12, Item 26) until taped end of right brake apply cam shaft (Figure 13, Item 27) comes through seal.
19. Push down on right brake support assembly (Figure 13, Item 8) and lightly move right brake support assembly back and forth until it slides down over pins (Figure 13, Item 23) and (Figure 13, Item 24). Right brake support assembly (Figure 13, Item 8) is properly installed when there is about 0.125 in. (3.175 mm) gap between right brake support assembly (Figure 13, Item 8) and right cover assembly (Figure 13, Item 9).
20. Install two 7/16-14 x 1-3/4 inch bolts (Figure 13, Item 4) and washers (Figure 13, Item 5) in right brake support assembly (Figure 13, Item 8).
21. Install 12 7/16-14 x 1-1/2 inch bolts (Figure 13, Item 6) and washers (Figure 13, Item 7) around perimeter of right brake support assembly (Figure 13, Item 8).
22. Torque bolts (Figure 13, Item 4) and (Figure 13, Item 6) evenly to 54 to 65 lb-ft (73 to 88 N·m).

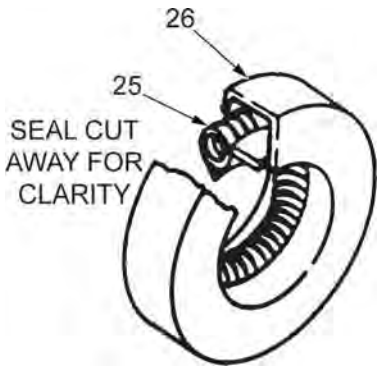


Figure 12. Seal and Spring.

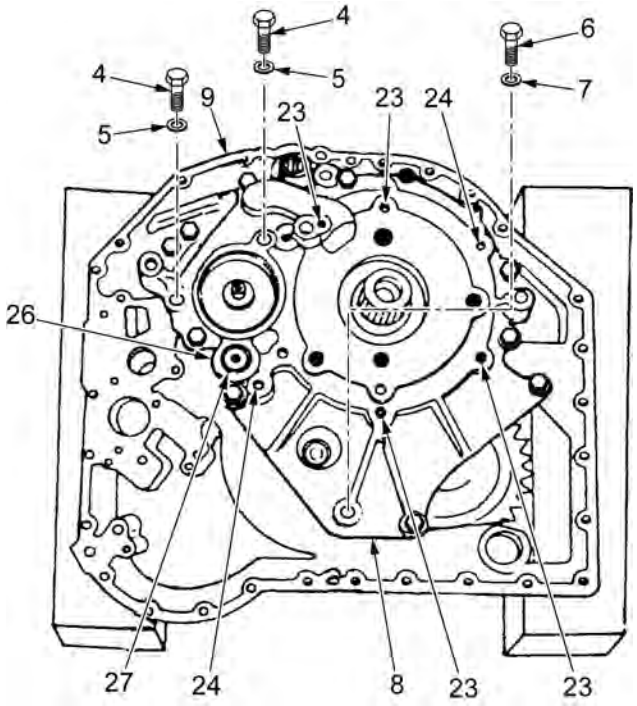


Figure 13. Right Brake Support Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR RIGHT BRAKE SUPPORT ASSEMBLY

INITIAL SETUP:

Tools and Special Tools

Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Chisel, Cold, 3/8”, Flat (WP 0079, Item 7)
Die and Tap Set, Rethreading (WP 0079, Item 12)
Gage, Vernier Caliper, 0-6” (WP 0079, Item 18)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Sander/Grinder, 4-1/2” (WP 0079, Item 31)
Slide Hammer Puller (WP 0079, Item 34)
Tap, 3/8 X 16 NC Rethread (WP 0079, Item 42)
Tap, 1/2 X 13 NC Rethread (WP 0079, Item 43)
Tap Wrench, Adjustable, 0-1/2” (WP 0079, Item 44)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts

Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Cloth, Abrasive, Crocus (WP 0078, Item 6)
Gloves, Leather (WP 0078, Item 8)
Sealant, Lubricating, Thread-Locking (WP 0078, Item 15)

Personnel Required

Track Vehicle Repairer, 91H10

Equipment Condition

Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right brake support assembly removed (WP 0023)

REPAIR RIGHT BRAKE SUPPORT ASSEMBLY

NOTE

Make sure that the right brake support assembly is on two wooden blocks before you begin repair procedures.

Inspect the right brake support assembly for serviceability. Replace all defective pins, tubes, plugs, bearings, and races. Do not remove or replace serviceable components.

1. Make sure that the right brake support assembly is on two wooden blocks (Figure 1, Item 1) so the external side points up.

NOTE

Remove the tube coupling only if necessary.

2. Tap the center hole of tube coupling (Figure 1, Item 3) with a 3/8-16 tap to a depth of about six to eight threads.
3. Put a slide hammer into the tube coupling (Figure 1, Item 3), and tap upward to remove the tube coupling (Figure 1, Item 3).
4. Clean out all metal shavings fully from right brake support assembly.
5. Push the long brake reaction pin (Figure 1, Item 2) from the right brake support assembly (Figure 1, Item 6).
6. Push two dowel pins (Figure 1, Item 5) from the right brake support assembly (Figure 1, Item 6).

NOTE

Remove the tube coupling only if necessary.

7. Tap the center hole of tube coupling with a 1/2-13 tap to a depth of about six to eight threads
8. Put a slide hammer into the tube coupling (Figure 1, Item 4), and tap upward to remove the tube coupling (Figure 1, Item 4).
9. Clean out all metal shavings fully from right brake support assembly.

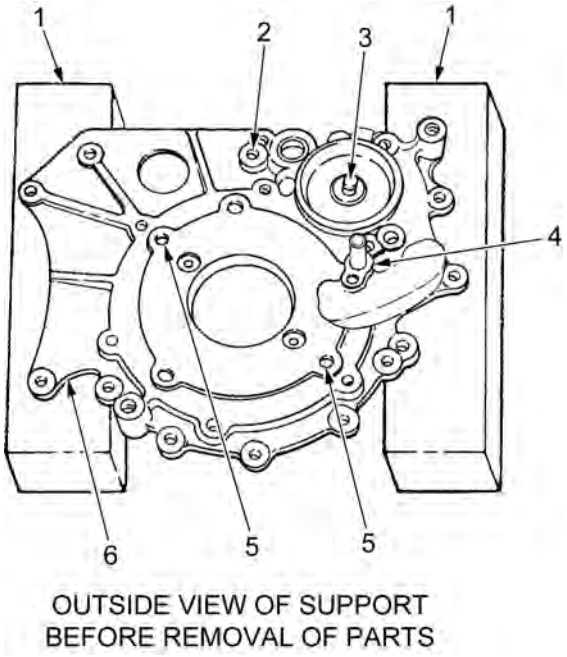


Figure 1. Tube Coupling and Pin Removal.

CAUTION

Be careful not to cut into right brake support assembly when you cut slots in the bearing race.

10. Cut two slots 180 degrees apart at the base of the bearing race (Figure 3, Item 7) as shown in Figure 2. Cut the slots slightly offset so that the pry bars will overlap. Cut the slots deep enough to catch the lip of the pry bar but not deep enough to cut into the right brake support assembly (Figure 3, Item 6).

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

11. Apply heat to the right brake support assembly (Figure 3, Item 6) with heat gun around the bearing race (Figure 3, Item 7) for 15 minutes.

CAUTION

Be careful not to damage the right brake support assembly when you use pry bars to remove the bearing race.

12. Lift up the bearing race (Figure 3, Item 7) using two pry bars in offset slots.
13. Move the two pry bars under the bearing race (Figure 3, Item 7) and remove bearing race.

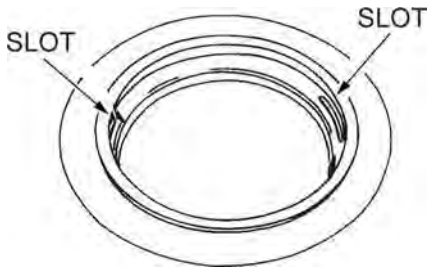


Figure 2. Small Bearing Race Slots.

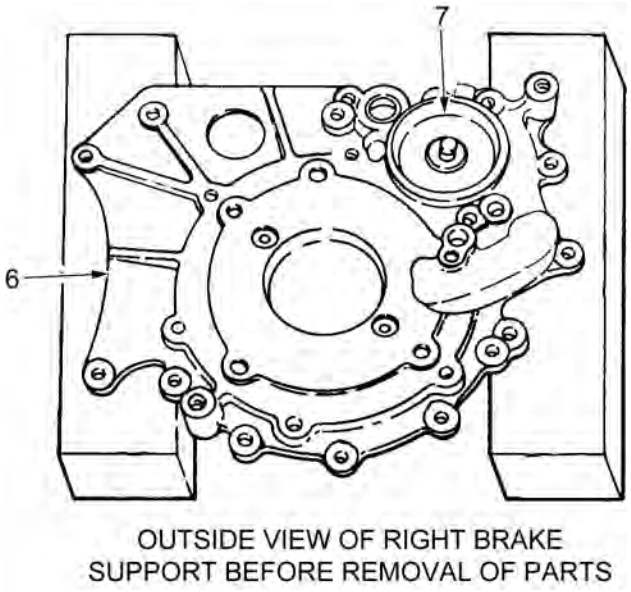


Figure 3. Small Bearing Race Removal.

14. Cut two slots 180 degrees apart at the base of the bearing race (Figure 5, Item 8) as shown in Figure 4. Cut the slots deep enough to catch the end of the chisel but not deep enough to cut into the right brake support assembly (Figure 5, Item 6).

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

15. Apply heat to the right brake support assembly (Figure 5, Item 6) with heat gun around the bearing race (Figure 5, Item 8) for 15 minutes.

CAUTION

Be careful not to cause damage to the right brake support assembly (Figure 5, Item 5) when you remove the bearing race.

16. Turn the right brake support assembly (Figure 5, Item 6) over and remove the bearing race (Figure 5, Item 8).

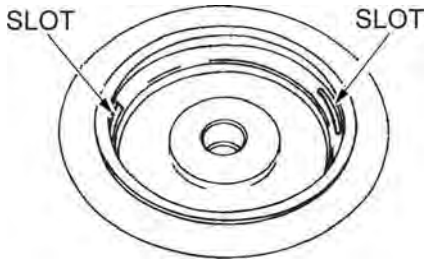


Figure 4. Large Bearing Race Slots.

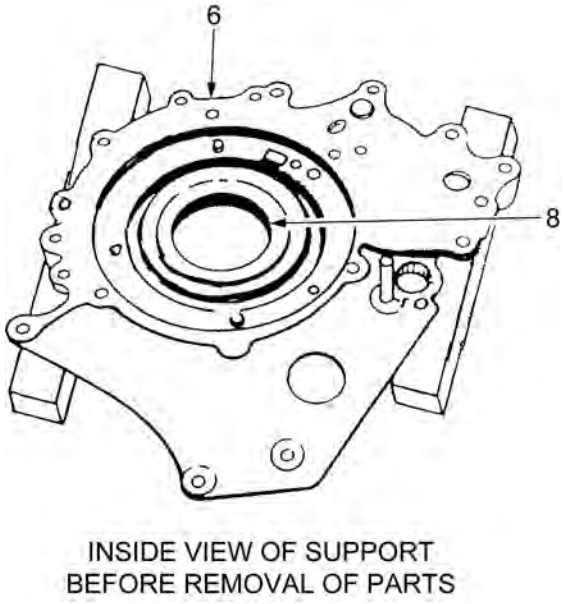


Figure 5. Large Bearing Race Removal.

17. Remove the needle bearing (Figure 6, Item 9) from the right brake support assembly (Figure 6, Item 6).
18. Turn the right brake support assembly (Figure 7, Item 6) over so that the external side points up, and put the right brake support assembly on a wooden block (Figure 7, Item 1) support placed near the pipe plug (Figure 7, Item 10).
19. Remove the pipe plug (Figure 7, Item 10) from the right brake support assembly (Figure 7, Item 6).
20. Check the bearing bores in the support for damage. Use crocus cloth to make scratches smooth. If there is grinding damage, replace the support.

NOTE

Some pipe plugs are precoated and do not require thread-locking compound lubricating sealant.

21. Apply lubricating sealant to the threads of the pipe plug (Figure 7, Item 10), if necessary.
22. Install the pipe plug (Figure 7, Item 10) in the right brake support assembly (Figure 7, Item 6). Torque the pipe plug (Figure 7, Item 10) to 5 lb-ft (6 to 7 N·m).

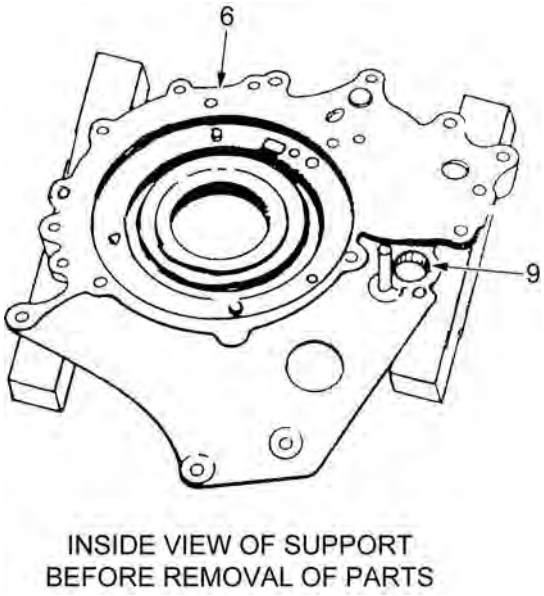


Figure 6. Needle Bearing Removal.

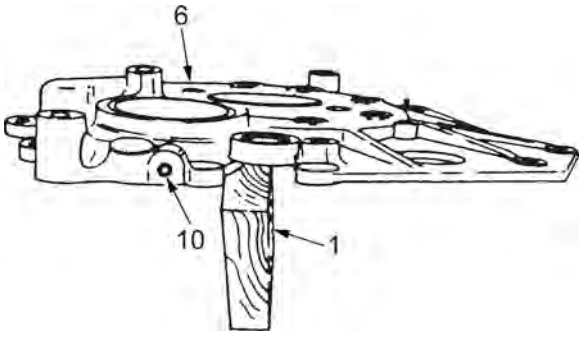


Figure 7. Pipe Plug Inspection and Replacement.

23. Turn the right brake support assembly (Figure 8, Item 6) over so that the internal side points up.
24. Install the long brake reaction pin (Figure 8, Item 2) in the right brake support assembly (Figure 8, Item 6). Push the long brake reaction pin to a height of 3.511 to 3.531 in. (89.18 to 89.69 mm) above the inner surface of the right brake support assembly.
25. Install the two dowel pins (Figure 8, Item 5) in the right brake support assembly (Figure 8, Item 6). Push pins to a height of 0.230 to 0.250 in. (5.84 to 6.35 mm) from the shoulder.

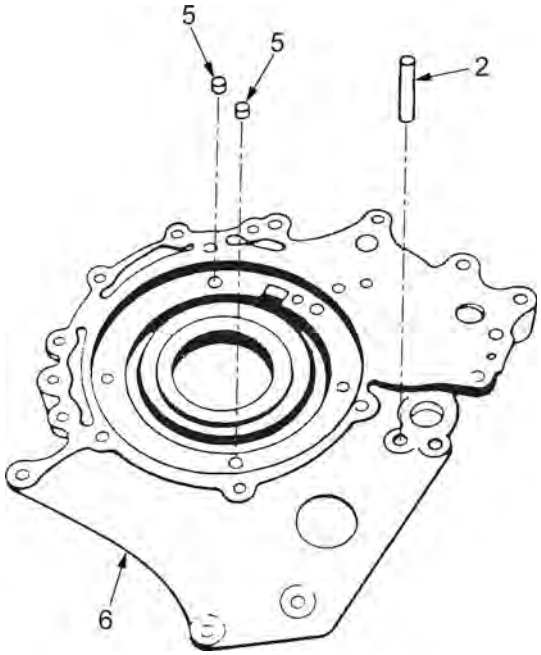


Figure 8. Pins Installation.

26. Turn the right brake support assembly (Figure 9, Item 6) over so that the external side points up.
27. Install the needle bearing (Figure 9, Item 9) with the driver against the numbered end of the bearing case. Push the needle bearing to 0.060 to 0.070 in. (1.52 to 1.78 mm) below the surface of the right brake support assembly (Figure 9, Item 6).

WARNING

Frozen parts can stick to your f ngers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

28. Put the tube coupling (Figure 9, Item 4) in technical carbon dioxide (dry ice) for one hour.
29. Install the tube coupling (Figure 9, Item 4), with the end that has grooves facing out, into the right brake support assembly (Figure 9, Item 6). Push the tube coupling f ush to stop.
30. Install the tube coupling (Figure 9, Item 3), with the end that has grooves facing out, into the right brake support assembly (Figure 9, Item 6). Push the tube coupling to a height of 0.620 to 0.660 in. (14.75 to 16.76 mm) above the shoulder.
31. Put the bearing races (Figure 9, Item 7) and (Figure 9, Item 8) in technical carbon dioxide (dry ice) for one hour.
32. Install the bearing races (Figure 9, Item 7) and (Figure 9, Item 8) in the right brake support assembly (Figure 9, Item 6). Push the bearing races to the shoulder.

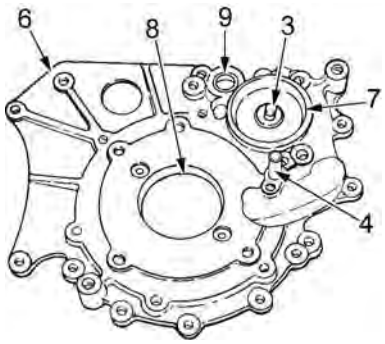


Figure 9. Needle Bearing, Tube Coupling, and Bearing Races Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BRAKE APPLY CAM, BRAKE ADJUSTING LINKS, AND RIGHT BRAKE ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Caps, Vise Jaw (WP 0079, Item 6)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Screwdriver Attachment Hex, 3/8” Drive, 1/8” Hex Bit (WP 0079, Item 32)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Vise, Machinist’s, 4” Jaw (WP 0079, Item 47)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Bands, Rubber (WP 0078, Item 2) (2)
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Lubricating Oil, Engine (WP 0078, Item 10)
O-Ring (WP 0080, Item 16)
O-Ring (WP 0080, Item 15)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Ring, Retaining (WP 0080, Item 1) (6)
Seal (WP 0080, Item 51)
Seal (WP 0080, Item 50)
Seal, Brake Coolant (WP 0080, Item 34)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right brake support assembly removed (WP 0023)

REMOVE BRAKE APPLY CAM, BRAKE ADJUSTING LINKS, AND RIGHT BRAKE ASSEMBLY

NOTE

Right cover assembly on work table is turned inside up.

Brake apply (rotating) cam, eight balls, and brake adjusting linkage may come out with right brake support assembly, or these parts may stay with the right cover assembly.

External seal rings (inner and outer) may come out attached to the stationary cam, or they may stay in the brake apply cam.

Procedures in this task are based upon above components staying with right cover assembly.

1. Remove brake apply cam (Figure 1, Item 4), eight balls (Figure 1, Item 3), and brake adjusting linkage (Figure 1, Item 1) from right cover assembly (Figure 1, Item 2). Put balls (Figure 1, Item 3) in a container.

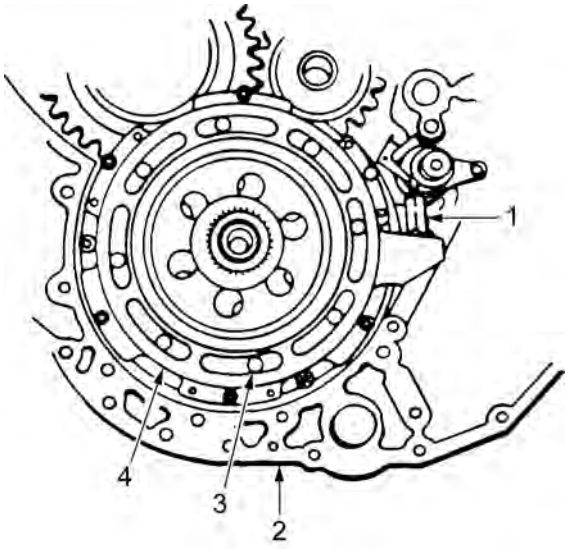


Figure 1. Brake Apply Cam and Brake Adjusting Linkage Removal.

2. Remove seals (Figure 2, Item 5) and (Figure 2, Item 6) from brake apply cam (Figure 2, Item 4). Discard seals (Figure 2, Item 5) and (Figure 2, Item 6).
3. Remove O-rings (Figure 2, Item 9) and (Figure 2, Item 10) from face of brake apply cam (Figure 2, Item 4). Discard O-rings (Figure 2, Item 9) and (Figure 2, Item 10).
4. Remove bolt (Figure 2, Item 11) and two spring tension clips (Figure 2, Item 12) from brake apply cam (Figure 2, Item 4).
5. Remove brake adjusting linkage (Figure 2, Item 1) from brake apply cam (Figure 2, Item 4).
6. Turn and remove inner brake adjusting link (Figure 2, Item 7) from outer brake adjusting link (Figure 2, Item 8).

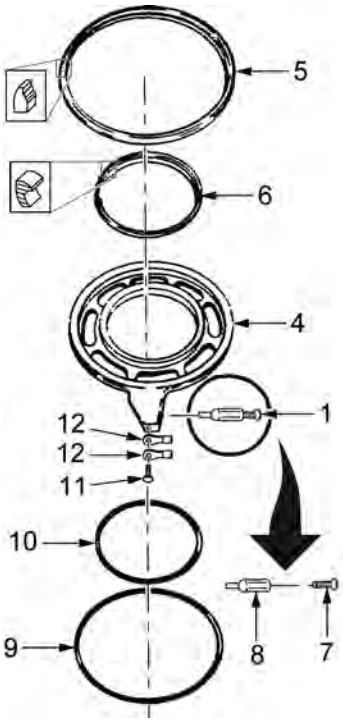


Figure 2. Brake Apply Cam Components Removal.

NOTE

Remove four brake reaction pins at this time. Fixed pins cannot be removed.

7. Remove four brake reaction pins (Figure 3, Item 13).
8. Hold retaining ring (Figure 3, Item 15) against clutch reaction plate (Figure 3, Item 14) with f nger of one hand.
9. Pry six retaining rings (Figure 3, Item 15) away from spring guide pins (Figure 3, Item 16). Discard six retaining rings (Figure 3, Item 15).

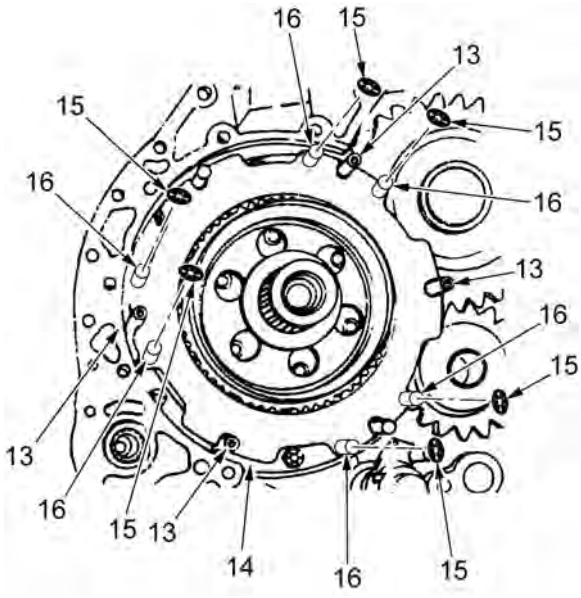


Figure 3. Reaction Pins and Retaining Rings Removal.

10. Remove clutch reaction plate (Figure 4, Item 14) from spring guide pins (Figure 4, Item 16).
11. Remove six springs (Figure 4, Item 17) from spring guide pins (Figure 4, Item 16).

CAUTION

Keep all clutch plates in the same order and facing the same way. When one plate is replaced, replace the entire clutch pack. Each used plate has made its own contour and wear pattern. The clutch assembly may not operate effectively because plates in the pack may have poor surface contact when:

A plate is facing the opposite direction.

A plate position in the pack is changed.

A new plate is inserted in the pack.

12. Remove the right brake pack having six internal splined clutch (friction) plates (Figure 4, Item 19) and f ve clutch reaction (steel) plates (Figure 4, Item 18).

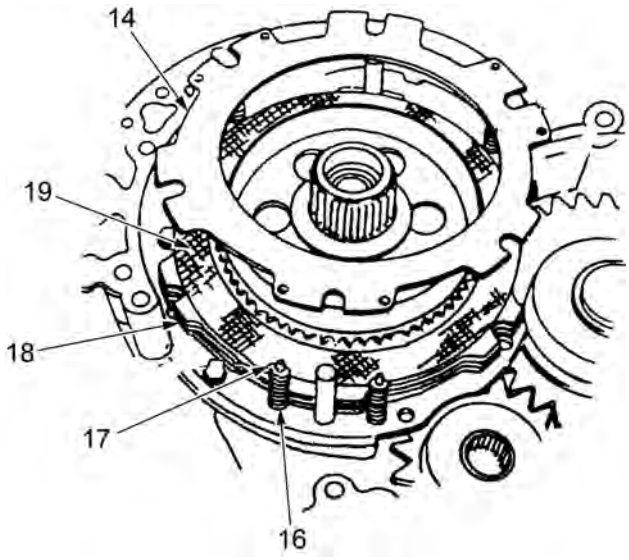


Figure 4. Right Brake Pack Plates Removal.

13. Remove steer ring gear assembly (Figure 5, Item 21) from output carrier assembly (Figure 5, Item 22) and brake clutch drum (Figure 5, Item 20).

NOTE

Thrust washer may come out with steer ring gear assembly, or it may stay on output carrier assembly.

14. Remove thrust washer (Figure 5, Item 23) from output carrier assembly (Figure 5, Item 22).

NOTE

Output carrier assembly and brake clutch drum are held together by a retaining ring and removed as one unit.

15. Remove output carrier assembly (Figure 5, Item 22) and brake clutch drum (Figure 5, Item 20).

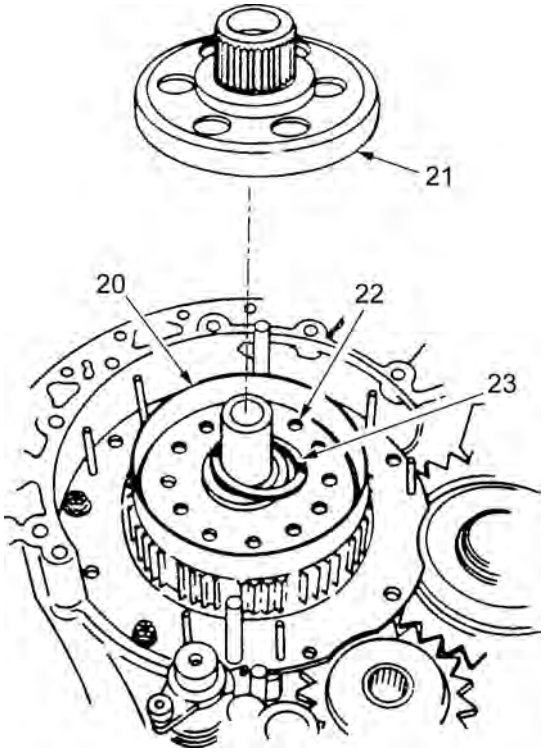


Figure 5. Steer Ring Gear Assembly and Related Parts Removal.

16. Turn output carrier assembly (Figure 6, Item 22) and brake clutch drum (Figure 6, Item 20) upside down.

NOTE

Thrust washer usually comes off with right cover assembly inside output carrier assembly, but it may stay on right steer driven gear.

17. Remove thrust washer (Figure 6, Item 24) from output carrier assembly (Figure 6, Item 22).
18. Remove snap ring (Figure 6, Item 25) from brake clutch drum (Figure 6, Item 20).
19. Remove output carrier assembly (Figure 6, Item 22) from brake clutch drum (Figure 6, Item 20).

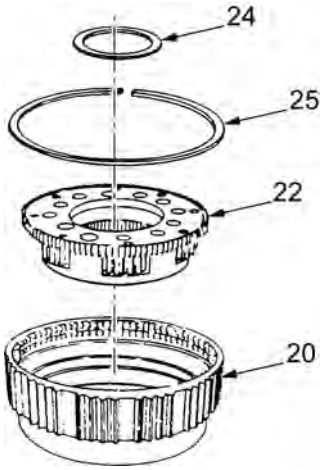


Figure 6. Brake Clutch Drum Parts Removal.

20. Remove brake coolant seal ring (Figure 7, Item 26) from brake clutch backing plate (Figure 7, Item 28). Discard seal (Figure 7, Item 26).
21. Remove four bolts (Figure 7, Item 30) and four washers (Figure 7, Item 29) from brake clutch backing plate (Figure 7, Item 28).

NOTE

Brake clutch backing plate may catch on two brake reaction pins during removal. Tap brake clutch backing plate near pin to help release brake clutch backing plate.

Six spring guide pins may come out with brake clutch backing plate, or pins may stay in right cover assembly.

22. Remove brake clutch backing plate (Figure 7, Item 28) using two pry bars (Figure 7, Item 27) under inside edge of brake clutch backing plate.
23. Remove six spring guide pins (Figure 7, Item 16) and (Figure 8, Item 16) from brake clutch backing plate (Figure 7, Item 28) or from right cover assembly (Figure 7, Item 2) and (Figure 8, Item 2).

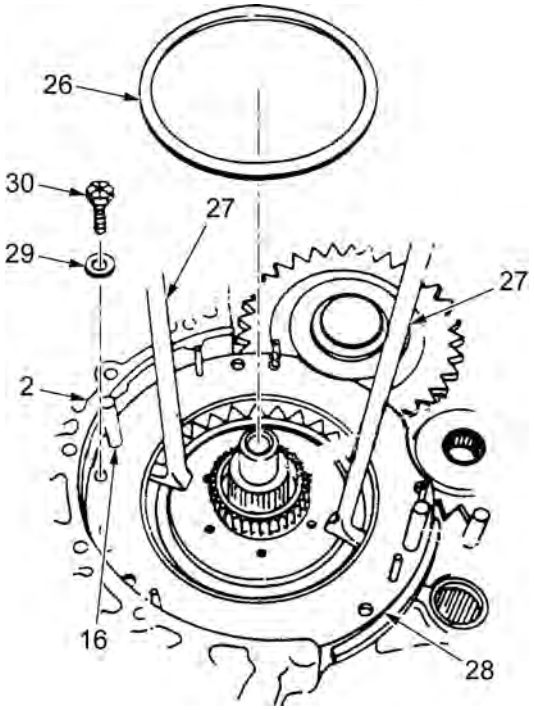


Figure 7. Clutch Backing Plate and Related Parts Removal.

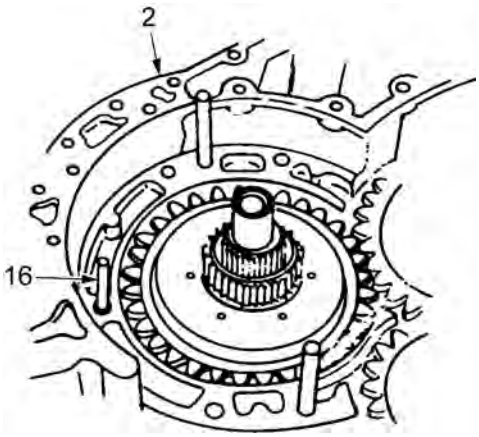


Figure 8. Spring Guide Pins Removal.

END OF TASK

INSTALL RIGHT BRAKE ASSEMBLY, BRAKE APPLY CAM, AND BRAKE ADJUSTING LINKS

NOTE

Right cover assembly turned inside up.

Install brake clutch backing plate with part number surface down.

1. Install six spring guide pins (Figure 9, Item 16) in brake clutch backing plate (Figure 9, Item 28).
2. Use rubber bands (Figure 9, Item 34) to hold spring guide pins (Figure 9, Item 16) in position on brake clutch backing plate (Figure 9, Item 28).

NOTE

Move brake clutch backing plate back and forth as necessary to move it down on brake reaction pins. Brake clutch backing plate may be tapped near brake reaction pins to install brake clutch backing plate.

3. Install brake clutch backing plate (Figure 9, Item 28) on two brake reaction pins (Figure 9, Item 31) so that recesses in edge of brake clutch backing plate meet with range steer gear (Figure 9, Item 33) and steer idler gear (Figure 9, Item 32).
4. Install four bolts (Figure 9, Item 30) and four washers (Figure 9, Item 29) on brake clutch backing plate (Figure 9, Item 28).
5. Torque bolts (Figure 9, Item 30) to 36 to 43 lb-ft (49 to 58 N·m).

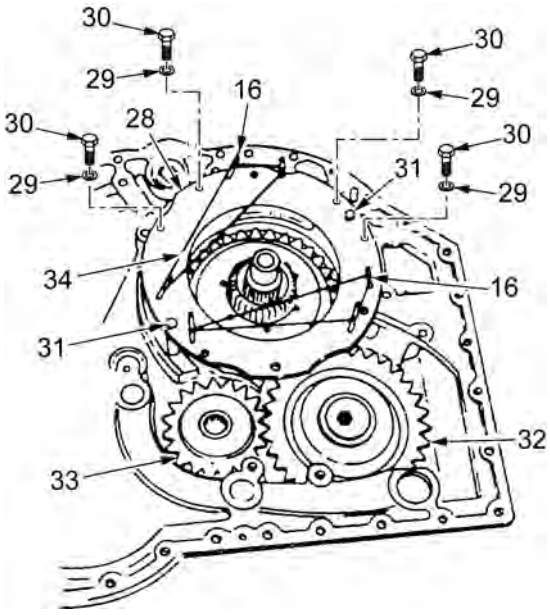


Figure 9. Clutch Backing Plate Installation.

6. Install new brake coolant seal ring (Figure 10, Item 26) on inside edge on brake clutch backing plate (Figure 10, Item 28).
7. Install four short brake reaction pins (Figure 10, Item 13) in holes in brake clutch backing plate (Figure 10, Item 28).
8. Install six springs (Figure 10, Item 17) on spring guide pins (Figure 10, Item 16).

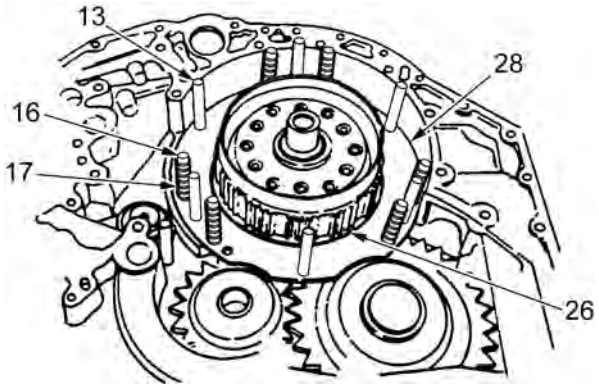


Figure 10. Clutch Backing Plate Related Parts Installation.

9. Install output carrier assembly (Figure 11, Item 22) in brake clutch drum (Figure 11, Item 20).
10. Install snap ring (Figure 11, Item 25) in inside groove of brake clutch drum (Figure 11, Item 20) to hold output carrier assembly (Figure 11, Item 22) in brake clutch drum (Figure 11, Item 20).
11. Apply petrolatum to thrust washer (Figure 11, Item 24).
12. Install thrust washer (Figure 11, Item 24) in center of output carrier assembly (Figure 11, Item 22).

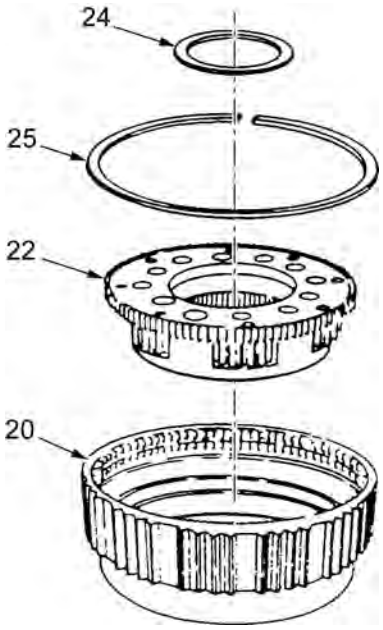


Figure 11. Brake Clutch Drum Related Parts Installation.

13. Install output carrier assembly (Figure 12, Item 22) and brake clutch drum (Figure 12, Item 20) on right output shaft (Figure 12, Item 35).
14. Apply petrolatum to thrust washer (Figure 12, Item 23).
15. Install thrust washer (Figure 12, Item 23) in bottom of steer ring gear assembly (Figure 12, Item 21).
16. Install steer ring gear assembly (Figure 12, Item 21) in brake clutch drum (Figure 12, Item 20) and over right output shaft (Figure 12, Item 35).

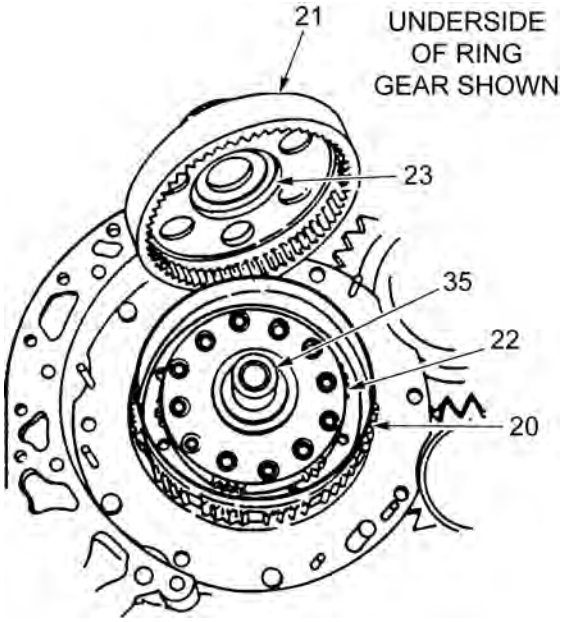


Figure 12. Brake Clutch Drum and Steer Ring Gear Assembly Installation.

CAUTION

Unless the brake clutch pack is new, keep all friction and reaction plates in the same order and facing the same way. When one plate is replaced, replace the entire clutch pack. Each used plate has made its own contour and wear pattern. The clutch assembly may not operate effectively because plates in the pack may have poor surface contact when:

A plate is turned over.

A plate position in the pack is changed.

A new plate is inserted in the pack.

NOTE

A brake clutch pack has six internally splined friction plates and f ve reaction (steel) plates and should be put fully into lubricating oil for a minimum of two minutes before installing the pack.

17. Soak brake clutch pack (Figure 13, Item 36) in lubricating oil for a minimum of two minutes.

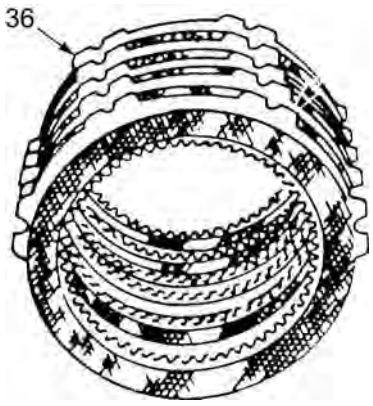


Figure 13. Brake Pack.

18. Install one internally splined (friction) plate (Figure 14, Item 19) on brake clutch backing plate (Figure 14, Item 28).
19. Install one clutch reaction (steel) plate (Figure 14, Item 18) with six notched external projections around four brake reaction pins (Figure 14, Item 13) and two f xed pins (Figure 14, Item 37).
20. Install one splined (friction) plate (Figure 14, Item 19) and then one clutch reaction (steel) plate (Figure 14, Item 18) until six splined (friction) plates and f ve clutch reaction (steel) plates have been installed.
21. Install end clutch reaction (steel) plate (Figure 14, Item 18) so ends of six spring guide pins (Figure 14, Item 17) are through pin holes (Figure 14, Item 38) in clutch reaction (steel) plate (Figure 14, Item 18).

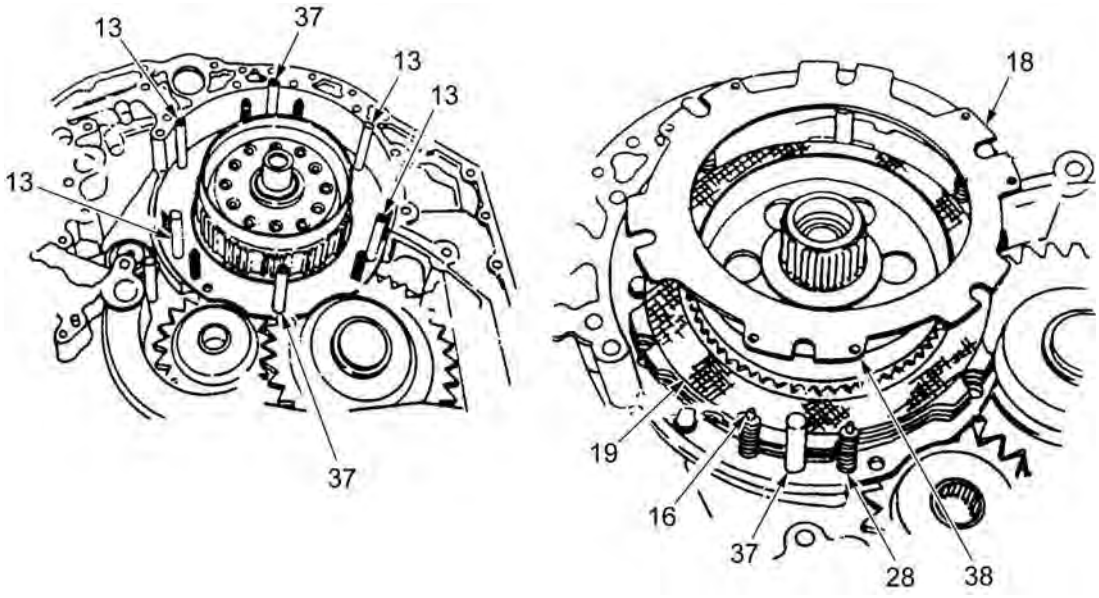


Figure 14. Plates Installation.

22. Push down on end of clutch reaction (steel) plate (Figure 15, Item 18) with one hand near one of six spring guide pins (Figure 15, Item 16) so grooved end of spring guide pin is above clutch reaction (steel) plate.
23. Install one new retaining ring (Figure 15, Item 15) on end of spring guide pin (Figure 15, Item 16). Install the other f ve new retaining rings (Figure 15, Item 15) on f ve remaining spring guide pins (Figure 15, Item 16).

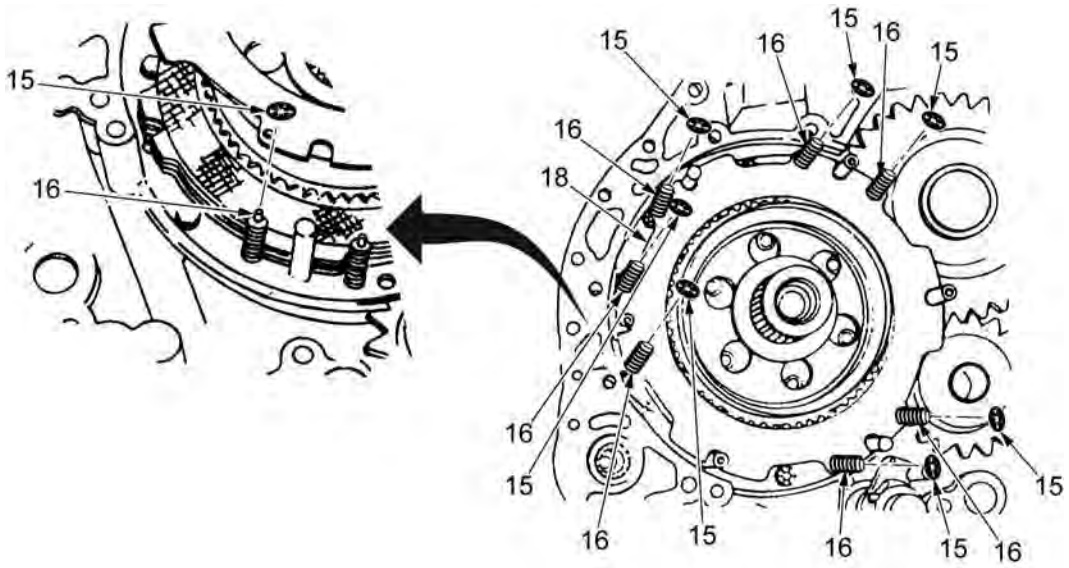


Figure 15. Retaining Rings Installation.

24. Apply petrolatum to washer (Figure 16, Item 40).
25. Install washer (Figure 16, Item 40) on right cover assembly (Figure 16, Item 2) over bearing (Figure 16, Item 39).
26. Apply lubricating oil to bearings (Figure 16, Item 39) and (Figure 16, Item 41).

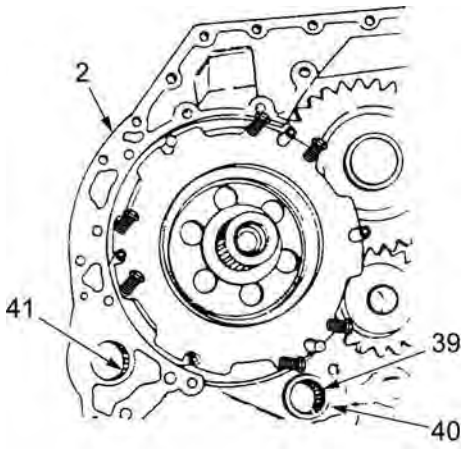


Figure 16. Washer Installation.

END OF TASK

INSTALL BRAKE APPLY CAM AND BRAKE ADJUSTING LINKS

1. Install new O-rings (Figure 17, Item 9) and (Figure 17, Item 10) into face of brake apply cam (Figure 17, Item 4).

CAUTION

Make sure seals are installed with seal lips in direction shown in illustration. If seals are not installed properly, components will not function properly.

2. Install new seal (Figure 17, Item 6), seal lip down, in brake apply cam (Figure 17, Item 4).
3. Install new seal (Figure 17, Item 5), seal lip upward, in brake apply cam (Figure 17, Item 4).
4. Apply a layer of petrolatum to seals and O-rings (Figure 17, Item 5), (Figure 17, Item 6), (Figure 17, Item 9), and (Figure 17, Item 10).
5. Hold two spring tension clips (Figure 17, Item 12) in position on brake apply cam (Figure 17, Item 4) as shown in Figure 17.
6. Install bolt (Figure 17, Item 11) to keep clips (Figure 17, Item 12) in position.
7. Torque bolt (Figure 17, Item 11) to 108 to 132 lb-in. (12 to 15 N·m).

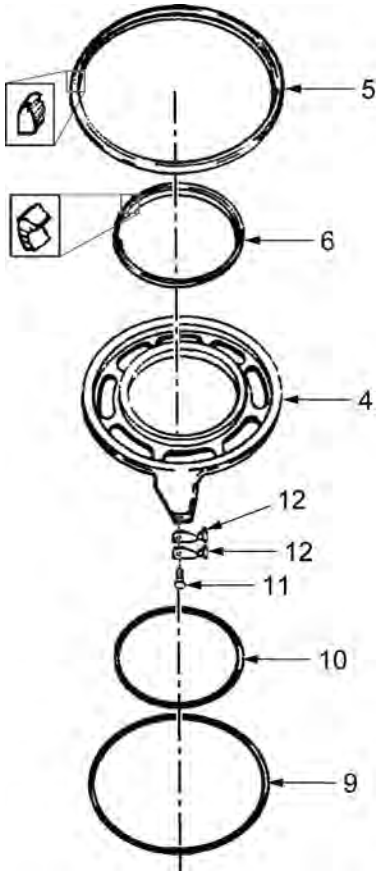


Figure 17. Seals and O-Rings Installation.

8. Position right brake support assembly (Figure 18, Item 42), inside surface up, on wooden blocks (Figure 18, Item 46).
9. Install eight balls (Figure 18, Item 3) in lowest areas of ramps on stationary cam (Figure 18, Item 43).
10. Apply petrolatum on eight balls (Figure 18, Item 3) and in ramps around balls.
11. Apply petrolatum on beveled thrust washer (Figure 18, Item 44) and install thrust washer (Figure 18, Item 44) on right brake support assembly (Figure 18, Item 42) over needle bearing (Figure 18, Item 45).
12. Apply lubricating oil to needle bearing (Figure 18, Item 45) and run f nger over needle bearing until all rollers are wet.

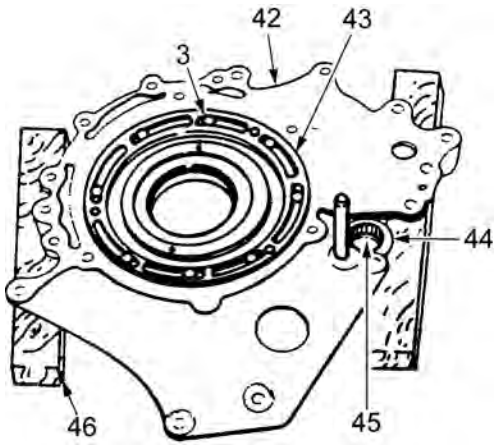


Figure 18. Brake Apply Cam and Support Installation.

13. Install inner brake adjusting link (Figure 21, Item 7) into outer brake adjusting link (Figure 21, Item 8) and (Figure 22, Item 8). Turn links until threads on inner link cannot be seen.
14. Install small end of outer brake adjusting link (Figure 21, Item 8) and (Figure 22, Item 8) in brake apply cam (Figure 22, Item 4) so that f at area on link body (Figure 21, Item 8) and (Figure 22, Item 8) is against free end of spring tension clip (Figure 22, Item 12).

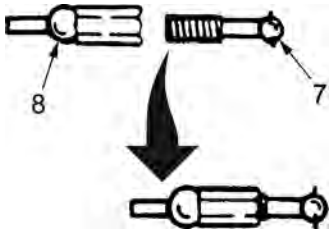


Figure 19. Inner and Outer Brake Adjust Links Assembly.

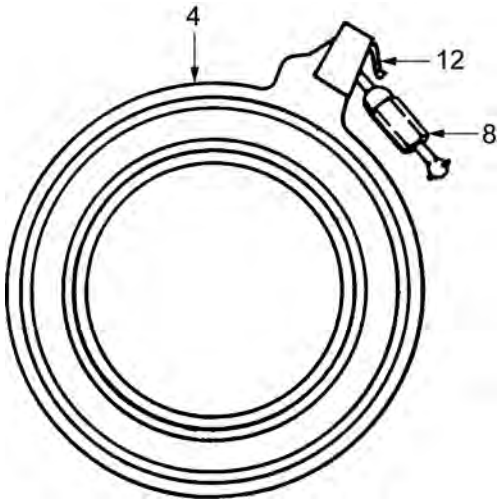


Figure 20. Outer Brake Adjusting Link Installation in Right Brake Apply Cam.

15. Install brake apply cam (Figure 23, Item 4) while installing ball end of inner brake adjusting link (Figure 23, Item 7) in pocket of right brake apply cam shaft (Figure 23, Item 47) so that pin (Figure 23, Item 48) is in the retaining slot.
16. Push ball end of link (Figure 23, Item 7) into cam shaft (Figure 23, Item 47) pocket as far as ball will go.

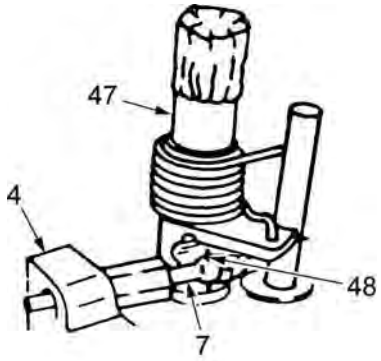


Figure 21. Right Brake Apply Cam, Link, and Brake Apply Shaft Installation.

17. Turn brake apply cam (Figure 24, Item 4) clockwise until the projection on the cam hits against the outer brake adjust link (Figure 24, Item 8) and the cam will no longer turn.
18. Place one hand on brake apply cam (Figure 24, Item 4) and apply a small amount of down force.
19. Turn slotted tip (Figure 24, Item 49) of outer brake adjust link (Figure 24, Item 8) counterclockwise with a screwdriver in the other hand until tension is felt on the screwdriver. Continue to turn screwdriver 1/2 to 3/4 of a turn.

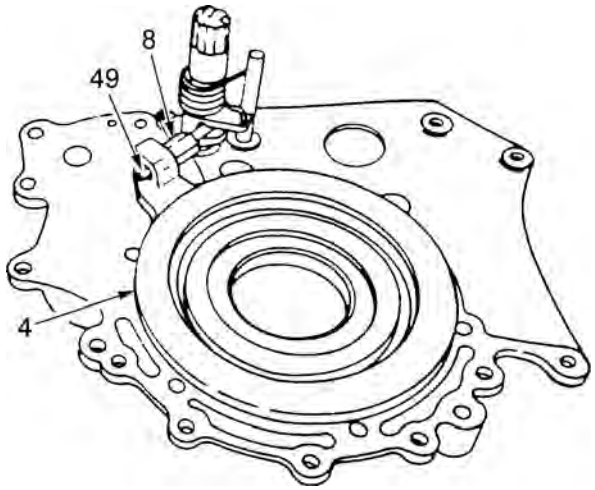


Figure 22. Right Brake Apply Cam Final Adjustments.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RIGHT BRAKE APPLY CAM SHAFT

INITIAL SETUP:

Tools and Special Tools
Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Screwdriver Attachment Hex, 3/8” Drive, 1/8” Hex Bit (WP 0079, Item 32)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Nut, Self-Locking, Hex (WP 0080, Item 5)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Tape, Masking (WP 0078, Item 19)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right brake support assembly removed (WP 0023)

REMOVE RIGHT BRAKE APPLY CAM SHAFT

NOTE

Right cover assembly on two wooden blocks, inner side turned up.

Right brake apply cam shaft may have come out with right brake support or it may be in right cover assembly. Tension between right brake apply cam shaft and seal usually causes shaft to stay in end cover.

Right brake apply cam shaft should come out of the right cover assembly when right brake apply cam shaft is pulled. If right brake apply cam shaft stays on seal, turn right cover assembly over and tap on taped end of right brake apply cam shaft.

1. Remove right brake apply cam shaft (Figure 1, Item 4) from right cover assembly (Figure 1, Item 3).

NOTE

Washer may stay with right cover assembly or it may come out with right brake apply cam shaft.

Thrust washer may have stayed with right brake support or it may be on right brake apply cam shaft.

2. Remove washer (Figure 1, Item 2) from right brake apply cam shaft (Figure 1, Item 4) or right cover assembly (Figure 1, Item 3).
3. Remove thrust washer (Figure 1, Item 1) from right brake apply cam shaft (Figure 1, Item 4), if present.

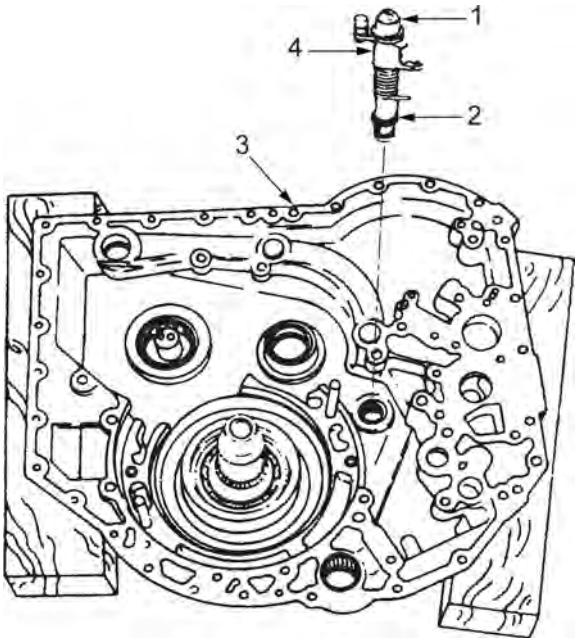


Figure 1. Right Brake Apply Cam Shaft Removal.

4. Remove retaining ring (Figure 2, Item 5) from right brake apply cam shaft (Figure 2, Item 4).
5. Remove spring (Figure 2, Item 6) from right brake apply cam shaft (Figure 2, Item 4).
6. Remove locknut (Figure 2, Item 7) from threaded end of cam follower (Figure 2, Item 9). Discard locknut (Figure 2, Item 7).
7. Remove cam follower (Figure 2, Item 9) from right brake apply cam shaft (Figure 2, Item 4).
8. Remove spacer (Figure 2, Item 8) from cam follower (Figure 2, Item 9).

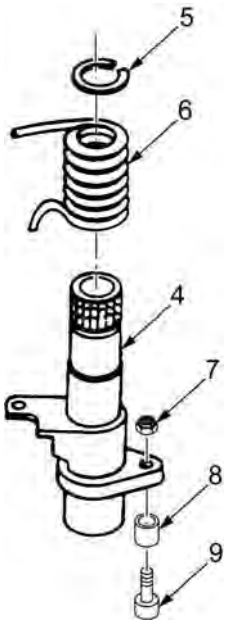


Figure 2. Right Brake Apply Cam Shaft Disassembly.

END OF TASK

INSTALL RIGHT BRAKE APPLY CAM SHAFT

1. Install right brake apply cam shaft (Figure 3, Item 4) in soft jaw vise.
2. Install spacer (Figure 3, Item 8) on cam follower (Figure 3, Item 9).
3. Position threaded end (Figure 3, Item 11) of cam follower (Figure 3, Item 9) through lobe (Figure 3, Item 10) with cam follower (Figure 3, Item 9) on side of lobe opposite splined end of right brake apply cam shaft (Figure 3, Item 4).
4. Install new locknut (Figure 3, Item 7) on cam follower (Figure 3, Item 9) using fingers.
5. Put a screwdriver or 1/8 inch hex head key in center slot on cam follower (Figure 3, Item 9) to make sure cam follower (Figure 3, Item 7) does not turn.

NOTE

When installing locknut with torque wrench, monitor prevailing torque (run-in torque) reading on torque wrench as nut turns.

6. Use a torque wrench to install locknut (Figure 3, Item 7) on cam follower (Figure 3, Item 9). Find torque.

CAUTION

Cam follower must turn after final tightening of locknut. If cam follower does not turn, parts will wear quickly and brake apply valve/brake apply cam shaft may operate incorrectly.

7. Torque locknut (Figure 3, Item 7) to 8 to 10 lb-ft (11 to 14 N·m) plus prevailing torque (run-in torque).
8. Make sure cam follower (Figure 3, Item 9) turns.

9. Remove brake apply cam shaft (Figure 3, Item 4) from vise.
10. Install spring (Figure 3, Item 6) on brake apply cam shaft (Figure 3, Item 4) with curved end of spring on first.
11. Install curved end of spring (Figure 3, Item 6) in cam arm (Figure 3, Item 12).
12. Install retaining ring (Figure 3, Item 5) on brake apply cam shaft (Figure 3, Item 4) to hold spring (Figure 3, Item 6) in position.

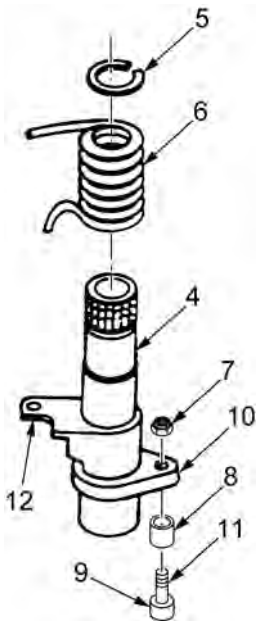


Figure 3. Brake Apply Cam Components Installation.

NOTE

End of brake apply cam shaft opposite splined end goes into right brake support assembly.

13. Install brake apply cam shaft (Figure 4, Item 4) through thrust washer (Figure 4, Item 1) and into needle bearing (Figure 4, Item 14) so that straight end of spring (Figure 4, Item 6) and cam arm (Figure 4, Item 12) are on opposite sides of long brake reaction pin (Figure 4, Item 15).
14. Tap end of brake apply cam shaft (Figure 4, Item 4) as necessary to install brake apply cam shaft in right brake support assembly (Figure 4, Item 13).
15. Clean splined end of brake apply cam shaft (Figure 4, Item 4).

CAUTION

Protective material, such as masking tape, must cover splines when brake apply cam shaft goes through right cover assembly. If brake apply cam shaft goes through seal without protection, splines on brake apply cam shaft will damage seal.

16. Wind masking tape over splines and end of brake apply cam shaft (Figure 4, Item 4).
17. Apply petrolatum over tape on brake apply camshaft (Figure 4, Item 4).

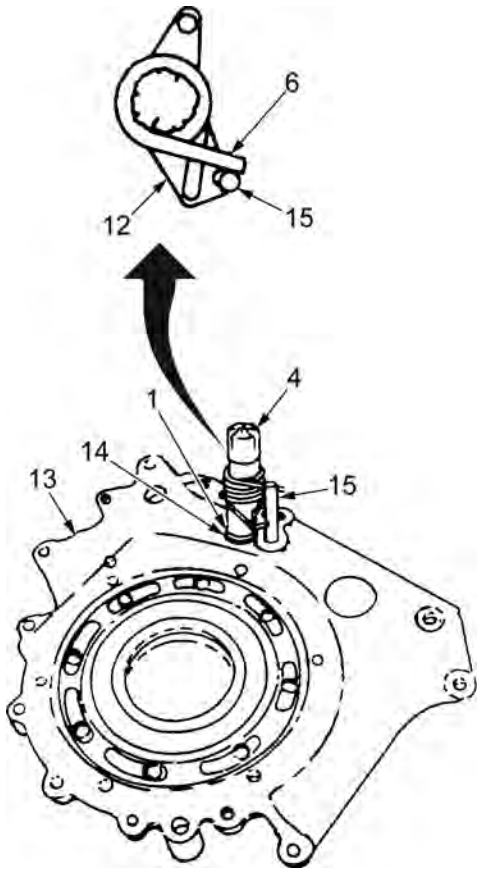


Figure 4. Right Brake Apply Cam Shaft Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE STEER GEARS

INITIAL SETUP:

Tools and Special Tools
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0024
TM 9-214

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right brake support assembly removed (WP 0023)

REMOVE STEER GEARS

NOTE

It is not necessary to remove bearings during disassembly for inspection. Refer to TM 9-214.

Bearings on underside of right steer driven gear and range steer gear have cages and inner races. Outer races stay in right cover assembly housing.

Bearings and races staying in the right cover assembly, after gears have been removed in this task, require heat to be applied for removal. Refer to Repair Right Brake Support Assembly, WP 0024, for removal of these bearings and races.

1. Remove right steer driven gear (Figure 1, Item 1) and bearing (Figure 1, Item 6) from right output shaft (Figure 1, Item 5).
2. Make sure bearing (Figure 1, Item 6) is serviceable. If bearing requires replacement, remove bearing (Figure 1, Item 6) from right steer driven gear (Figure 1, Item 1).
3. Remove range steer gear (Figure 1, Item 2) and bearing (Figure 1, Item 3) from right cover assembly (Figure 1, Item 4).
4. Make sure bearing (Figure 1, Item 6) is serviceable. If bearing requires replacement, remove bearing (Figure 1, Item 3) from range steer gear (Figure 1, Item 2).

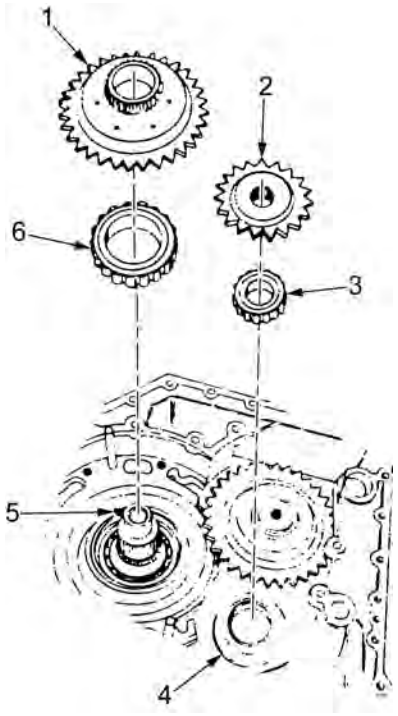


Figure 1. Steer Gears Removal.

5. Remove bolt (Figure 2, Item 7) from steer idler retainer plate (Figure 2, Item 8).
6. Remove steer idler retainer plate (Figure 2, Item 8) from steer idler gear (Figure 2, Item 10).
7. Remove bronze thrust washer (Figure 2, Item 9) from steer idler gear (Figure 2, Item 10).

NOTE

Journal on bottom of steer idler gear sits in cylindrical roller bearing assembly which stays in right cover assembly.

8. Remove steer idler gear (Figure 2, Item 10) from right cover assembly (Figure 2, Item 4).

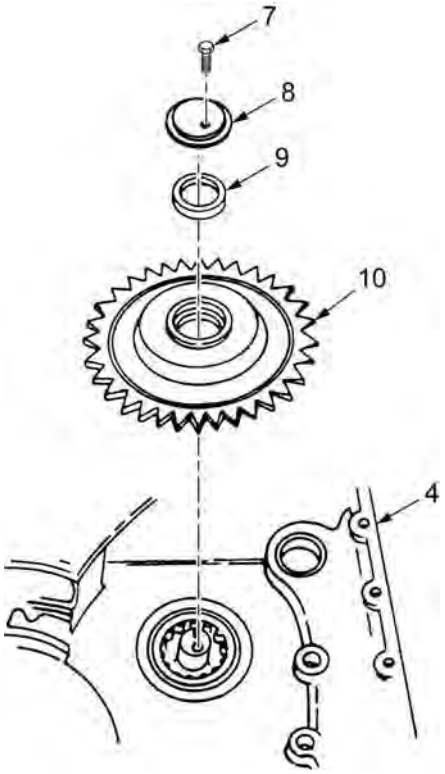


Figure 2. Steer Idler Gear Removal.

END OF TASK

INSTALL STEER GEARS

NOTE

Right cover assembly turned inside up.

1. Apply lubricating oil to cylindrical roller bearing assembly (Figure 3, Item 11) located in right cover assembly (Figure 3, Item 4) beneath steer idler gear (Figure 3, Item 10).
2. Install steer idler gear (Figure 3, Item 10) with journal (Figure 3, Item 13) around boss (Figure 3, Item 12) and in cylindrical roller bearing assembly (Figure 3, Item 11).

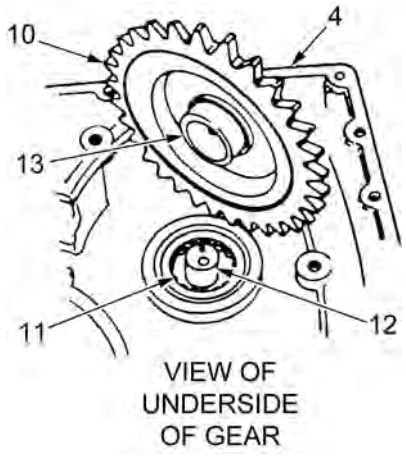


Figure 3. Steer Idler Gear Installation.

3. Install bronze thrust washer (Figure 4, Item 9) in top center recess in steer idler gear (Figure 4, Item 10) and (Figure 5, Item 10).

NOTE

Bolt hole and pin hole in steer idler retainer plate are off center. Turn plate to seat pin in pin hole before installing bolt.

4. Install steer idler retainer plate (Figure 4, Item 8) and (Figure 5, Item 8) on boss (Figure 4, Item 12) in center of steer idler gear (Figure 4, Item 10) and (Figure 5, Item 10).
5. Install bolt (Figure 5, Item 7) in steer idler retainer plate (Figure 4, Item 8) and (Figure 5, Item 8).
6. Torque bolt (Figure 5, Item 7) to 36 to 43 lb-ft (49 to 58 N·m).

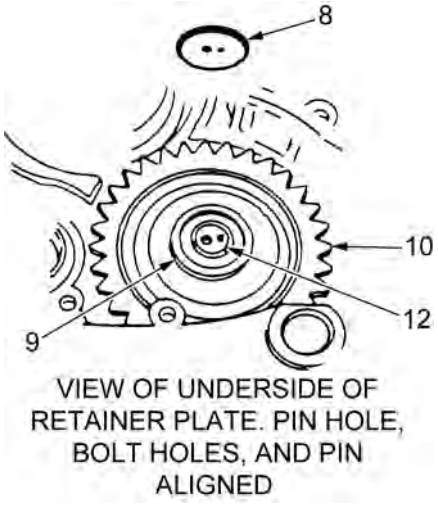


Figure 4. Steer Idler Retainer Plate Installation.

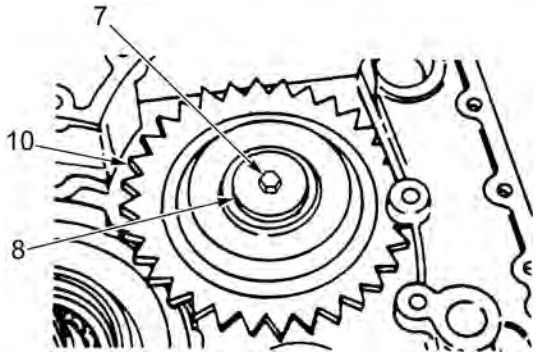


Figure 5. Steer Idler Retainer Plate Hardware Installation.

NOTE

Do Step 7 and Step 8 only if the bearing was removed.

7. Apply petrolatum and lubricating oil to bearing (Figure 6, Item 3) journal located on underside of range steer gear (Figure 6, Item 2).
8. Install new bearing (Figure 6, Item 3) on range steer gear (Figure 6, Item 2). Push bearing to shoulder.
9. Apply lubricating oil to bearing (Figure 6, Item 3).
10. Install range steer gear (Figure 6, Item 2) in right cover assembly (Figure 6, Item 4) with bearing (Figure 6, Item 3) in bearing race (Figure 6, Item 14).

NOTE

Do Step 11 and Step 12 only if the bearing was removed.

11. Apply petrolatum and lubricating oil to bearing (Figure 6, Item 6) journal located on underside of right steer driven gear (Figure 6, Item 1).
12. Install new bearing (Figure 6, Item 6) on right steer driven gear (Figure 6, Item 1). Push bearing to shoulder.
13. Apply lubricating oil to bearing (Figure 6, Item 6).
14. Install right steer driven gear (Figure 6, Item 1) on right output shaft (Figure 6, Item 5), bearing (Figure 6, Item 6) down.

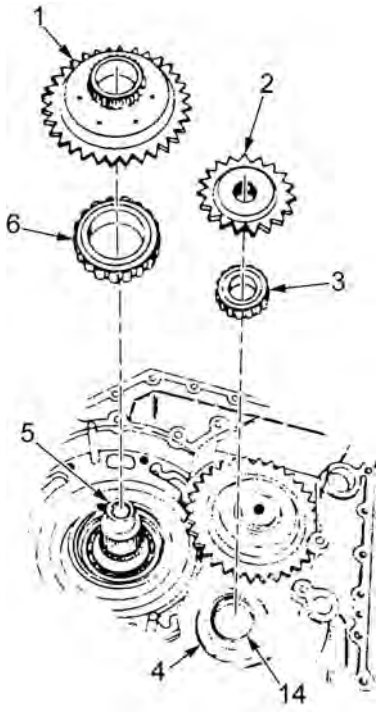


Figure 6. Steer Gears Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RIGHT OUTPUT SHAFT

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Sling, Engine and Transmission (WP 0079, Item 35)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
TM 9-2350-277-13&P

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right brake apply cam shaft removed (WP 0026)

REMOVE RIGHT OUTPUT SHAFT

NOTE

Put the right cover assembly on two wooden blocks so that the internal side points up.

1. Remove retaining ring (Figure 1, Item 3) from retaining bearing assembly (Figure 1, Item 2) on right output shaft (Figure 1, Item 1).

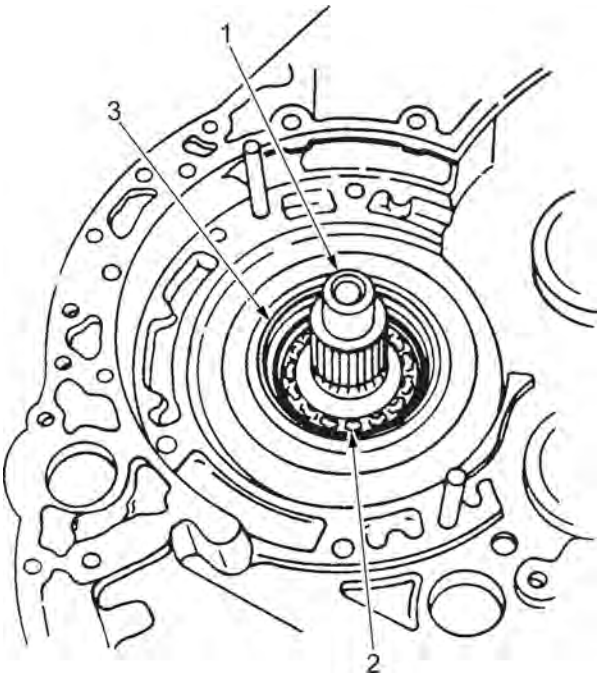


Figure 1. Retaining Ring Removal.

2. Turn right cover assembly (Figure 2, Item 5) over, external side up, on two wooden blocks.
3. Remove right output shaft (Figure 2, Item 1), retaining bearing assembly (Figure 2, Item 2), and sleeve (Figure 2, Item 6) from output shaft seal (Figure 2, Item 4) in right cover assembly (Figure 2, Item 5).
4. Refer to TM 9-2350-277-13&P to remove output shaft seal from right cover assembly.

NOTE

When retaining bearing assembly is removed from right output shaft, sleeve is pushed ahead of retaining bearing assembly.

5. Make sure retaining bearing assembly (Figure 2, Item 2) and sleeve (Figure 2, Item 6) are serviceable. If retaining bearing assembly or sleeve needs to be replaced, push retaining bearing assembly (Figure 2, Item 2) and sleeve (Figure 2, Item 6) from right output shaft (Figure 2, Item 1).

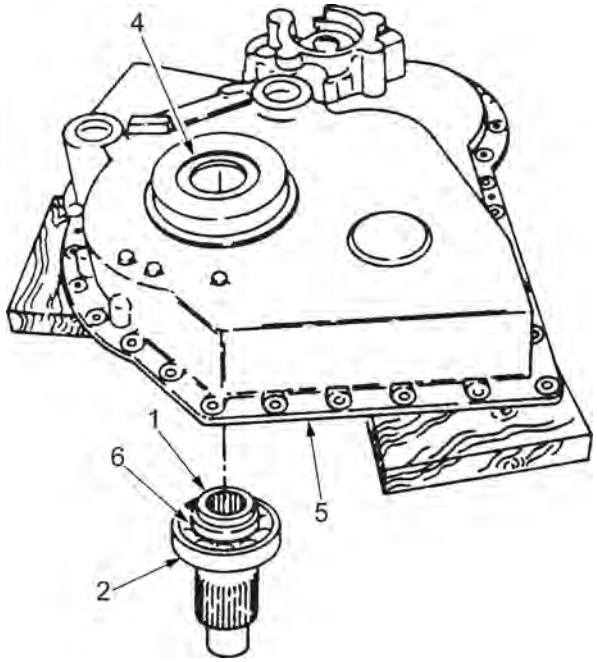


Figure 2. Right Output Shaft Removal.

END OF TASK

INSTALL RIGHT OUTPUT SHAFT

WARNING

Do a check of slings and trestle for cuts, breaks, or wear before hoisting right cover assembly and during hoisting. Slings and trestle devices can break and cause injury or death.

Right cover assembly weighs approximately 125 lb (57.1 kg). When lifting right cover assembly, a hoist and trestle must be used to avoid bodily injury.

1. Refer to TM 9-2350-277-13&P to install output shaft seal in right cover assembly.

WARNING

Frozen parts can bond to your f ngers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

2. Apply petrolatum and lubricating oil to retaining bearing assembly journal of right output shaft (Figure 3, Item 1).
3. Install retaining bearing assembly (Figure 3, Item 2), numbered end out, on output shaft (Figure 3, Item 1). Push retaining bearing assembly (Figure 3, Item 2) to shoulder.

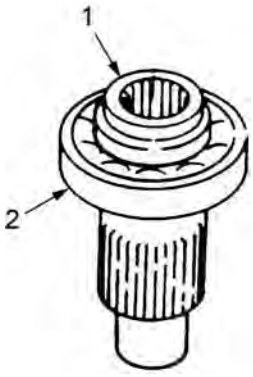


Figure 3. Retaining Bearing Assembly Installation on Output Shaft.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

4. Heat sleeve (Figure 4, Item 4) with heat gun for 30 minutes to approximately 250°F (121°C).
5. Install sleeve (Figure 4, Item 6) on right output shaft (Figure 4, Item 1) with inside beveled edge on first. Push sleeve onto retainer bearing assembly (Figure 4, Item 2).

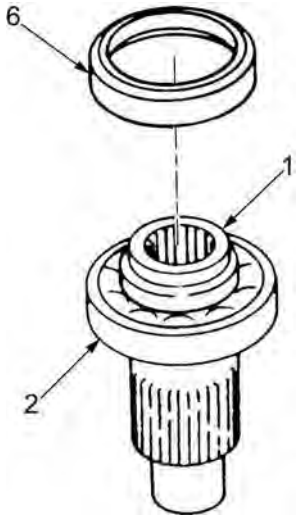


Figure 4. Sleeve Installation.

6. Turn right cover assembly (Figure 5, Item 5) over, inside up, on wooden blocks.
7. Apply a thin coat of petrolatum to inner surface of output shaft seal (Figure 5, Item 4).
8. Start short end of right output shaft (Figure 5, Item 1) and retainer bearing assembly (Figure 5, Item 2) into output shaft seal (Figure 5, Item 4). Turn shaft while pushing end of shaft through seal.
9. Turn right cover assembly over and check that output seal (Figure 5, Item 4) stays in position in right cover assembly (Figure 5, Item 5), and that lip on seal is not twisted when right output shaft (Figure 5, Item 1) passes through output shaft seal (Figure 5, Item 4).

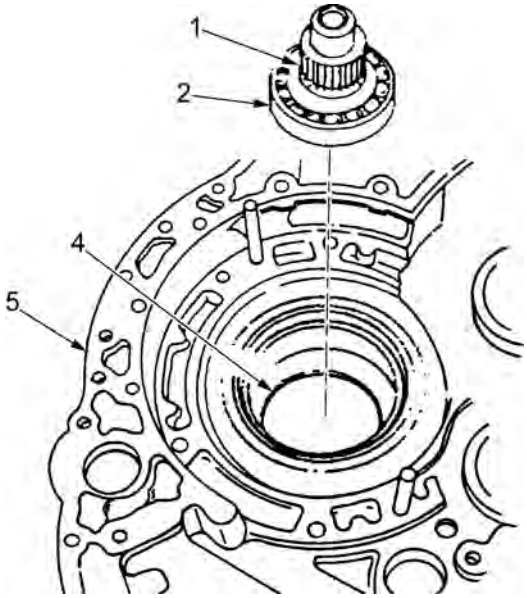


Figure 5. Right Output Shaft Installation.

NOTE

When right output shaft and retainer bearing assembly are installed, access to retaining ring groove is in sleeve at outer edge of retainer bearing assembly.

10. Tap on end of right output shaft (Figure 6, Item 1) to install retaining bearing assembly (Figure 6, Item 2) in shoulder on right cover assembly (Figure 6, Item 5).
11. Install retaining ring (Figure 6, Item 3) in groove in sleeve above retaining bearing assembly (Figure 6, Item 2).
12. Apply lubricating oil to retaining bearing assembly (Figure 6, Item 2).

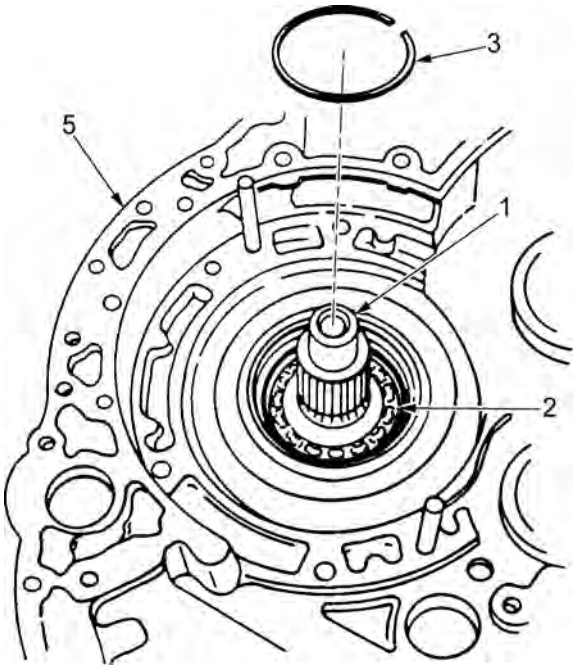


Figure 6. Retaining Bearing Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE OUTER (RIGHT) STEER SHAFT, RANGE OUTPUT GEARS, STEER SHAFT DRIVE GEAR, OUTPUT DRIVEN GEAR, AND BEARINGS

INITIAL SETUP:

Tools and Special Tools
Pliers Set, Retaining Ring (WP 0079, Item 27)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Puller Set, Mechanical, Gear and Bearing, 3-Jaw (WP 0079, Item 30)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10

References
TM 9-214
WP 0017
WP 0030
WP 0043
WP 0046

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE OUTER (RIGHT) STEER SHAFT, RANGE OUTPUT GEARS, STEER SHAFT DRIVE GEAR, OUTPUT DRIVEN GEAR, AND BEARINGS

CAUTION

Do the steps in this procedure to remove the components. Failure to comply will let components fall out of the transmission when the uncovered right side is turned to point down.

NOTE

The outer (right) steer shaft may come out when the right cover assembly is removed.

If necessary, move the shaft back and forth lightly to remove it.

The retaining rings on the steer shafts are stops. Do not remove them unless they show damage.

1. Remove outer (right) steer shaft (Figure 1, Item 2) from steer shaft drive gear (Figure 1, Item 4) in transmission (Figure 1, Item 3).
2. Remove two retaining rings (Figure 1, Item 1) from shaft (Figure 1, Item 2) if you observe such damage as them being out of round, bent, or if their tension is lost.

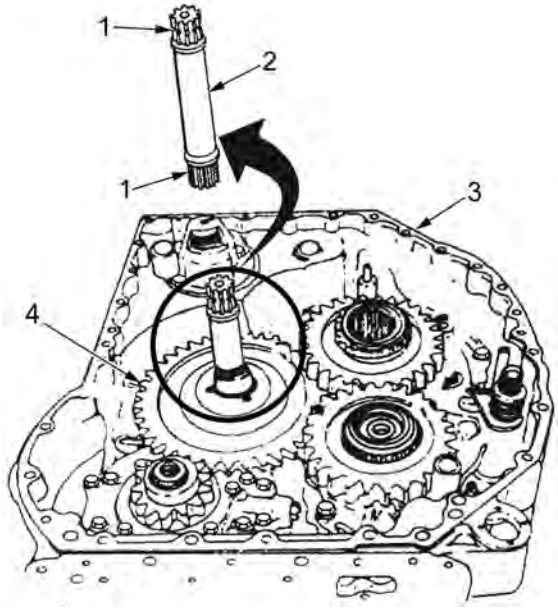


Figure 1. Outer (Right) Steer Shaft Removal.

NOTE

Bearings are not to be replaced unless defective. Refer to TM 9-214 for inspection of bearings.

When either bearing on gears is defective, both top and bottom bearings on the gear must be replaced.

When the inner race and rollers are replaced, the outer race must also be replaced.

The outer races for bearings on top of gears remain in the right cover assembly. Refer to Repair Right Cover Assembly, WP 0017, to replace these races.

Outer races for bearings under gears remain in the center housing assembly. Refer to Repair Center Housing Components (WP 0043) to replace these races.

3. Remove range output driven gear (Figure 2, Item 6) from transmission (Figure 2, Item 3).
4. Remove range output drive gear (Figure 2, Item 7) from transmission (Figure 2, Item 3).
5. Remove steer shaft drive gear (Figure 2, Item 4) from transmission (Figure 2, Item 3).

NOTE

If bearings require replacement, continue on to Step 6.

If bearings are serviceable, go to the NOTE just before Step 7.

6. Remove two bearings (Figure 2, Item 5) from range output driven gear (Figure 2, Item 6).

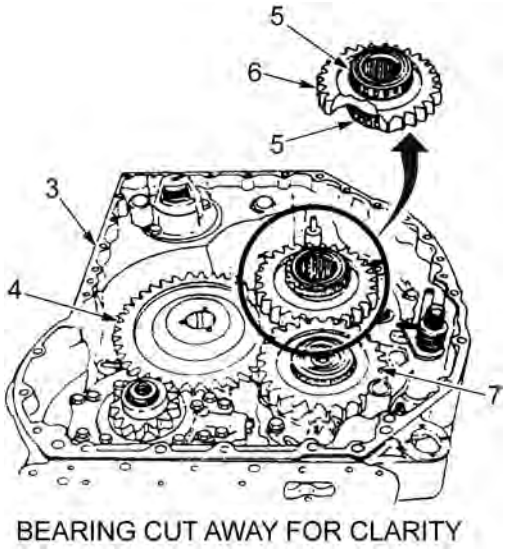


Figure 2. Range Output Gears, Steer Shaft Drive Gear, and Bearings Removal.

NOTE

If bearings require replacement, continue on to Step 7.

If bearings are serviceable, go to the NOTE just before Step 8.

7. Remove two bearings (Figure 3, Item 9) from range output drive gear (Figure 3, Item 7).

NOTE

If bearings require replacement, continue on to Step 8.

If bearings are serviceable, go to Replace Inner (Left) Steer Shaft, Range Output Gear Spacer, and Tubes (WP 0030).

8. Remove bearing (Figure 3, Item 8) from steer shaft drive gear (Figure 3, Item 4).

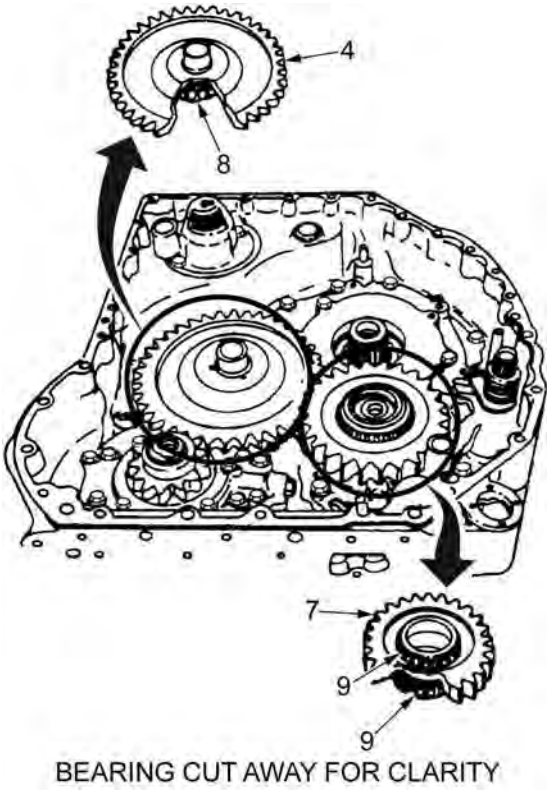


Figure 3. Bearing Inspection and Removal.

END OF TASK

INSTALL BEARINGS, OUTPUT DRIVEN GEAR, STEER SHAFT DRIVE GEAR, RANGE OUTPUT GEARS, AND OUTER (RIGHT) STEER SHAFT

NOTE

Do Step 1 and Step 2 only if old bearing was removed.

1. Lubricate journal (Figure 4, Item 10) located under steer shaft drive gear (Figure 4, Item 4) with petrolatum and lubricating oil.

NOTE

Bearing consists of cage and inner race. Make sure that outer race is in left brake support assembly. Refer to Repair Left Brake Support (WP 0046).

2. Install new bearing (Figure 4, Item 8) on journal (Figure 4, Item 10) of steer shaft drive gear (Figure 4, Item 4). Press bearing to shoulder.
3. Apply lubricating oil to bearing (Figure 4, Item 8).
4. Install steer shaft drive gear (Figure 4, Item 4) on end of inner (left) steer shaft (Figure 4, Item 11) with bearing side of gear down.

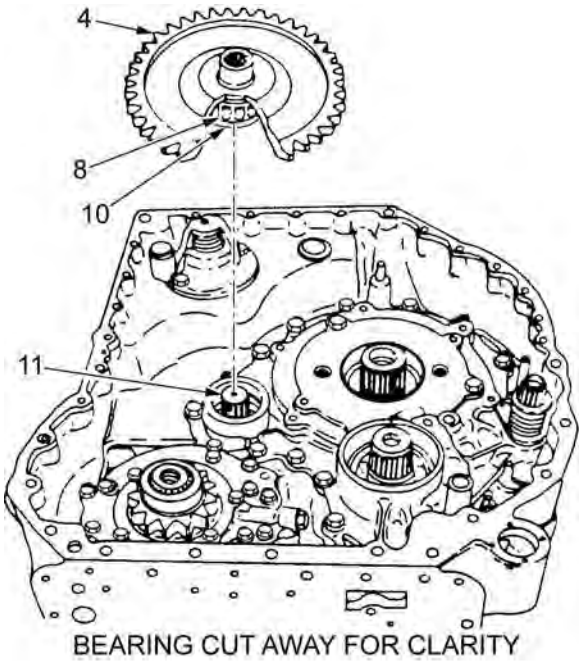


Figure 4. Steer Shaft Drive Gear Installation.

NOTE

Do Step 5 and Step 6 only if old bearing was removed.

5. Lubricate bearing (Figure 5, Item 9) journals on both sides of range output drive gear (Figure 5, Item 7) with lubricating oil and petrolatum.

NOTE

Bearings consist of inner race with rollers and outer races. Make sure that the outer race beneath the gear is in the left brake support assembly (refer to Repair Left Brake Support, WP 0046) and outer race above gear is in right cover assembly (refer to Repair Right Cover Assembly, WP 0017).

6. Install two new bearings (Figure 5, Item 9) on range output drive gear (Figure 5, Item 7). Press bearings to shoulder.
7. Apply lubricating oil to bearings (Figure 5, Item 9).
8. Install range output drive gear (Figure 5, Item 7) on shaft and bushing assembly (Figure 5, Item 12), with either side of gear (Figure 5, Item 7) down.

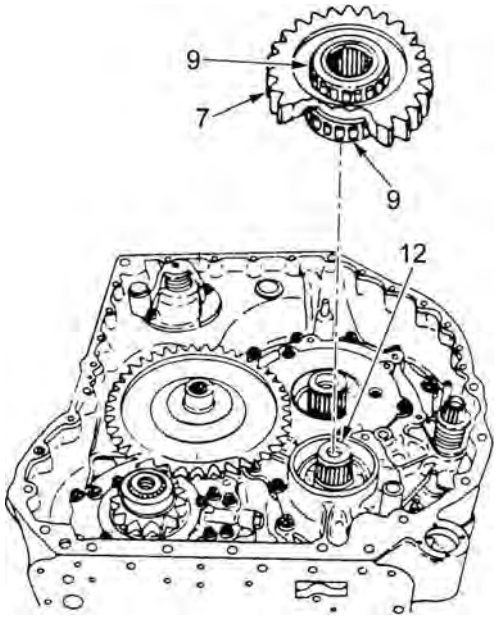


Figure 5. Range Output Drive Gear Installation.

NOTE

Do Step 9 and Step 10 only if old bearing was removed.

9. Lubricate bearing (Figure 6, Item 5) journals on both sides of range output driven gear (Figure 6, Item 6) with lubricating oil and petrolatum.

NOTE

Bearings consist of inner race with rollers and outer races. Make sure that outer race beneath output driven gear is in left brake support assembly (refer to Repair Left Brake Support, WP 0046) and outer race above gear is in Right Cover Assembly (refer to Repair Right Cover Assembly, WP 0017).

10. Install two new bearings (Figure 6, Item 5) on range output driven gear (Figure 6, Item 6). Press bearings to shoulder.
11. Apply lubricating oil to two bearings (Figure 6, Item 5).
12. Install range output driven gear (Figure 6, Item 6) on steer ring gear assembly (Figure 6, Item 13) (located on left output shaft), with longer internal spline on gear (Figure 6, Item 6) down.

NOTE

Retaining rings on each end of outer (right) steer shaft serve as stops. It is not necessary to replace retaining rings that are in good condition.

Outer (right) steer shaft may be installed either end f rst.

13. Install outer (right) steer shaft (Figure 6, Item 2) with retaining rings (Figure 6, Item 1) installed in steer shaft drive gear (Figure 6, Item 4).

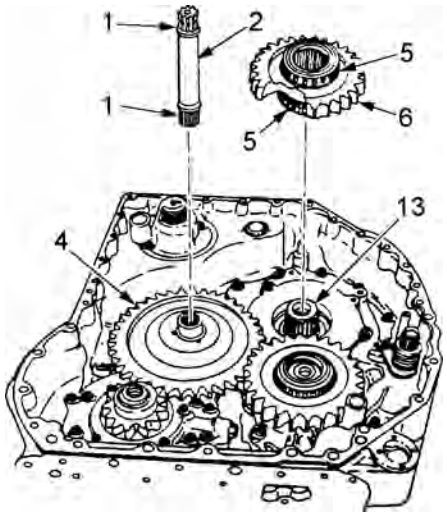


Figure 6. Range Output Driven Gear and Outer (Right) Steer Shaft Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE INNER (LEFT) STEER SHAFT, RANGE OUTPUT GEAR SPACER, AND TUBES

INITIAL SETUP:

Tools and Special Tools
Pliers Set, Retaining Ring (WP 0079, Item 27)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Packing (WP 0080, Item 43)
Packing (WP 0080, Item 45)
Packing (WP 0080, Item 47) (2)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10

References
TM 9-2520-272-40P

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Outer (right) steer shaft, range output gears, steer shaft drive gear, output driven gear, and bearings removed (WP 0029)

REMOVE INNER (LEFT) STEER SHAFT, RANGE OUTPUT GEAR SPACER, AND TUBES

NOTE

It may be necessary to lightly move the steer shaft back and forth to remove it from transmission.

1. Remove the inner (left) steer shaft (Figure 1, Item 1).
2. Remove the two retaining rings (Figure 1, Item 2) if they show damage.

NOTE

Do Step 3 only if sleeve (range output gear spacer) is installed. Early models of the X200-4A Transmission had a sleeve installed. This sleeve was used when older carrier and shouldered shaft parts were installed. This sleeve is not installed in later models of the X200-4A Transmission. Refer to TM 9-2520-272-40P for the current conf guration.

3. Remove the sleeve (Figure 1, Item 4) from the shaft and bushing assembly (Figure 1, Item 3).

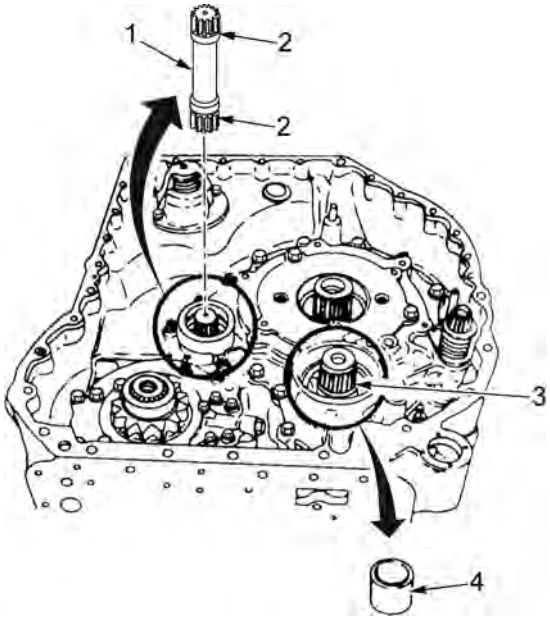


Figure 1. Inner (Left) Steer Shaft and Sleeve Removal.

4. Remove the lube tube (Figure 2, Item 6) and two packings (Figure 2, Item 5). Discard packings (Figure 2, Item 5).

NOTE

The brake apply tube is pushed into the right brake support and uses only one packing.

5. Remove packing (Figure 2, Item 7) from the brake apply tube (Figure 2, Item 8). Discard packing (Figure 2, Item 7).

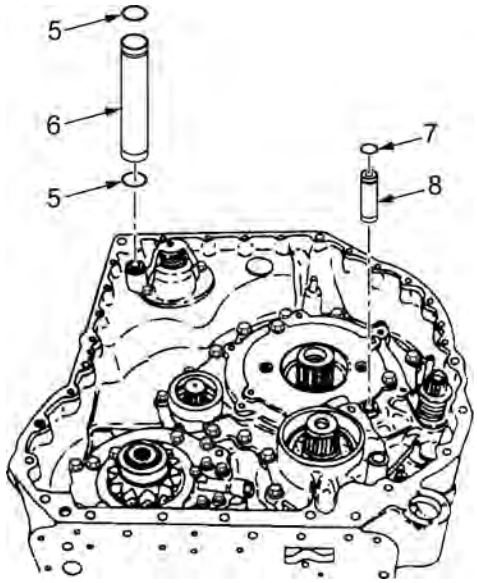


Figure 2. Lube Tube and Packings and Brake Apply Tube Packing Removal.

NOTE

The brake coolant tube is pushed into the right brake support and should stay in the right brake support. Remove only one packing. The brake coolant tube uses two packings. (Remove the second packing only during repair of the right brake support.)

6. Remove one packing (Figure 3, Item 10) from the brake coolant tube (Figure 3, Item 11). Discard packing (Figure 3, Item 10).

NOTE

If tube does not lift out easily, let it stay in place.

7. Remove the sump communication tube (Figure 3, Item 9).

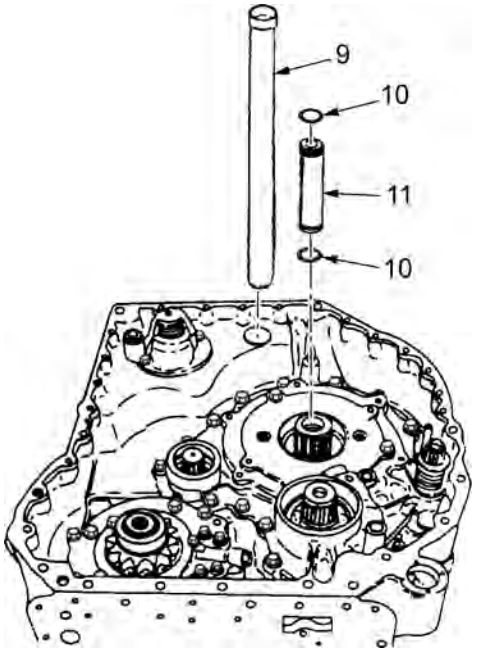


Figure 3. Brake Coolant Tube Packing and Sump Communication Tube Removal.

END OF TASK

INSTALL TUBES, RANGE OUTPUT GEAR SPACER, AND INNER (LEFT) STEER SHAFT

1. Install two new packings (Figure 4, Item 5) on the lube tube (Figure 4, Item 6).
2. Apply petrolatum to the packings (Figure 4, Item 5).

NOTE

Insert the end of the lube tube into the center housing assembly, and install it in the bevel gear assembly. The external end of tube will not be f ush with the surface of the center housing assembly.

3. Install one of the two ends of the lube tube (Figure 4, Item 6) in the center housing bore (Figure 4, Item 13) adjacent to the equalizer valve housing (Figure 4, Item 12).

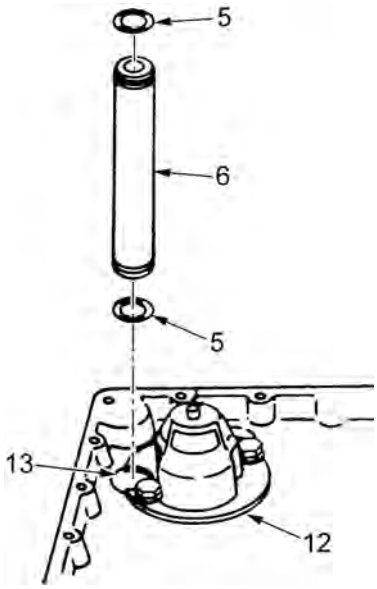


Figure 4. Lube Tube and Packings Installation.

NOTE

The brake apply tube is pushed into the right brake support and uses only one packing.

4. Install one new packing (Figure 5, Item 7) on the brake apply tube (Figure 5, Item 8), which is pushed into the right brake support (Figure 5, Item 14). Coat the packing (Figure 5, Item 7) with petrolatum.
5. Install two new packings (Figure 5, Item 10) on the brake coolant tube (Figure 5, Item 11). Coat packings (Figure 5, Item 10) with petrolatum.
6. Install one of the two ends of the brake coolant tube (Figure 5, Item 11) into the bore (Figure 5, Item 15) in the right brake support (Figure 5, Item 14).

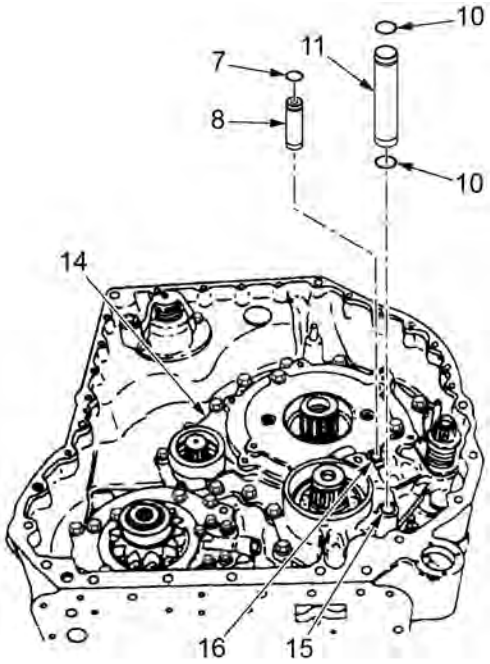


Figure 5. Brake Apply Tube, Brake Coolant Tube, and Packings Installation.

NOTE

The retaining rings on the two ends of the steer shaft are stops. Do not replace retaining rings that are in good condition.

If necessary, remove retaining rings with f at-tip screwdriver.

Install one of the two ends of the inner (left) steer shaft. Steer shaft is interchangeable.

7. Install the inner (left) steer shaft (Figure 6, Item 1) in the bore (Figure 6, Item 17) in the right brake support (Figure 6, Item 14).

NOTE

Do Step 8 only if sleeve (range output gear spacer) was removed. Early models of the X200-4A Transmission had a sleeve installed. This sleeve was used when older carrier and shouldered shaft parts were installed. This sleeve is not installed in later models of the X200-4A Transmission. Refer to TM 9-2520-272-40P for the current conf guration.

8. Install sleeve (Figure 6, Item 4) on shaft and bushing assembly (Figure 6, Item 3).

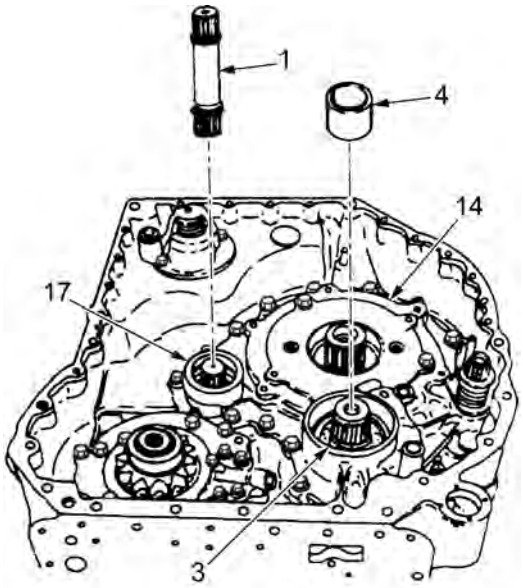


Figure 6. Inner (Left) Steer Shaft and Sleeve Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE REVERSE EQUALIZER VALVE COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
O-Ring (WP 0080, Item 44) (2)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal Ring (WP 0080, Item 39)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE REVERSE EQUALIZER VALVE COMPONENTS

CAUTION

Spring-loaded parts can f y and cause injury. Always obey specif ed instructions when you remove bolts from covers that are attached to valve assemblies.

NOTE

Scavenge tube and oil transfer tube, extending into the bevel gear assembly, cannot be removed until the equalizer valve housing has been removed.

1. Hold spring-loaded equalizer valve housing (Figure 1, Item 3) down with one hand when housing is being removed.
2. Remove two bolts (Figure 1, Item 1) and washers (Figure 1, Item 2) that attach equalizer valve housing (Figure 1, Item 3) to transmission. Carefully release housing, removing spring pressure before lifting off housing.
3. Remove spring (Figure 1, Item 4).
4. Remove reverse equalizer valve (Figure 1, Item 5).
5. Remove reverse equalizer piston assembly (Figure 1, Item 6) with seal ring (Figure 1, Item 7).
6. Remove seal ring (Figure 1, Item 7). Discard seal ring (Figure 1, Item 7).

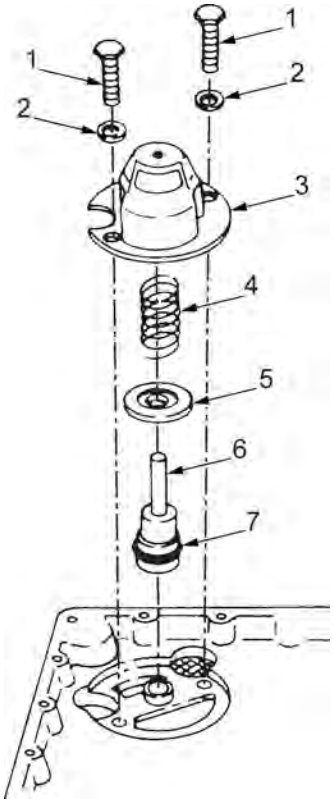


Figure 1. Equalizer Valve Housing, Valve, and Piston Assembly Removal.

NOTE

Oil transfer tube may stay in transmission (bevel gear assembly) or it may come out attached to bottom of diaphragm.

7. Remove equalizer valve diaphragm (Figure 2, Item 8).
8. Remove equalizer valve oil transfer tube (Figure 2, Item 11) with two O-Rings (Figure 2, Item 10).
9. Remove two O-Rings (Figure 2, Item 10). Discard two O-Rings (Figure 2, Item 10).
10. Remove scavenge tube assembly (Figure 2, Item 9).

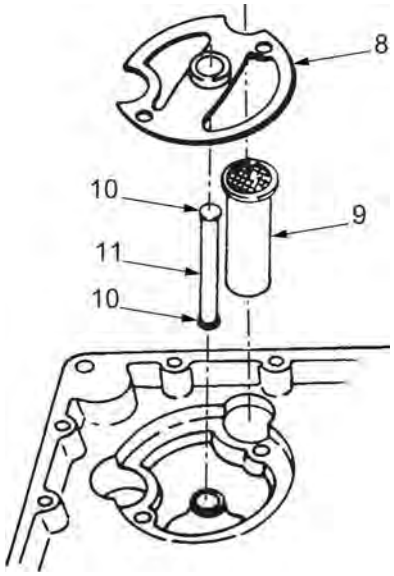


Figure 2. Equalizer Valve Diaphragm, Oil Transfer Tube, and Scavenge Tube Assembly Removal.

END OF TASK

INSTALL REVERSE EQUALIZER VALVE COMPONENTS

NOTE

Transmission is on maintenance stand, right end turned up.

End of scavenge tube opposite screened end installs in bevel gear assembly.

1. Install scavenge tube assembly (Figure 3, Item 9), screen end out, in center housing bore (Figure 3, Item 12).

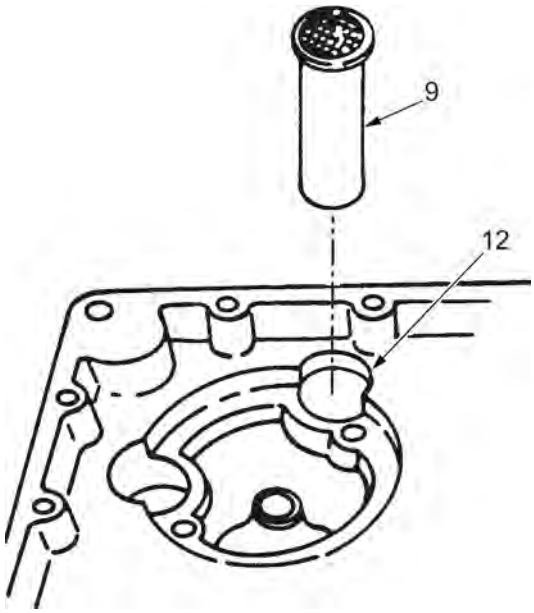


Figure 3. Scavenge Tube Assembly Installation.

2. Install two new O-Rings (Figure 4, Item 10) on oil transfer tube (Figure 4, Item 11).
3. Apply petrolatum to O-Rings (Figure 4, Item 10).
4. Push oil transfer tube (Figure 4, Item 11), either end, into center hole in bottom of equalizer valve diaphragm (Figure 4, Item 8).
5. Install equalizer valve diaphragm (Figure 4, Item 8) so that end of oil transfer tube (Figure 4, Item 11) enters hole (Figure 4, Item 13) in bevel gear assembly.
6. Push on diaphragm (Figure 4, Item 8) to install oil transfer tube (Figure 4, Item 11) in bevel gear assembly and install diaphragm (Figure 4, Item 8) in center housing bore (Figure 4, Item 14).

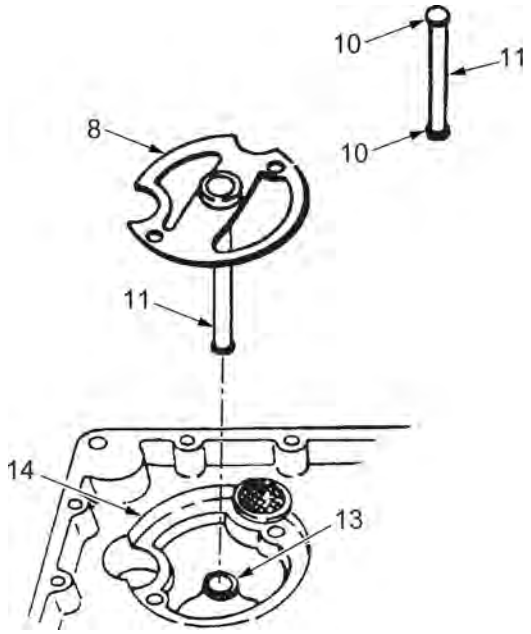


Figure 4. Oil Transfer Tube and Equalizer Valve Diaphragm Installation.

7. Install new seal ring (Figure 5, Item 7) on large end of reverse equalizer piston assembly (Figure 5, Item 6).
8. Push large end of reverse equalizer piston assembly (Figure 5, Item 6) into center hole on top of equalizer valve diaphragm (Figure 5, Item 8).
9. Install reverse equalizer valve (Figure 5, Item 5), cutaway side out, over reverse equalizer piston assembly (Figure 5, Item 6).
10. Install spring (Figure 5, Item 4) on reverse equalizer valve (Figure 5, Item 5).

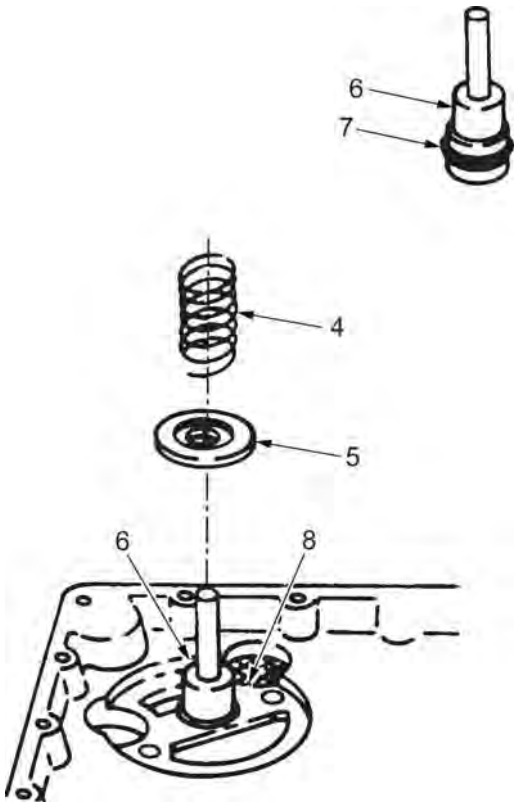


Figure 5. Equalizer Piston Assembly and Valve Installation.

WARNING

Spring-loaded parts can f y and cause injury. Always obey specif ed instructions when you install bolts in covers that are attached to valve assemblies.

11. Install reverse equalizer valve housing (Figure 6, Item 3) over spring (Figure 6, Item 4) so that bolt holes and recesses for tubes are aligned.
12. Push reverse equalizer valve housing (Figure 6, Item 3) down on spring (Figure 6, Item 4) with one hand, and use other hand to install two bolts (Figure 6, Item 1) and washers (Figure 6, Item 2). Turn bolts two or three turns to hold housing.

NOTE

If end of reverse equalizer piston assembly does not go through housing hole, bolts may be loosened and piston moved by putting a screwdriver through side of housing.

13. Tighten bolts (Figure 6, Item 1) carefully. End of reverse equalizer piston assembly (Figure 6, Item 6) must come through hole (Figure 6, Item 15) in top center of equalizer valve housing (Figure 6, Item 3) when bolts are tightened.
14. Torque two bolts (Figure 6, Item 1) to 36 to 43 lb-ft (48 to 58 N·m).

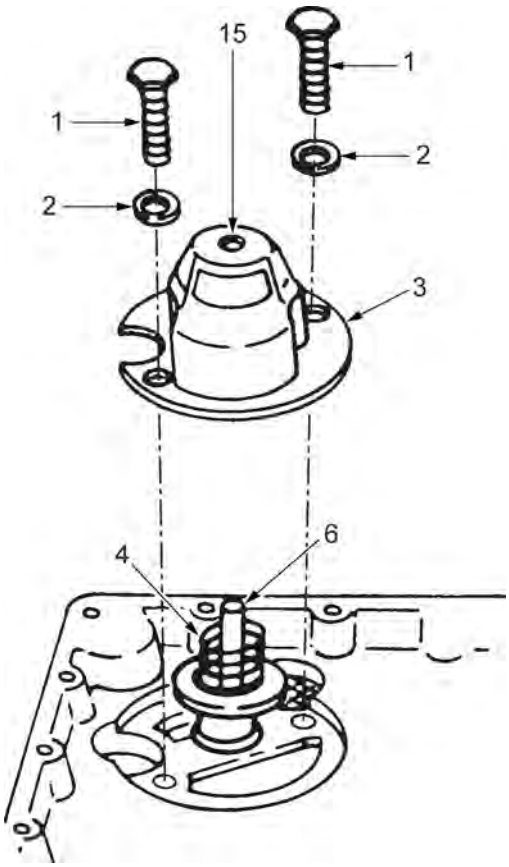


Figure 6. Equalizer Valve Housing Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE OIL FILTER HEAD ASSEMBLY

INITIAL SETUP:

References
TM 9-2350-277-13&P

Refer to TM 9-2350-277-13&P for procedures to replace oil filter head assembly.

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE LEFT COVER ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Guide Pin, 3/8-16 x 2 in. (WP 0075, Item 6) (2)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Sling, Multiple-Leg (3 Legs) (WP 0079, Item 36)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 33)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
WP 0038

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)

REMOVE LEFT COVER ASSEMBLY

WARNING

Check sling and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

Left cover assembly must be lifted using sling, hoist, and trestle. To avoid injury, keep clear of left cover assembly at all times. Do not let left cover assembly swing freely during hoisting.

1. Remove left lifting bracket. Refer to TM 9-2350-277-13&P.
2. Remove the remaining 29 bolts (Figure 1, Item 2) and washers (Figure 1, Item 3) from left cover assembly (Figure 1, Item 1).

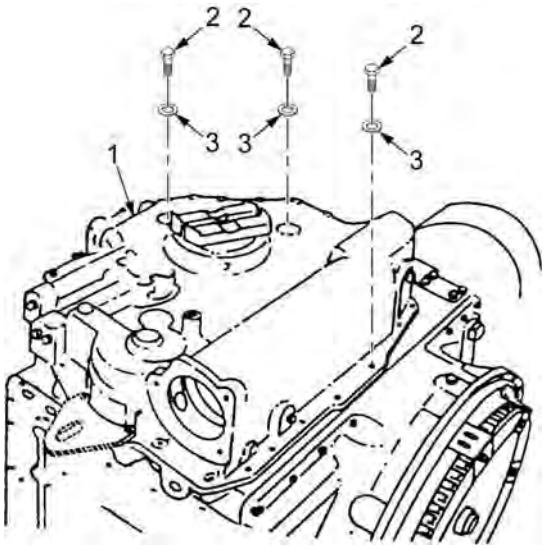


Figure 1. Left Lifting Bracket Removal.

NOTE

Two legs of multiple-leg sling are used in this task. When sling bolts are tightened, they lift left cover assembly from transmission.

3. Install two 3/8 inch washers (Figure 2, Item 6) on two 3/8-16 x 2 inch bolts (Figure 2, Item 5) and install bolts through two lugs of multiple-leg sling.
4. Install two bolts (Figure 2, Item 5) in holes (Figure 2, Item 4) on left cover assembly (Figure 2, Item 1).
5. Tighten one bolt (Figure 2, Item 5) then the other bolt (Figure 2, Item 5) until left cover assembly (Figure 2, Item 1) loosens.
6. Pry between left cover assembly (Figure 2, Item 1) and center housing assembly (Figure 2, Item 7) to pry left cover assembly (Figure 2, Item 1) loose.
7. Remove left cover assembly (Figure 2, Item 1).

NOTE

Stow left cover assembly prior to removal of hardware and sling.

8. Remove bolts (Figure 2, Item 5), washers (Figure 2, Item 6) and multiple-leg sling from left cover assembly (Figure 2, Item 1).
9. Remove left cover gasket (Figure 2, Item 8). Discard gasket (Figure 2, Item 8).

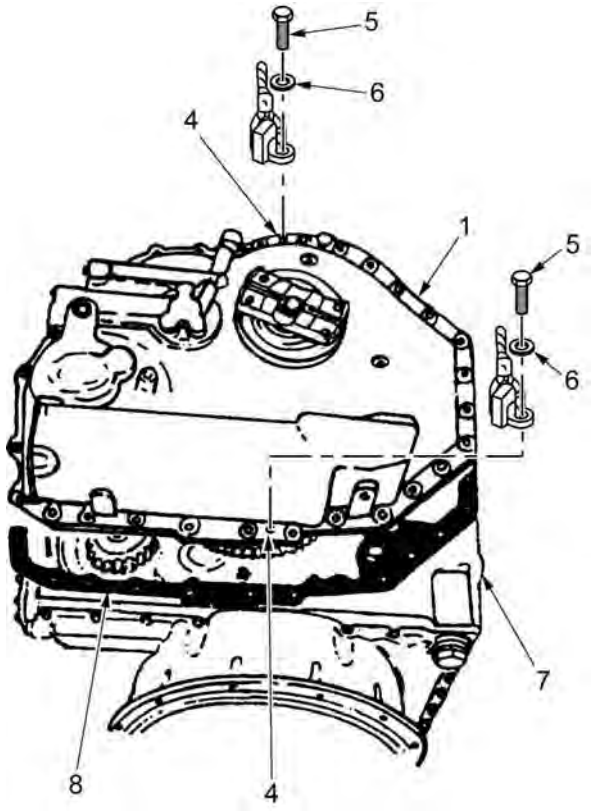


Figure 2. Left Cover Assembly and Gasket Removal.

END OF TASK

INSTALL LEFT COVER ASSEMBLY

NOTE

Transmission is on maintenance stand, left end turned up.

1. Install two 3/8-16 x 4 inch guide pins (Figure 3, Item 9) into center housing assembly (Figure 3, Item 7).
2. Install new left cover gasket (Figure 4, Item 8) on center housing assembly (Figure 4, Item 7), over guide pins (Figure 3, Item 9).
3. Install 3/8 inch f at washer (Figure 4, Item 9) on each of two 3/8-16 x 2 inch bolts (Figure 4, Item 8) and install bolts through two lugs of multiple-leg sling.

NOTE

Bolts should not extend beyond the inside surface of left cover. If tips of bolts extend beyond surface of end cover, then the cover will not seat on gasket.

4. Install two bolts (Figure 4, Item 5) in two holes (Figure 4, Item 4) in the left cover assembly (Figure 4, Item 1).

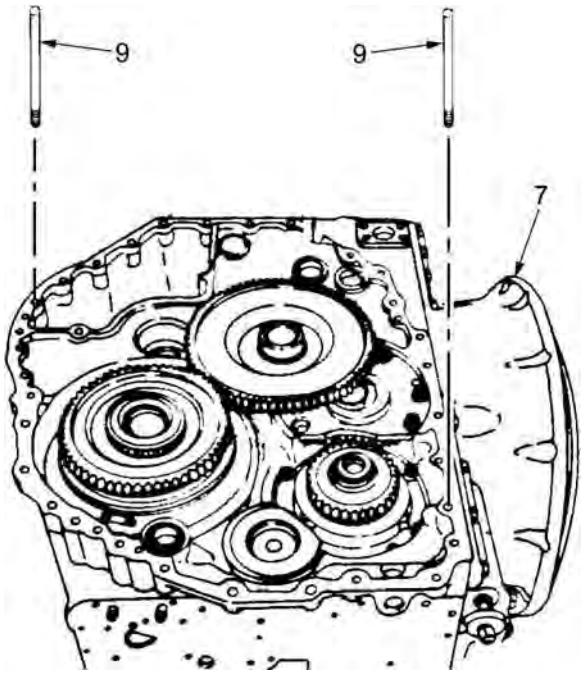


Figure 3. Guide Pins Installation.

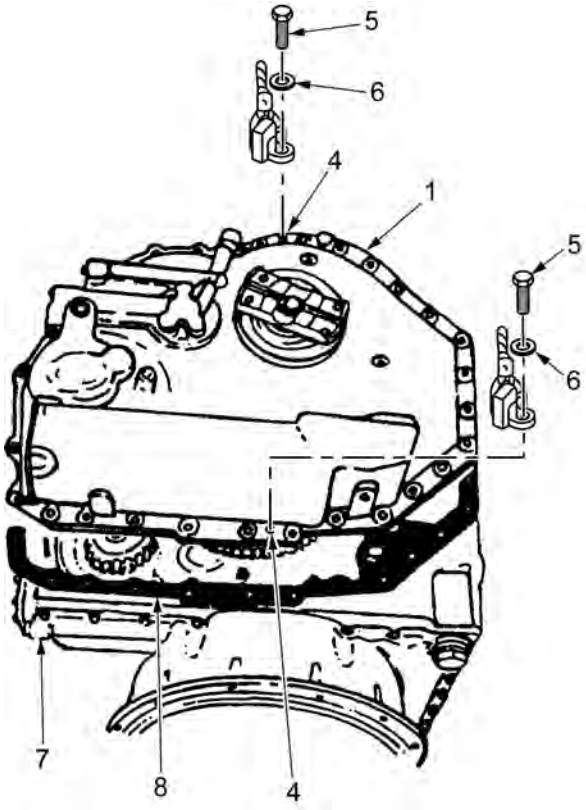


Figure 4. Gasket Installation.

WARNING

Check sling and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

Weight of left cover assembly exceeds safe limits for lifting without a sling, hoist, and trestle. Lift left cover with sling, hoist, anf trestle to avoid bodily injury.

5. Hoist left cover assembly (Figure 5, Item 1) over center housing assembly (Figure 5, Item 7).
6. Lower left cover assembly (Figure 5, Item 1) so that it is resting lightly on center housing assembly (Figure 5, Item 7).

NOTE

Output f ange must be rotated left and right repeatedly while lowering cover to line up splines of output shafts and output pump drive gear.

7. Rotate output f ange (Figure 5, Item 10) back and forth while lowering left cover assembly (Figure 5, Item 1), using one hand on hoist control and other hand on output f ange.
8. Remove bolts (Figure 5, Item 5) and washers (Figure 5, Item 6) and sling from left cover assembly (Figure 6, Item 1). Remove two guide pins (Figure 6, Item 9).

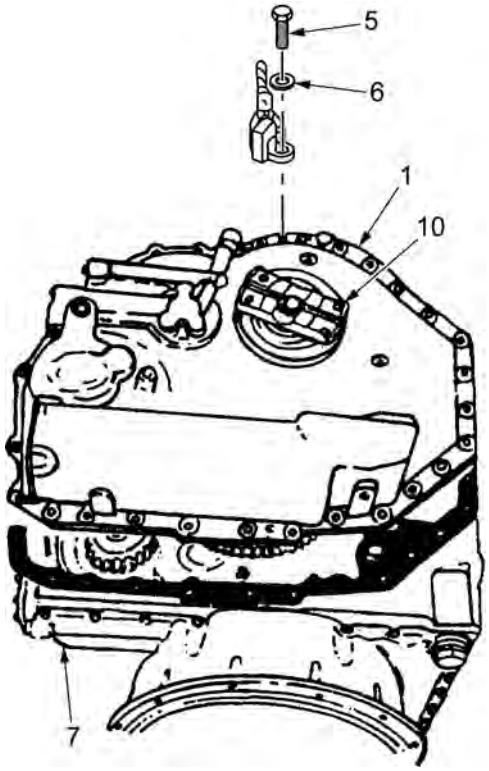


Figure 5. Left Cover Assembly Placement on Center Housing Assembly.

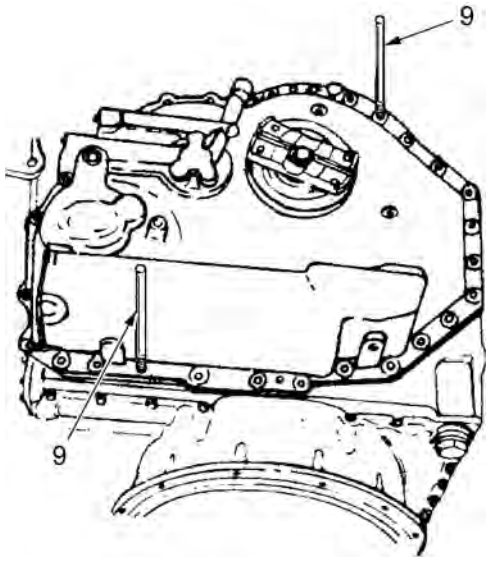


Figure 6. Guide Pins Removal.

9. Install left lifting bracket. Refer to TM 9-2350-277-13&P.
10. Install loosely two 3/8-16 x 1-1/4 inch bolts (Figure 7, Item 2) and two washers (Figure 7, Item 3) in body of left cover assembly (Figure 7, Item 1).
11. Install loosely the 27 remaining 3/8-16 x 1-1/4 inch bolts (Figure 7, Item 2) and washers (Figure 7, Item 3) around perimeter of left cover assembly (Figure 7, Item 1).

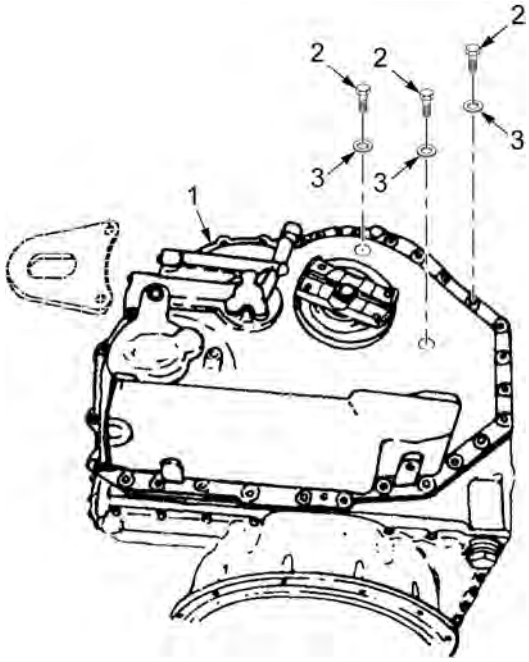


Figure 7. Left Lifting Bracket Installation.

CAUTION

Damage to left cover assembly can occur if excessive force is used. Do not force the cover to seat on the transmission. Do not beat on it with a hammer or use the split line bolts to pull it into position. If the cover seems to be hung up and will not properly install, remove the left cover assembly from the transmission and verify that the correct bevel gear driven shaft is installed. Conf rm that the part identif cation and length of bevel gear driven shaft matches that which you have previously recorded during Replace Bevel Gear Drive Shaft and Filter Tubes, WP 0038. This should be P/N 29533537, with length 10.65 in. (270.51 mm), used with rear carrier assembly P/N 29533535.

12. Tap left cover assembly (Figure 8, Item 1) to seat cover against gasket on center housing assembly.
13. Torque two bolts (Figure 8, Item 4) and 29 bolts (Figure 8, Item 2) to 27 to 32 lb-ft (37 to 43 N·m).

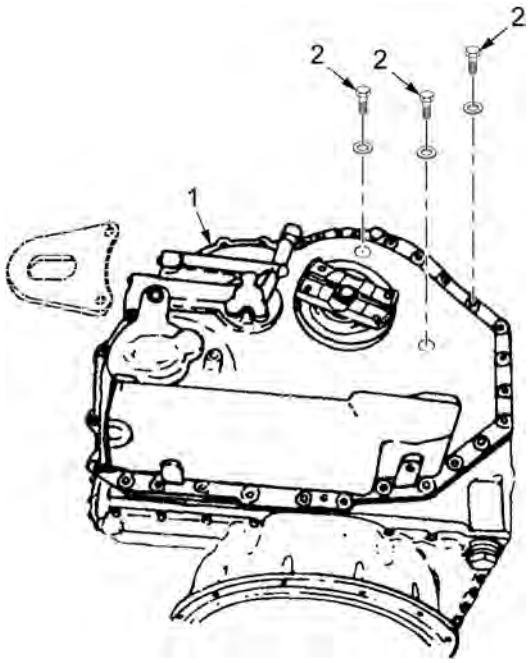


Figure 8. Left Cover Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR LEFT COVER ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Insert Installer, Remover (WP 0075, Item 6)
Sling, Multiple-Leg (3 Legs) (WP 0079, Item 36)
Screwdriver Attachment Hex, 1/2” Drive, 9/16” Hex Bit (WP 0079, Item 33)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)

Materials/Parts
O-Ring (WP 0080, Item 49)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Sealant, Lubricating, Thread-Locking (WP 0078, Item 15)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left cover assembly removed (WP 0033)

DISASSEMBLE LEFT COVER ASSEMBLY

WARNING

Check slings and trestle for cuts, breaks, or wear before hoisting left cover assembly and during hoisting. Slings and trestle can break and cause injury or death.

Left cover assembly weighs approximately 90 lb (41 kg). When lifting left cover assembly, a hoist and trestle must be used to avoid bodily injury.

NOTE

Left cover assembly is turned outside up.

1. Remove pipe plugs (Figure 1, Item 1) and (Figure 2, Item 7) and (Figure 3, Item 4) and (Figure 1, Item 5) from left cover assembly (Figure 1, Item 3).
2. Remove O-ring (Figure 1, Item 6) from left cover assembly (Figure 1, Item 3). Discard O-ring (Figure 1, Item 6).

NOTE

Do Step 3 through Step 6 if insert(s) must be replaced.

3. Assemble 3/8-16 x 3 inch bolt, 3/8-16 inch f at washer, and fabricated spacer into insert installer, remover (Figure 4).
4. Screw tip of bolt into one insert (Figure 1, Item 2) in one end of left cover assembly (Figure 1, Item 3).
5. Lock nut against washer and hold nut to force insert (Figure 1, Item 2) to turn with bolt.
6. Turn bolt to the left (counterclockwise) and remove insert (Figure 1, Item 2).

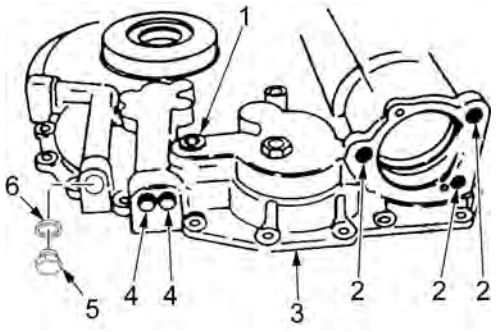


Figure 1. Pipe Plugs, Inserts, and O-Rings, Left Cover Assembly Removal, View 1.

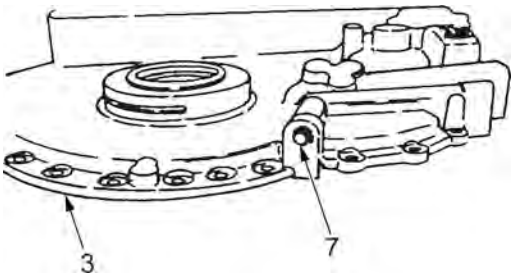


Figure 2. Pipe Plugs, Left Cover Assembly, Removal, View 2.

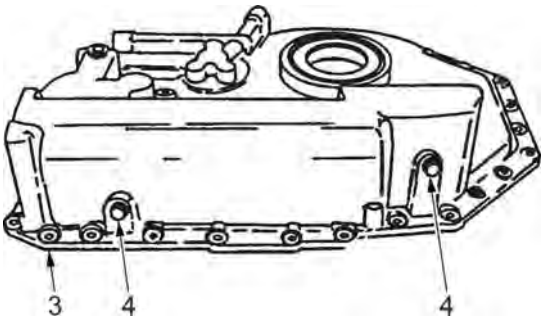


Figure 3. Pipe Plugs, Left Cover Assembly, Removal, View 3.

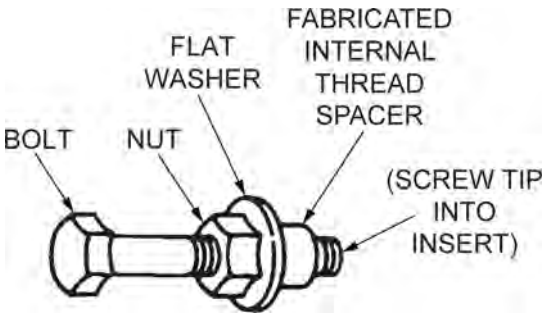


Figure 4. Insert Installer, Remover for Removal.

END OF TASK

ASSEMBLE LEFT COVER ASSEMBLY

NOTE

Do Step 1 through Step 4 if any of inserts were removed.

1. Assemble 3/8-16 x 3 inch bolt and 3/8-16 nut into Insert Installer (Figure 6).
2. Screw one insert (Figure 5, Item 2) onto bolt. Screw nut against insert.
3. Install insert (Figure 5, Item 2) in left cover assembly (Figure 5, Item 3) to 0.005 to 0.062 in. (0.127 to 0.157 mm) below surface of left cover assembly (Figure 5, Item 3).
4. Repeat Step 2 and Step 3 to install two other inserts (Figure 5, Item 2) if removed.
5. Install new O-ring (Figure 5, Item 6) on pipe plug (Figure 5, Item 5).

NOTE

Sealant is not applied to pipe plug that has an O-ring.

6. Apply petrolatum to O-ring (Figure 5, Item 6).
7. Install plug (Figure 5, Item 5) in left cover assembly (Figure 5, Item 3).
8. Torque plug (Figure 5, Item 5) to 72 to 96 lb-in. (8 to 11 N·m).

NOTE

Some pipe plugs are precoated and do not require thread-locking lubricating sealant.

9. Apply sealant to threads of six pipe plugs (Figure 5, Item 1) and Figure 8, Item 7) and (Figure 5, Item 4).
10. Install four pipe plugs (Figure 7, Item 4) in left cover assembly (Figure 7, Item 3).
11. Torque plugs (Figure 7, Item 4) to 96 to 120 lb-in. (11 to 14 N·m).
12. Install pipe plug (Figure 8, Item 7) in end of left cover assembly (Figure 8, Item 3).
13. Torque plug (Figure 8, Item 7) to 50 to 60 lb-in. (6 to 7 N·m).
14. Install pipe plug (Figure 5, Item 1) in end of left cover assembly (Figure 5, Item 3).
15. Torque plug (Figure 5, Item 1) to 21 to 28 lb-ft (28 to 38 N·m).

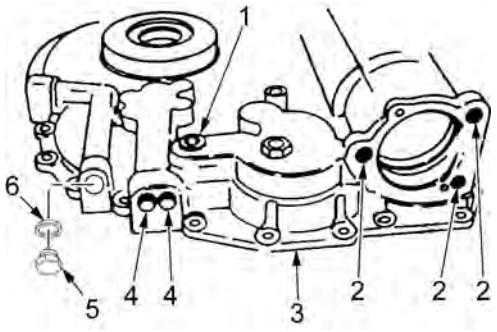


Figure 5. Pipe Plugs, Inserts, and O-Rings, Left Cover Assembly, Installation, View 1.

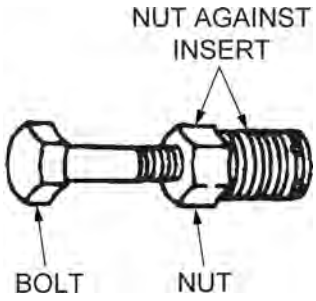


Figure 6. Insert Installer, Remover for Installation.

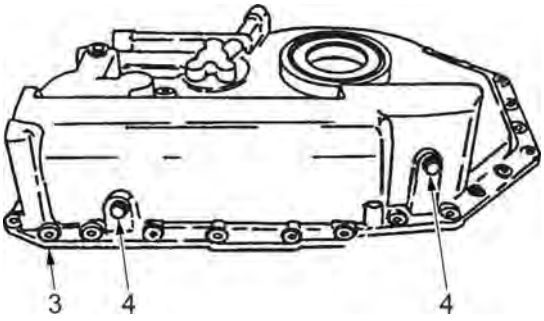


Figure 7. Pipe Plugs, Left Cover Assembly, Installation, View 2.

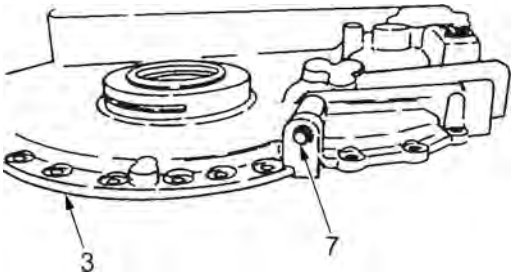


Figure 8. Pipe Plugs, Left Cover Assembly, Installation, View 3.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE LEFT OUTPUT SHAFT

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Retainer, Packing (WP 0080, Item 39)
Retainer, Packing (WP 0080, Item 53) (2)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
TM 9-2350-277-13&P

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left cover assembly removed (WP 0033)

REMOVE LEFT OUTPUT SHAFT

NOTE

Make sure that the left cover assembly is turned so that the internal side points up when it is not on its edge.

Use two wooden blocks to make the left cover assembly level when you put it on its edge. Put the blocks below the corner nearest to the left output shaft.

1. Remove the retaining ring (Figure 1, Item 3) that holds the bearing assembly (Figure 1, Item 4) and the left output shaft (Figure 1, Item 2) from the left cover assembly (Figure 1, Item 1).

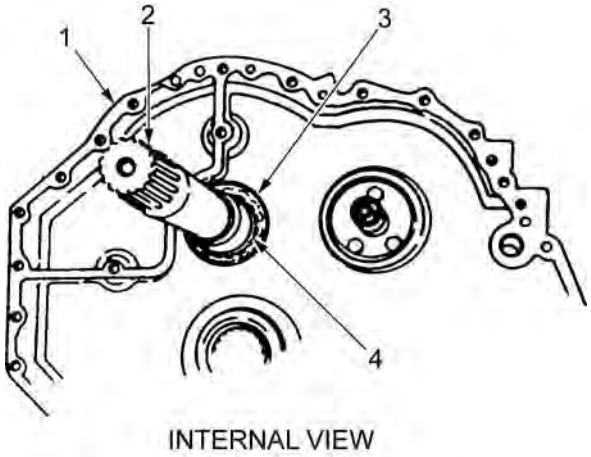


Figure 1. Retaining Ring Removal.

2. Hold the left cover assembly (Figure 2, Item 1) on its edge to get access to the external side of the assembly.
3. Remove the left output shaft (Figure 2, Item 2) using a soft-faced hammer to hit the shaft from the internal side of the left cover assembly (Figure 2, Item 1).

NOTE

The second person may now be dismissed.

4. Put the left cover assembly (Figure 2, Item 1) on wooden blocks so that the internal side points up.

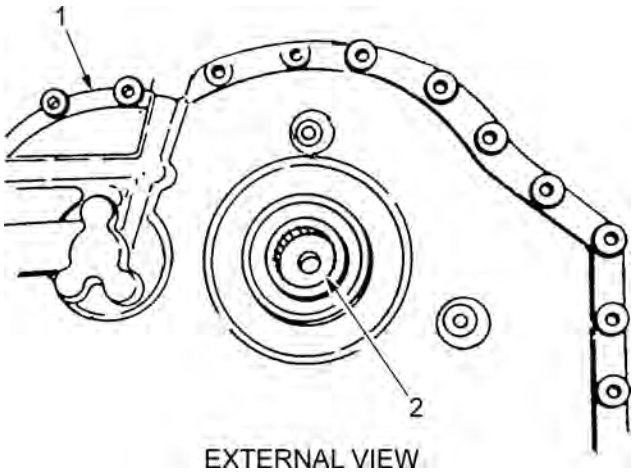


Figure 2. Left Output Shaft Removal.

5. Refer to TM 9-2350-277-13&P to remove the left output shaft seal.

6. Remove two packings (Figure 3, Item 6) from the left output shaft (Figure 3, Item 2). Discard two packings (Figure 3, Item 6).

NOTE

Do Step 7 only if the retaining bearing assembly and sleeve are to be replaced.

When the bearing is removed from the left output shaft, the sleeve is pushed off in front of the bearing.

7. Remove the retaining bearing assembly (Figure 3, Item 4) and sleeve (Figure 3, Item 5) from the left output shaft (Figure 3, Item 2).
8. Remove packing (Figure 3, Item 7) from the end of the left output shaft (Figure 3, Item 2). Discard packing (Figure 3, Item 7).

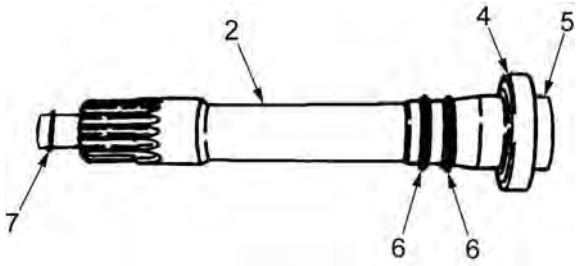


Figure 3. Left Output Shaft Seal Rings and Sleeve Removal.

END OF TASK

INSTALL LEFT OUTPUT SHAFT

1. Refer to TM 9-2350-277-13&P to install left output seal.

WARNING

Frozen parts can stick to your f ngers and cause serious injury. Always wear leather gloves when you work with parts that have been frozen in carbon dioxide.

2. Put the left output shaft (Figure 4, Item 2) bearing end in carbon dioxide for one hour.

NOTE

Do Step 3 through Step 5 only if the left output shaft bearing assembly and sleeve were removed.

3. Apply petrolatum and lubricating oil to the bearing end (Figure 4, Item 8) of the left output shaft (Figure 4, Item 2).
4. Install new bearing assembly (Figure 4, Item 4) on the output shaft (Figure 4, Item 2) so that the side that has numbers points out. Push the bearing so that it touches the shoulder.

WARNING

Hot parts can burn you. Always wear leather gloves when you work with parts that are or might be hot.

5. Apply heat to the sleeve (Figure 4, Item 5) with heat gun for 30 minutes until it is approximately 250ºF (121ºC).
6. Install the sleeve (Figure 4, Item 5) on the left output shaft (Figure 4, Item 2) so that the internal beveled edge points toward the shaft. Push the sleeve so that it touches the bearing assembly (Figure 4, Item 4).
7. Install two new packings (Figure 4, Item 6) on the left output shaft (Figure 4, Item 2). Apply petrolatum to the two new packings (Figure 4, Item 6).

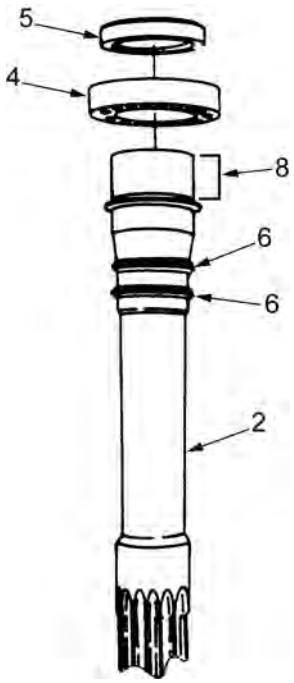


Figure 4. Left Output Shaft and Sleeve Installation.

NOTE

Put the left cover assembly on two wooden block to make it level. Make sure that the left cover assembly is turned so that the interior side points up.

8. Apply petrolatum to inner surface of seal (Figure 5, Item 9).
9. Turn the left output shaft (Figure 5, Item 2) carefully and push the end of the left output shaft (Figure 5, Item 2) through the left output seal (Figure 5, Item 9).
10. Make sure the left output shaft (Figure 6, Item 2) is very straight and tap on the splined end of the shaft (Figure 6, Item 2) to install the bearing assembly (Figure 6, Item 4) in the shoulder on the left cover assembly (Figure 5, Item 1). If the bearing does not install easily, apply heat to the left cover assembly (Figure 5, Item 1) with heat gun around bearing journal to install bearing.
11. Make sure that the left output seal (Figure 5, Item 9) stays in position in the left cover assembly (Figure 5, Item 1) and that the lip on the seal is not twisted when the left output shaft (Figure 5, Item 2) goes through the left output seal (Figure 5, Item 9).

NOTE

When the left output shaft and bearing are installed, you will have access to the snap ring groove in the sleeve at the outer edge of the bearing.

12. Install the retaining ring (Figure 6, Item 3) in the groove in the sleeve (Figure 6, Item 5) above the bearing assembly (Figure 6, Item 4).
13. Apply lubricating oil to bearing assembly (Figure 6, Item 4).

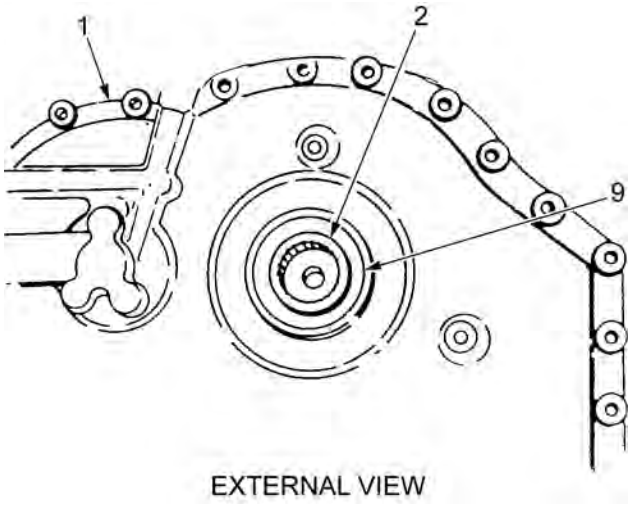


Figure 5. Left Output Shaft Installation.

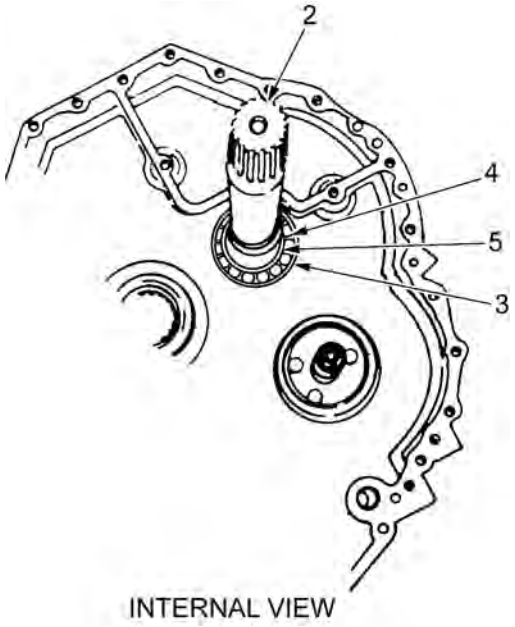


Figure 6. Retaining Ring Installation.

14. Install new packing (Figure 7, Item 7) on the end of the left output shaft (Figure 7, Item 2).
15. Apply petrolatum to new packing (Figure 7, Item 7).

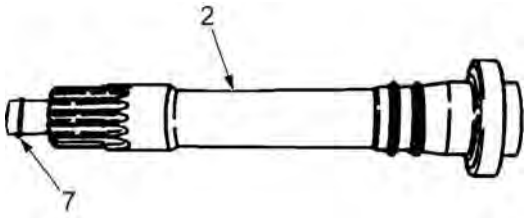


Figure 7. Packing Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RANGE INPUT DRIVEN GEAR RACE AND RANGE INPUT DRIVE GEAR BEARING

INITIAL SETUP:

Tools and Special Tools
Heater, Gun-Type, Electric (WP 0079, Item 20)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Puller Set, Mechanical, Gear and Bearing, 3-Jaw (WP 0079, Item 30)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
O-Ring (WP 0080, Item 55) (2)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal (WP 0080, Item 38)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left output shaft and seal removed (WP 0035)

REMOVE RANGE INPUT DRIVEN GEAR RACE, RANGE INPUT DRIVE GEAR BEARING, AND OIL TRANSFER TUBE SEAL RING

WARNING

Hot parts can burn you. Always wear leather gloves when you work with parts that are or might be hot.

NOTE

Make sure that the left cover assembly is turned so that the inner side points up.

Put left cover assembly on two wooden blocks. Put blocks below the edge of the left cover assembly on the corner nearest the left output shaft bore.

1. Apply heat to the left cover assembly (Figure 1, Item 6) with heat gun around the bearing (Figure 1, Item 5) and race (Figure 1, Item 4) for one hour to approximately 300ºF (149ºC).

NOTE

The left cover housing is cut away in two places 180 degrees apart below the bearing to give access to bearing.

2. Remove the bearing (Figure 1, Item 5) and race (Figure 1, Item 4).
3. Remove the small seal (Figure 1, Item 2) and two large O-rings (Figure 1, Item 3) from the oil transfer tube assembly (Figure 1, Item 1). Discard the small seal (Figure 1, Item 2) and two large O-rings (Figure 1, Item 3).

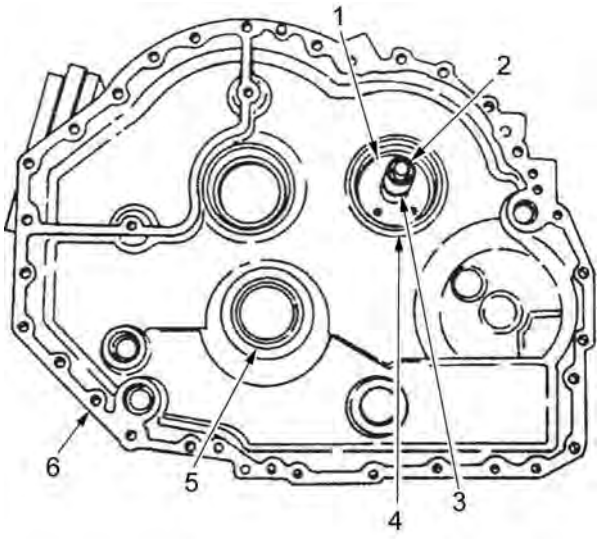


Figure 1. Bearing, Race, and Seal Removal.

END OF TASK

INSTALL OIL TRANSFER TUBE SEAL RINGS, RANGE INPUT DRIVE GEAR BEARING, AND INPUT DRIVEN GEAR RACE

NOTE

Make sure that the left cover assembly is turned so that the inner side points up.

Put left cover assembly on two wooden blocks. Put blocks below the edge of the left cover assembly on the corner nearest the left output shaft bore.

1. Install new small seal (Figure 2, Item 2) and two new large O-rings (Figure 2, Item 3) on the oil transfer tube assembly (Figure 2, Item 1).

NOTE

Do Step 2, Step 3, and Step 4 if the bearing and race were removed.

2. Apply petrolatum and lubricating oil to the bores in the left cover assembly (Figure 2, Item 6).

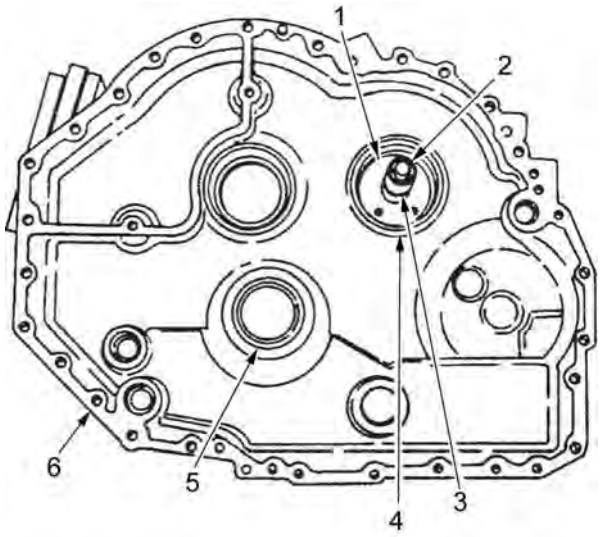


Figure 2. Seal Installation.

WARNING

Frozen parts can stick to your f ngers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in carbon dioxide.

3. Freeze the race (Figure 3, Item 4) with carbon dioxide.
4. Install new bearing (Figure 3, Item 5) in the left cover assembly (Figure 3, Item 6). Push the bearing (Figure 3, Item 5) to the shoulder.
5. Apply lubricating oil to bearing (Figure 3, Item 5) and race (Figure 3, Item 4).

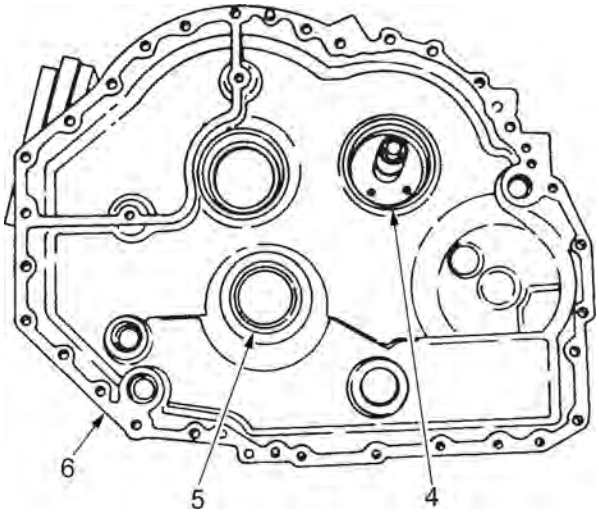


Figure 3. Bearing and Race Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RANGE INPUT GEARS AND HYDROSTATIC DRIVE GEAR

INITIAL SETUP:

Tools and Special Tools
Adapter Kit, Container (WP 0079, Item 3)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Puller Set, Mechanical, Gear and Bearing, 3-Jaw (WP 0079, Item 30)
Sander/Grinder, 4-1/2” (WP 0079, Item 31)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)

Materials/Parts
Cloth, Abrasive, Crocus (WP 0078, Item 6)
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
TM 9-214
WP 0034
WP 0036
WP 0038
WP 0043

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left cover assembly removed (WP 0033)

REMOVE RANGE INPUT GEARS AND HYDROSTATIC DRIVE GEAR

WARNING

If not removed, components will fall out of the transmission when the left side is turned down. Failure to comply may result in injury to equipment and personnel.

After left cover assembly has been removed, do not turn transmission more than 90 degrees until fabricated range pack retaining f xture has been installed. Two pitot tubes and two bolts extending into the range pack from center housing assembly keep the range pack in position, but are not suff cient support for the range pack when the transmission is turned over. If the left end of the transmission is turned more than 90 degrees (1/4 turn) from top without the range pack retaining f xture in position, parts in range pack may fall out. Failure to comply may result in injury to equipment and personnel.

NOTE

Bearings are not to be replaced unless defective. Refer to TM 9-214 for inspection of bearings.

1. Remove range input drive gear (Figure 1, Item 2) and hydrostatic drive gear (Figure 1, Item 3), together, from center housing assembly (Figure 1, Item 1).

NOTE

Range input drive gear and hydrostatic drive gear should not be separated unless one of these gears or inner race must be replaced.

When hydrostatic drive gear is removed, inner race is also removed.

Bearing outer race and rollers that match race stay in the center housing assembly. Refer to Repair Center Housing Components, WP 0043, to replace outer race and rollers.

2. Remove race (Figure 1, Item 4) and hydrostatic drive gear (Figure 1, Item 3) from range input drive gear (Figure 1, Item 2).

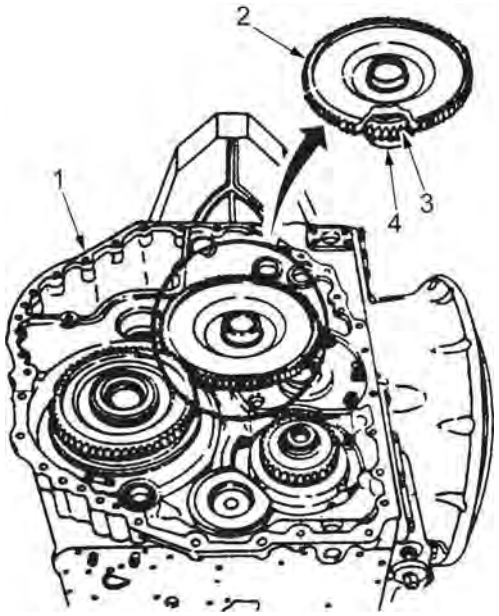


Figure 1. Range Input Gear, Hydrostatic Drive Gear.

CAUTION

Be careful not to cut into gear hub when cutting slots in bearing race.

3. Cut two slots 180 degrees apart at base of inner bearing race (Figure 2, Item 5). Cut slots deep enough to catch the lip of the pry bar, but not deep enough to cut through bearing race into gear hub.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or could be hot.

4. Apply heat to inner bearing race (Figure 2, Item 5) with heat gun for 15 minutes.
5. Pry up inner bearing race (Figure 2, Item 5).

CAUTION

Be careful not to cause damage to gear hub when using pry bars to remove race.

NOTE

Bearing outer race and rollers that match race stay in the left cover assembly. Refer to Replace Range Input Driven Gear Race and Range Input Drive Gear Bearing, WP 0036, replace the outer race and rollers.

6. Put tools back under bearing race (Figure 2, Item 5) and remove race from gear (Figure 2, Item 2).

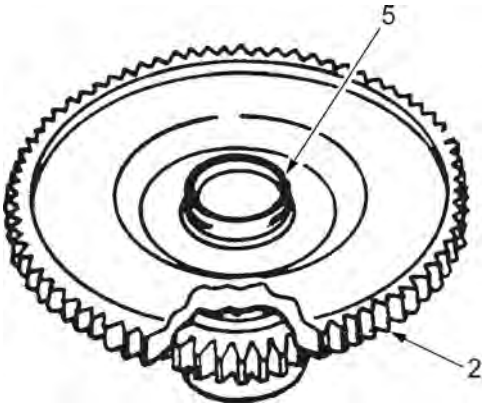


Figure 2. Hydrostatic Drive Gear Hub.

NOTE

Left cover assembly is in maintenance stand.

Range input driven gear has bearing rollers and inner race on top. Outer race remains in left cover assembly. Refer to Replace Range Input Driven Gear Race and Range Input Drive Gear Bearing, WP 0036, to replace the outer race.

7. Remove range input driven gear (Figure 3, Item 6). If bearing (Figure 3, Item 7) is defective, go to Step 8. If bearing is not defective, go to Replace Bevel Gear Driven Shaft and Filter Tubes, WP 0038.
8. Remove bearing (Figure 3, Item 7) from range input driven gear (Figure 3, Item 6).

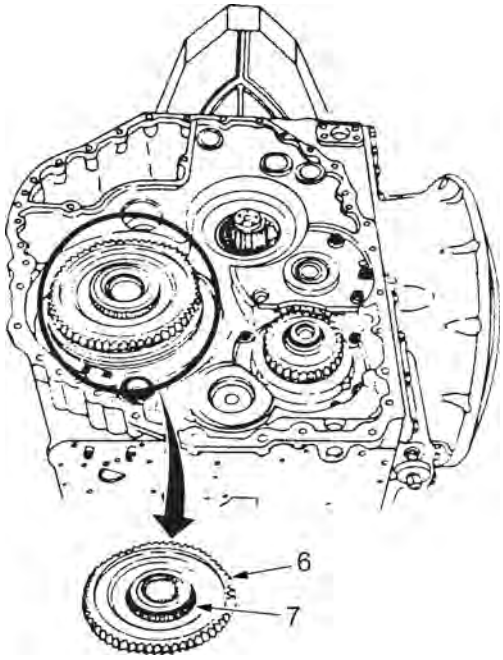


Figure 3. Range Input Driven Gear.

END OF TASK

INSTALL RANGE INPUT GEARS

1. Apply lubricating oil and petrolatum to bearing journal of range input driven gear (Figure 4, Item 6) if old bearing (Figure 4, Item 7) was removed.

NOTE

Bearing has cage and inner race. Check that outer race is in left cover assembly. Reference Repair Left Cover Assembly, WP 0034.

2. Install new bearing (Figure 4, Item 7) on range input driven gear (Figure 4, Item 6). Push bearing to shoulder.
3. Apply lubricating oil to bearing (Figure 4, Item 7).
4. Install range input driven gear (Figure 4, Item 6) over range input shaft on forward clutch housing, with bearing (Figure 4, Item 7) up.
5. Do a check of the bearing journal on range input drive gear (Figure 4, Item 2) hub for damage. Make scratches smooth with crocus cloth. If there is grinding damage because of bearing removal, replace range input drive gear (Figure 4, Item 2).
6. Apply lubricating oil and petrolatum to bearing journals on each side of range input drive gear (Figure 4, Item 2) if old bearings were removed.
7. Install new inner bearing race (Figure 4, Item 5). Push bearing to shoulder.

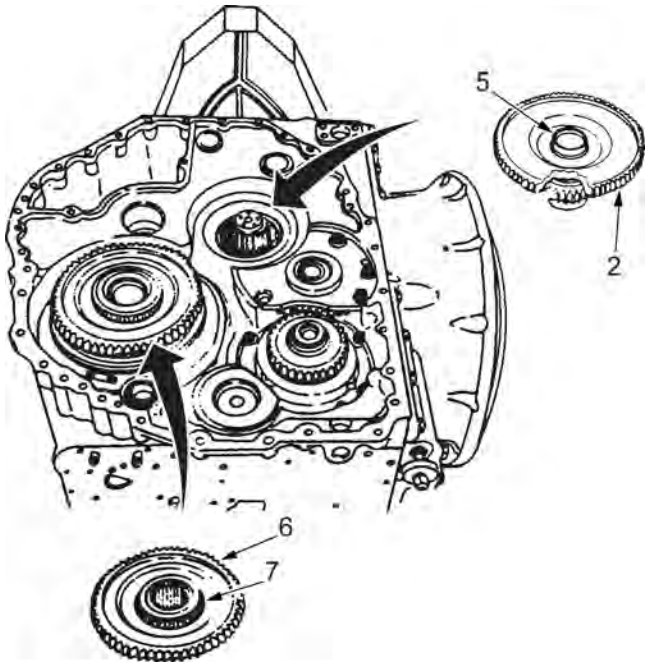


Figure 4. Range Input Drive Gear.

END OF TASK

INSTALL HYDROSTATIC DRIVE GEAR

NOTE

Hydrostatic drive gear may be installed either side first.

1. Install hydrostatic drive gear (Figure 5, Item 3) on shaft of range input drive gear (Figure 5, Item 2) if gears were separated. Push hydrostatic drive gear (Figure 5, Item 3) to shoulder.
2. Install new inner race (Figure 5, Item 4) on journal adjacent to hydrostatic drive gear (Figure 5, Item 3) if old bearing was removed.
3. Do a check to make sure cage and outer race (Figure 5, Item 8) for inner race (Figure 5, Item 4) is in the left end of center housing assembly (Figure 5, Item 1). Also do a check to make sure cage and outer race for inner bearing race (Figure 5, Item 5) is in the left cover assembly.
4. Install range input drive gear (Figure 5, Item 2) and hydrostatic drive gear (Figure 5, Item 3) on bevel gear driven shaft (Figure 5, Item 9) with hydrostatic drive gear (Figure 5, Item 3) down.
5. Move gears (Figure 5, Item 2) and (Figure 5, Item 3) left and right until inner splines on hydrostatic drive gear (Figure 5, Item 3) connect with splines on bevel gear driven shaft (Figure 5, Item 9), and teeth on hydrostatic drive gear (Figure 5, Item 3) connect with teeth on hydrostatic idler gear (Figure 5, Item 10).
6. Continue to move gears (Figure 5, Item 2) and (Figure 5, Item 3) left and right until teeth on range input drive gear (Figure 5, Item 2) connect with teeth on range input driven gear (Figure 5, Item 6).
7. Push down on range input drive gear (Figure 5, Item 2) to install gears (Figure 5, Item 2) and (Figure 5, Item 3) in operating position.

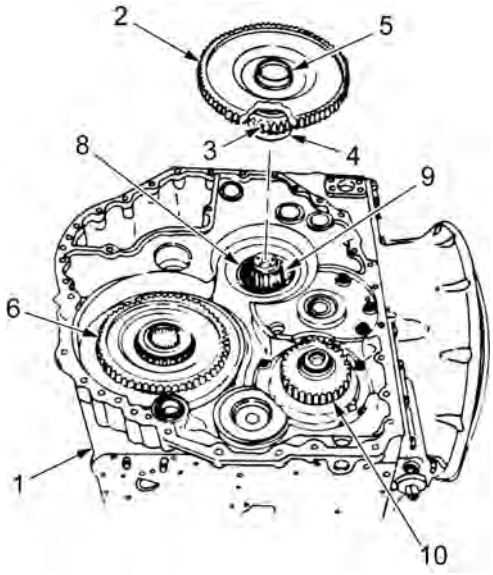


Figure 5. Center Housing Components.

NOTE

Range input drive gear and hydrostatic drive gear will not connect properly with range input driven gear (Figure 6, Item 6) and hydrostatic idler gear if the incorrect bevel gear driven shaft was installed.

8. Do a check to make sure teeth on range input drive gear (Figure 6, Item 2) and teeth on range input driven gear (Figure 6, Item 6) fully engage, and that outer surfaces of gears are on the same plane. If gears are not even, continue to move gears (Figure 6, Item 2) and (Figure 6, Item 3) until bevel gear driven shaft (Figure 6, Item 9) and gears (Figure 6, Item 2), (Figure 6, Item 3), (Figure 6, Item 6), and (Figure 6, Item 10) are all synchronized.

CAUTION

Damage to left cover assembly can occur if incorrect bevel gear driven shaft is installed. Make sure part identif cation as recorded when bevel gear shaft was removed, as well as the length of shaft before installation.

9. If range input drive gear (Figure 6, Item 2) and hydrostatic drive gear (Figure 6, Item 3) will not install properly, remove gears (Figure 6, Item 2) and (Figure 6, Item 3) and (Figure 6, Item 6), and bevel gear driven shaft (Figure 6, Item 9). If the gears install properly go to Repair Left Cover Assembly, WP 0034.

PN	Length
29533537	10.65 in. (27.05 cm), used with rear carrier assembly, PN 29533535

10. Make sure part identif cation of bevel gear driven shaft (Figure 6, Item 9) is correct. Install the correct bevel gear driven shaft (Figure 6, Item 9) and repeat Step 4 through Step 8.

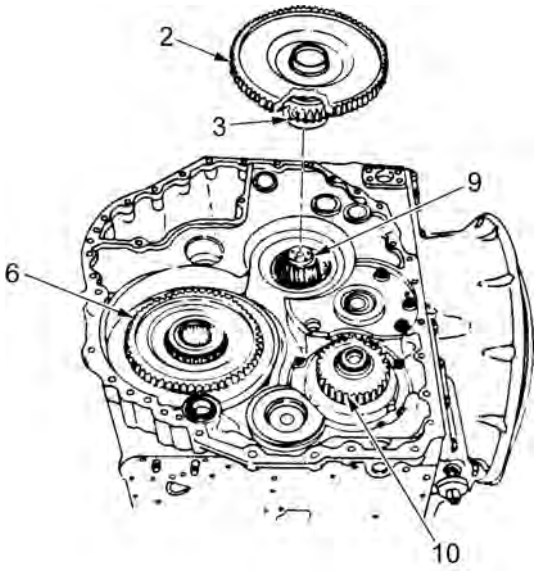


Figure 6. Center Housing Components.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BEVEL GEAR DRIVEN SHAFT AND FILTER TUBES

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Packing (WP 0080, Item 46) (4)
Packing (WP 0080, Item 4)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Range input gears and hydrostatic drive gear removed (WP 0035)

REMOVE BEVEL GEAR DRIVEN SHAFT AND FILTER TUBES

CAUTION

Left cover assembly can be damaged if incorrect bevel gear driven gear shaft is installed. Record part number of bevel gear driven shaft when removed.

NOTE

It may be necessary to move bevel gear driven shaft back and forth to remove it from transmission.

1. Remove bevel gear driven shaft (Figure 1, Item 1) and record part number.

NOTE

The filter-in tube is 3.60 in. (91.44 mm) long. The filter-out tube is 2.25 in. (57.15 mm) long. The filter-out tube (shorter tube) is located near the input housing.

2. Remove filter-in tube (Figure 1, Item 3) and filter-out tube (Figure 1, Item 4) from center housing assembly or from end cover.
3. Remove four packings (Figure 1, Item 2) from tubes (Figure 1, Item 3) and (Figure 1, Item 4). Discard four packings (Figure 1, Item 2).
4. Remove packing (Figure 1, Item 5) from end of jumper tube (Figure 1, Item 6). Discard packing (Figure 1, Item 5).

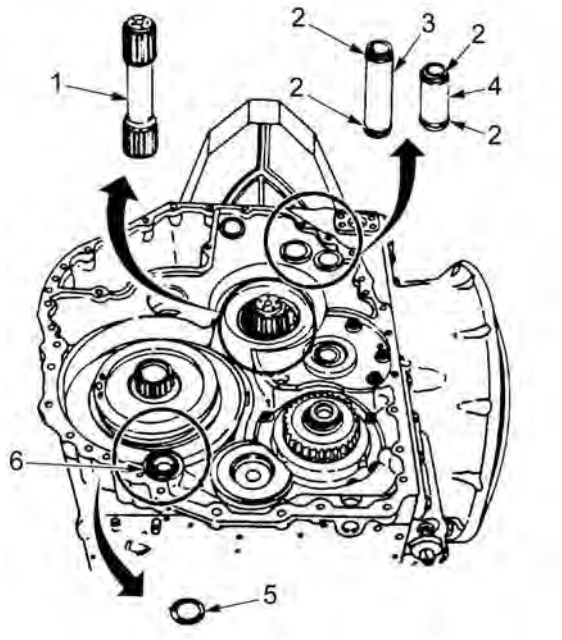


Figure 1. Bevel Gear Driven Shaft, Filter Tubes, and Packings Removal.

END OF TASK

INSTALL FILTER TUBES

1. Install new packing (Figure 2, Item 5) on end of jumper tube (Figure 2, Item 6).
2. Apply petrolatum to new packing (Figure 2, Item 5).
3. Install four new packings (Figure 2, Item 2), two packings on filter-in tube (Figure 2, Item 3) and two packings on filter-out tube (Figure 2, Item 4).
4. Apply petrolatum to four new packings (Figure 2, Item 2).

NOTE

The filter-in tube is 3.60 in. (91.44 mm) long.

The filter-out tube is 2.25 in. (57.15 mm) long.

The filter-out tube (shorter tube) is installed closest to the input housing.

5. Install filter-out tube (Figure 2, Item 4) in center housing assembly (Figure 2, Item 7), top or bottom end of tube in first.
6. Install filter-in tube (Figure 2, Item 3) in center housing assembly (Figure 2, Item 7), top or bottom end of tube in first.

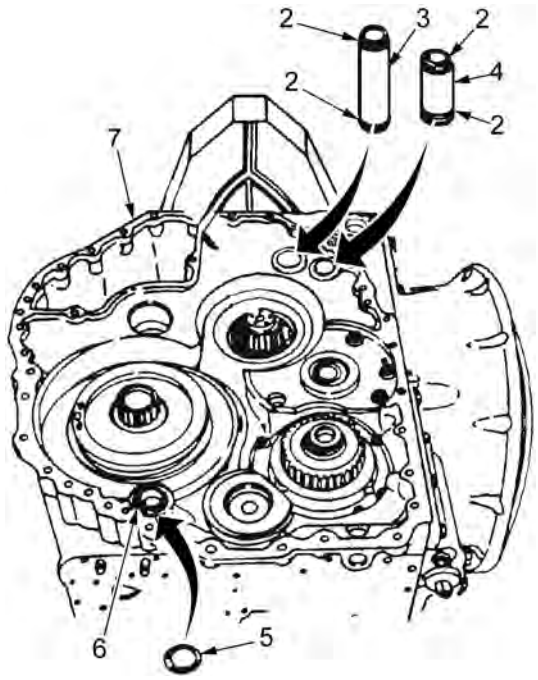


Figure 2. Filter Tubes and Packings Installation.

END OF TASK

INSTALL BEVEL GEAR DRIVEN SHAFT

CAUTION

Left cover assembly can be damaged if incorrect bevel gear driven gear shaft is installed. Make sure part identif cation and length of shaft is correct before installation.

P/N	Length
29533537	10.65 in. (270.51 mm), used with rear carrier assembly P/N 29533535

1. Install bevel gear driven shaft (Figure 3, Item 1) in center housing assembly (Figure 3, Item 7), top or bottom end of shaft f rst.

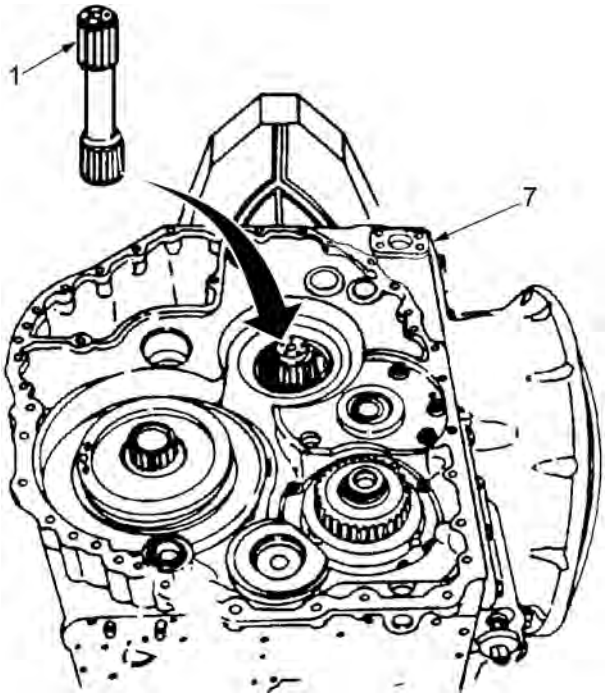


Figure 3. Bevel Gear Driven Shaft Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE CONVERTER ELEMENT COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Chisel, Cold, 3/8", Flat (WP 0079, Item 7)
Guide Pin, 5/16-24 x 3" (WP 0075, Item 2) (2)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Sling, Multiple-Leg (3 Legs) (WP 0079, Item 36)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 28) (2)
Gasket (WP 0080, Item 36)
Lubricating Oil, Engine (WP 0078, Item 10)
Locking Plate, Nut and Bolt (WP 0080, Item 37) (4)
Marker, Tube-Type, Black (WP 0078, Item 11)
Nut, Self-Locking, Hex (WP 0080, Item 2) (24)
Rag, Wiping (WP 0078, Item 13)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0040

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Transmission mounted on adapter plate on maintenance stand, input housing up (WP 0069)

REMOVE CONVERTER ELEMENT COMPONENTS

NOTE

Make sure that the transmission is on a maintenance stand so that the input housing points up.

If ring gear fails, use the procedure for removal of external ring gear. Do not remove ring gear unless converter pump cover assembly or ring gear is to be replaced. If ring gear is to be removed, go to Step 1. If ring gear is not to be removed, go to Step 5.

1. Put pry bar (Figure 1, Item 6) between two studs (Figure 1, Item 7) to keep converter pump cover assembly (Figure 1, Item 1) from turning when removing the f ex disk nuts (Figure 1, Item 4), if shipping brackets are not in place.
2. Remove six f ex disk nuts (Figure 1, Item 4) from the external-splined ring gear (Figure 1, Item 5). Remove shipping brackets if they are installed.
3. Install two 3/8-16 x 2 inch jack bolts (Figure 1, Item 2) in jack bolt holes (Figure 1, Item 3) in ring gear (Figure 1, Item 5).
4. Turn one jack bolt (Figure 1, Item 2), then turn the other jack bolt (Figure 1, Item 2), repeating until external-splined ring gear (Figure 1, Item 5) loosens from converter pump cover assembly (Figure 1, Item 1). Remove external-splined ring gear (Figure 1, Item 5).

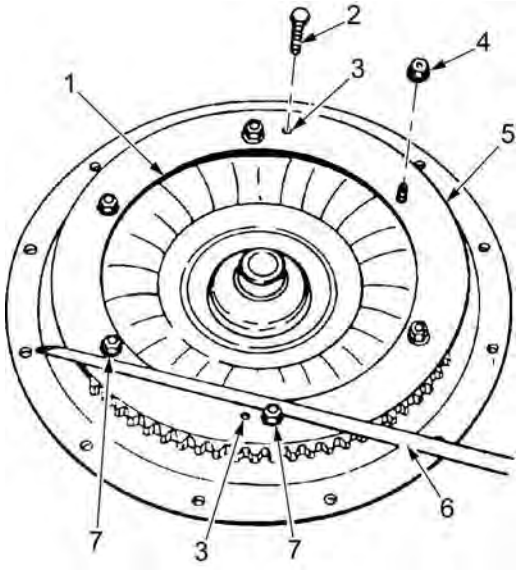


Figure 1. External-Splined Ring Gear Removal.

5. Put the pry bar (Figure 2, Item 6) between two studs (Figure 2, Item 7) to keep the converter pump cover assembly (Figure 2, Item 1) from turning when loosening nuts (Figure 2, Item 8).
6. Remove 24 self-locking hex nuts (Figure 2, Item 8) that attach the converter pump cover assembly (Figure 2, Item 1). Discard self-locking hex nuts (Figure 2, Item 8).

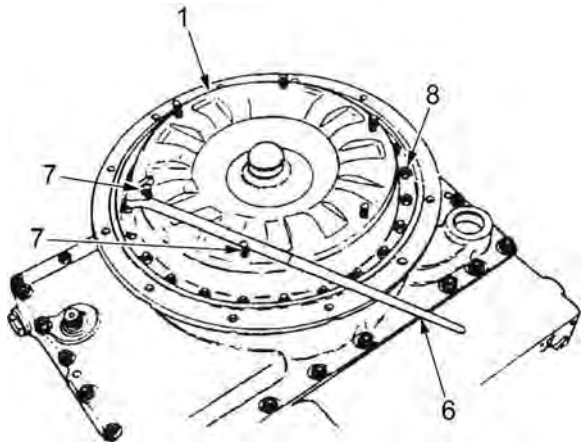


Figure 2. Converter Pump Cover Assembly Hardware Removal.

NOTE

Tap converter pump cover assembly with plastic-faced hammer to loosen, if necessary.

7. Using f ngers, pull up on two studs (Figure 3, Item 7) that are opposite each other and remove the converter pump cover assembly (Figure 3, Item 1) from the transmission.

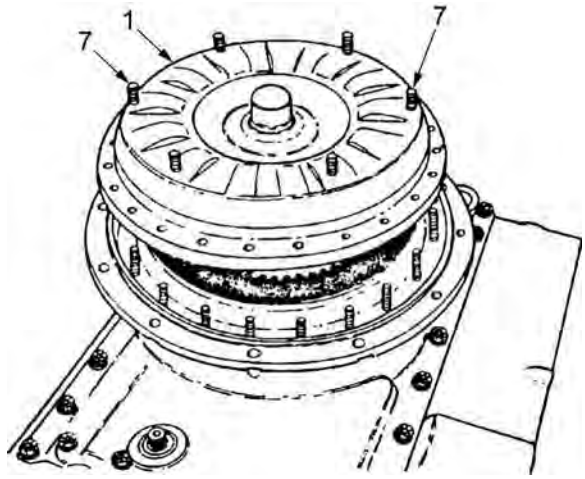


Figure 3. Converter Pump Cover Assembly Removal.

8. Lift the clutch plate (Figure 4, Item 9) from the converter assembly.
9. Remove clutch backing plate (Figure 4, Item 11) from the converter assembly using a pry bar.
10. Remove seal ring (Figure 4, Item 10) from clutch backing plate (Figure 4, Item 11). Check for sections that are missing or stretching out of shape. Discard seal ring (Figure 4, Item 10).
11. Remove retaining ring (Figure 4, Item 12) from turbine shaft (Figure 4, Item 13).

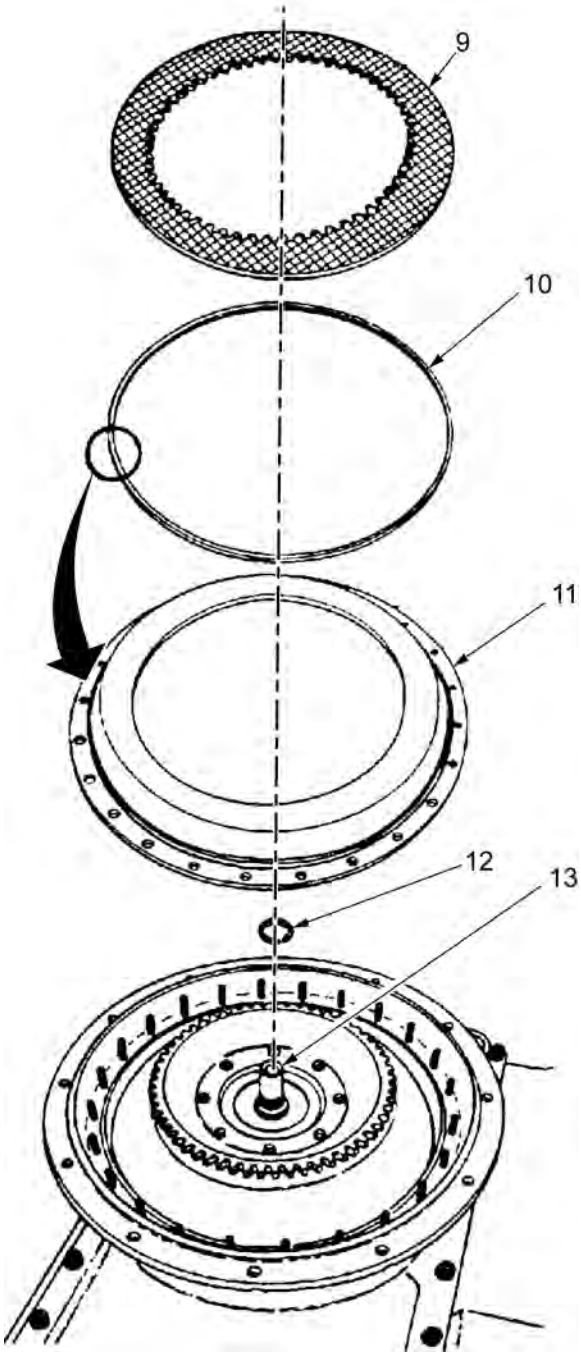


Figure 4. Clutch Elements Removal.

12. Remove the torque converter turbine assembly (Figure 5, Item 14) from the transmission.

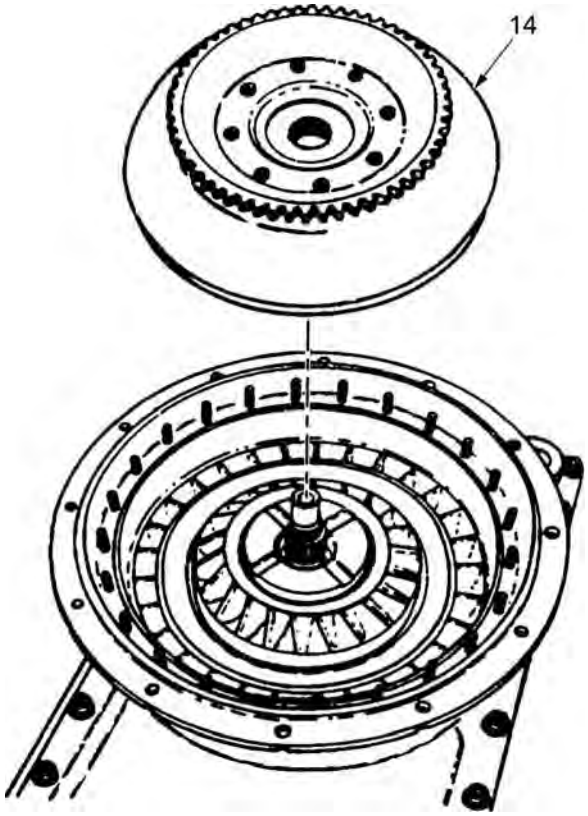


Figure 5. Converter Turbine Assembly Removal.

NOTE

The stator is removed from transmission with assembled parts inside that are held in position by two retaining rings.

13. Remove the stator (Figure 6, Item 15) from the transmission.

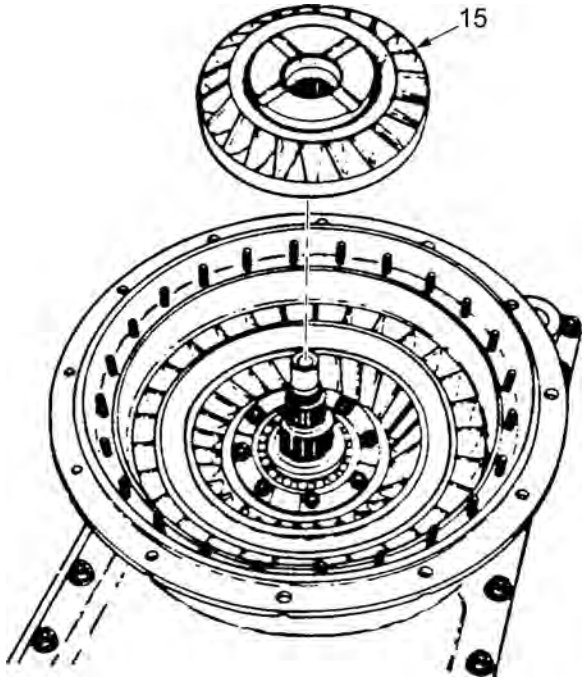


Figure 6. Stator Removal.

14. Remove gasket (Figure 7, Item 16) from the converter pump assembly (Figure 7, Item 17). Discard gasket (Figure 7, Item 16).
15. Bend the tabs on the ends of four locking strips (Figure 7, Item 19) away from the heads of eight cap screws (Figure 7, Item 18).

CAUTION

When you hold the pry bar between the stud and the input housing wall, use only enough force to keep pump from turning while you remove bolts. Using too much force on the pry bar can cause damage to the input housing wall or stud.

16. Put the end of the pry bar (Figure 7, Item 6) between the stud (Figure 7, Item 21) and the input housing wall. Hold the converter pump assembly (Figure 7, Item 17) so that it cannot turn.
17. Remove eight cap screws (Figure 7, Item 18) that attach the locking strips (Figure 7, Item 19) and the converter bearing retainer plates (Figure 7, Item 20) to converter pump assembly (Figure 7, Item 17).
18. Remove the four locking strips (Figure 7, Item 19) and the two converter bearing retainer plates (Figure 7, Item 20). Discard the four locking strips (Figure 7, Item 19).

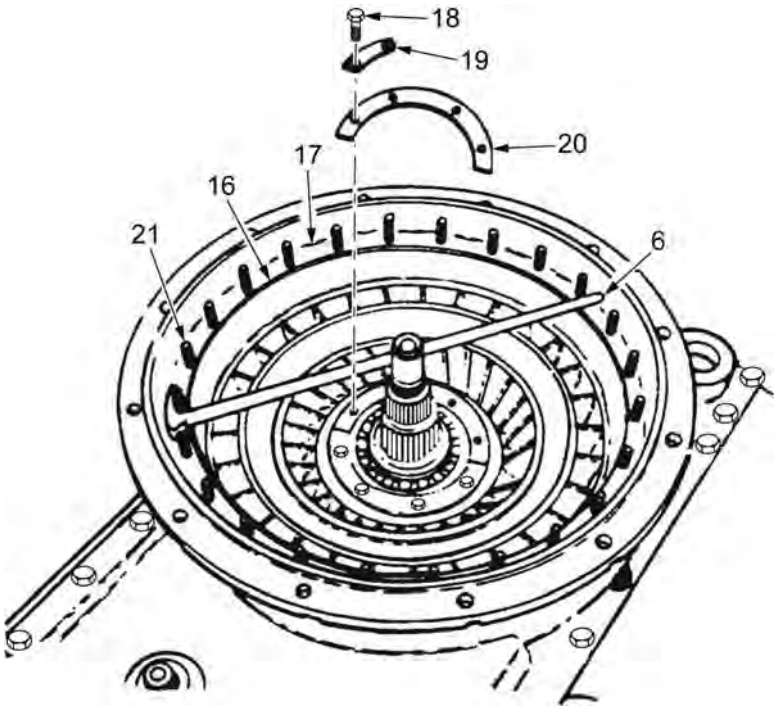


Figure 7. Converter Pump Assembly Disassembly.

NOTE

When you attach the multiple-leg sling to three studs at approximately equal distances apart, there will be seven studs between sling lugs in two places and eight studs between sling lugs in one place.

19. Put three lugs of the multiple-leg sling (Figure 8, Item 25) over studs (Figure 8, Item 21) that are at equal distances apart on the converter pump assembly (Figure 8, Item 17), and install three 5/16-24 inch hex nuts (Figure 8, Item 22) and three 5/16 inch washers (Figure 8, Item 23). Tighten the nuts with your fingers.
20. Tap on the converter pump assembly (Figure 8, Item 17) as you pull up on the pump with the multiple-leg sling (Figure 8, Item 25). Remove the converter pump assembly (Figure 8, Item 17).
21. Remove three 5/16-24 inch hex nuts (Figure 8, Item 22), three 5/16 inch washers (Figure 8, Item 23), and the multiple-leg sling (Figure 8, Item 25) from the converter pump assembly (Figure 8, Item 17).

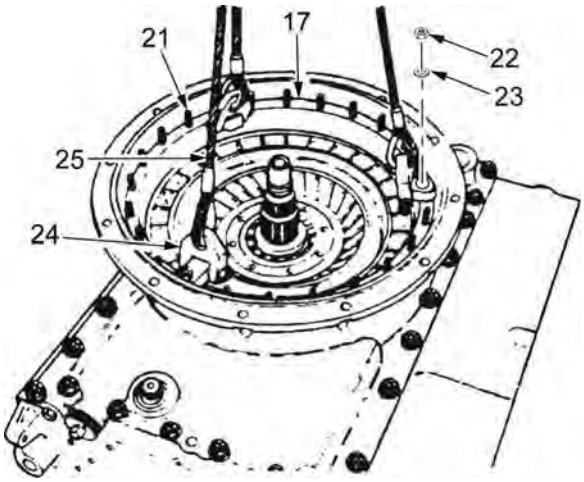


Figure 8. Converter Pump Assembly Removal.

22. Remove the converter pump gasket (Figure 9, Item 26) from inside the input housing (Figure 9, Item 27). Discard gasket (Figure 9, Item 26).

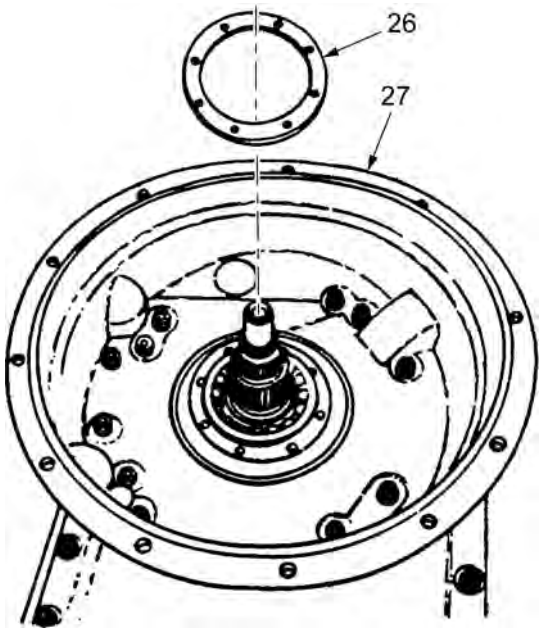


Figure 9. Converter Pump Gasket Removal.

END OF TASK

INSTALL CONVERTER ELEMENT COMPONENTS

NOTE

Make sure that the transmission is on maintenance stand so that the input housing points up.

1. Install two 5/16-24 x 3 inch guide pins (Figure 10, Item 28) 180 degrees apart in the shoulder of the input pump drive gear (Figure 10, Item 29).
2. Install new converter pump gasket (Figure 10, Item 26) over the guide pins (Figure 10, Item 28) and on the shoulder of the input pump drive gear (Figure 10, Item 29).

NOTE

You will not be able to see the manufacturer's balance mark after you install the converter pump. Using a black marker, put a mark at the location of the balance mark near a stud so that you can see it from the top view of the converter pump.

3. Install the converter pump assembly (Figure 10, Item 17) over guide pins (Figure 10, Item 28).

NOTE

Make sure the converter pump assembly is down far enough to allow the inner lips on the converter bearing retainer plate to touch and align with groove on bearing.

4. Tap the converter pump assembly (Figure 10, Item 17) to install the pump on gasket (Figure 10, Item 26).
5. Remove two guide pins (Figure 10, Item 28).

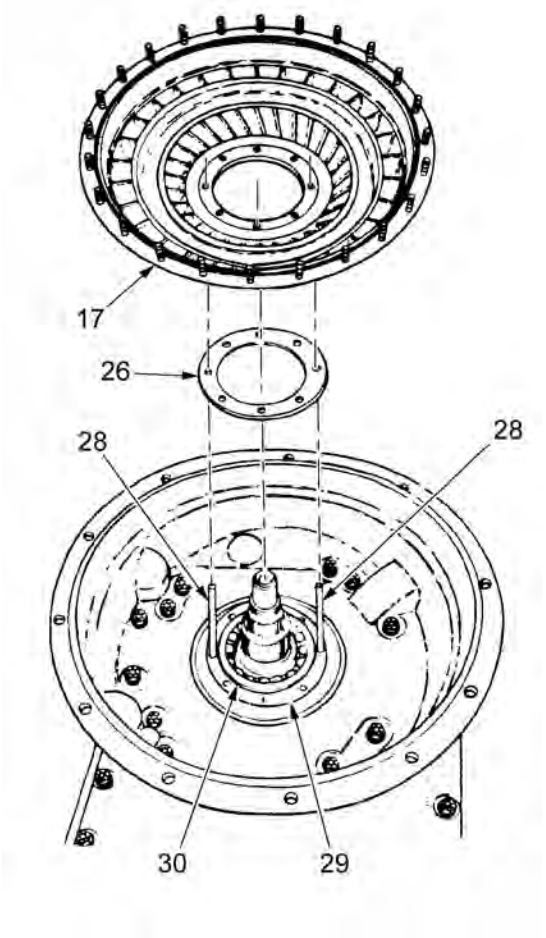


Figure 10. Converter Pump Gasket and Converter Pump Assembly Installation.

6. Put two converter bearing retainer plates (Figure 11, Item 20) over eight bolt holes in the converter pump assembly (Figure 11, Item 17) and into groove in bearing (Figure 11, Item 30).

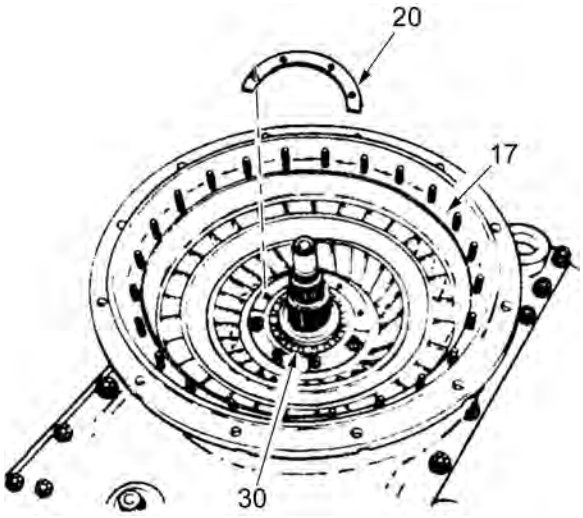


Figure 11. Retainer Places Installation.

NOTE

The two locking plates go over the two bolt holes on the retainers.

7. Place four new locking strips (Figure 12, Item 19) on the converter bearing retainer plates (Figure 12, Item 20), bent tabs up.
8. Install eight cap screws (Figure 12, Item 18) in locking strips (Figure 12, Item 19) and converter bearing retainer plates (Figure 12, Item 20).
9. Use a pry bar to keep the converter pump assembly (Figure 12, Item 17) from turning. Torque eight cap screws (Figure 12, Item 18) to 19 to 23 lb-ft (25 to 31 N·m). Remove pry bar.

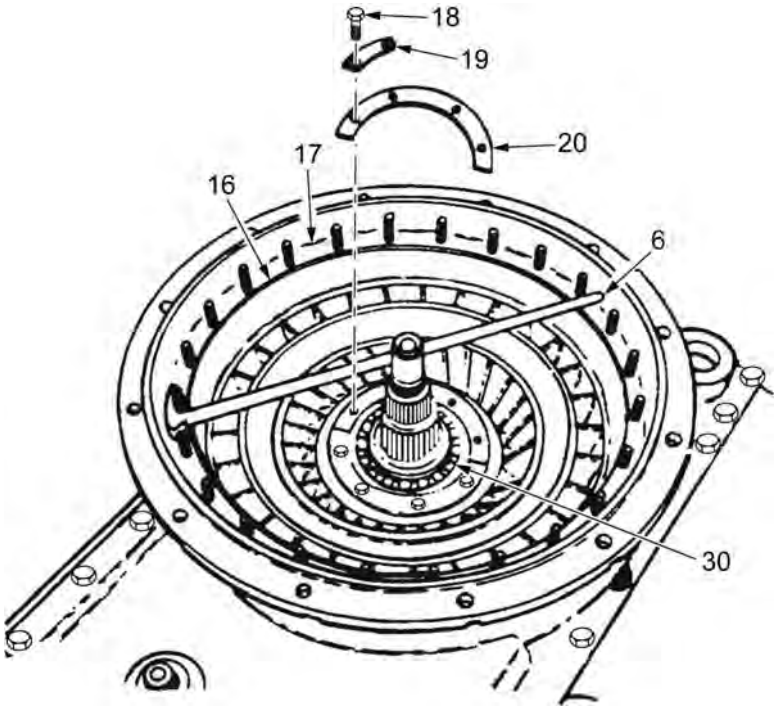


Figure 12. Converter Pump Assembly Hardware Installation.

10. Bend all eight tabs of locking strips (Figure 13, Item 19) at ends of four converter bearing retainer plates (Figure 13, Item 20) so that tabs are against f ats of cap screws (Figure 13, Item 18).

NOTE

Do not lubricate the 13.750 in. (349.25 mm) Inside Diameter (ID) gasket installed in the next step.

11. Install new gasket (Figure 13, Item 16) in groove near pump studs (Figure 13, Item 21).

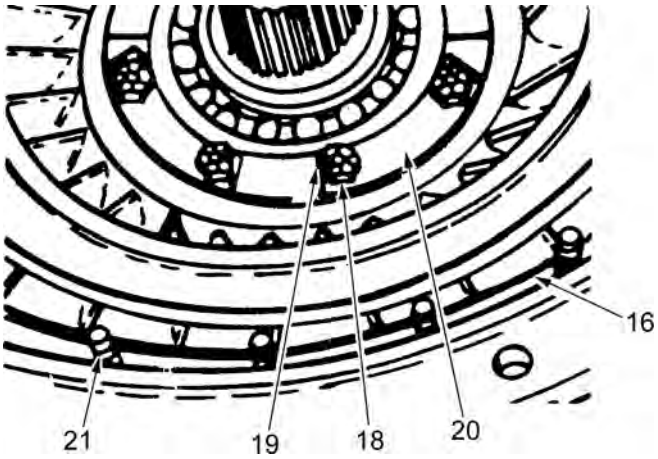


Figure 13. Gasket Installation.

NOTE

The stator, as used in the steps that follow, refers to the stator and all of the assembled parts that are held in the stator by two retaining rings. For access to the parts within the stator group, refer to Repair Converter Pump Components (WP 0040).

12. Install stator (Figure 14, Item 15) over turbine shaft (Figure 14, Item 13) so that the clutch plate (Figure 14, Item 31) side of stator points up.

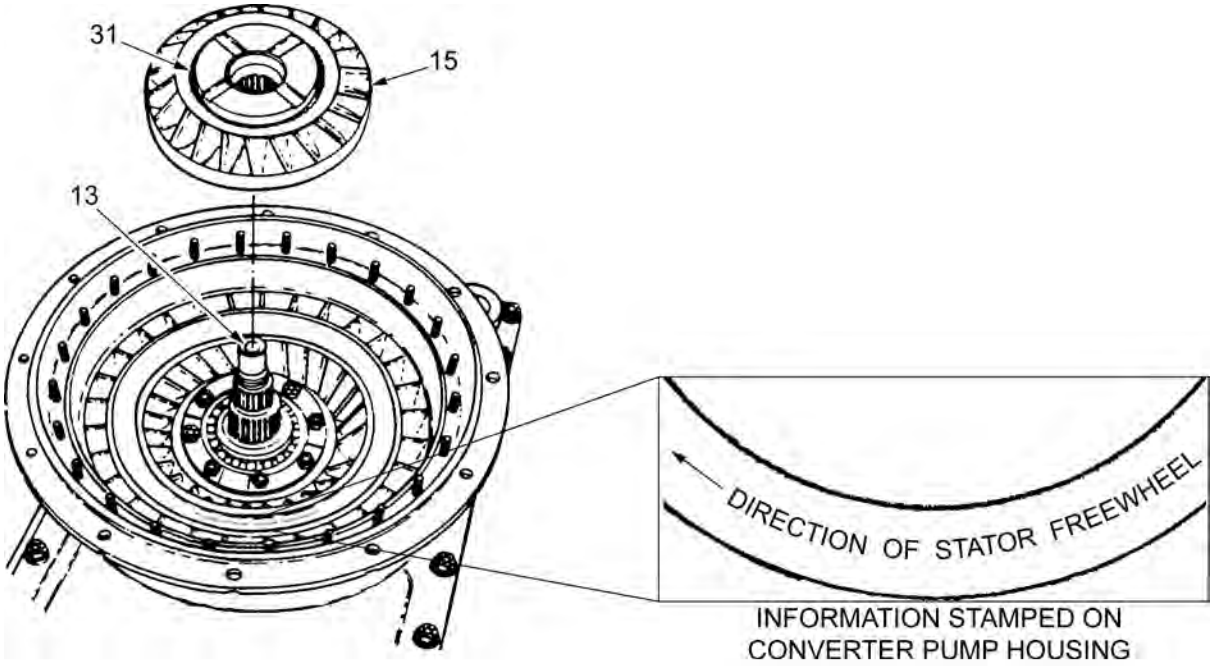


Figure 14. Stator Installation.

NOTE

The steps that follow are a check on the assembly of stator components. If the stator turns when you turn it to the right (clockwise) but does not move when you turn it to the left (counterclockwise), the rollers and springs were properly installed in the stator group.

If the stator does not move when turned to the right (clockwise), the freewheel roller springs and rollers have been incorrectly installed. Refer to Repair Converter Pump Components (WP 0040).

13. Turn the stator (Figure 15, Item 15) to the right (clockwise). The stator will not turn to the left (counterclockwise).
14. Install the torque converter turbine assembly (Figure 15, Item 14) on the turbine shaft (Figure 15, Item 13).

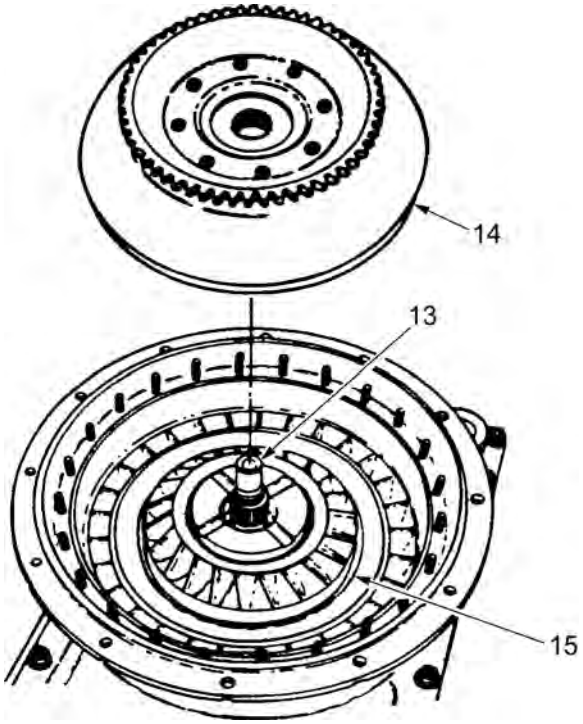


Figure 15. Converter Turbine Assembly Installation.

15. Install the retaining ring (Figure 16, Item 12) on the turbine shaft (Figure 16, Item 13) to hold the torque converter turbine assembly (Figure 16, Item 14).

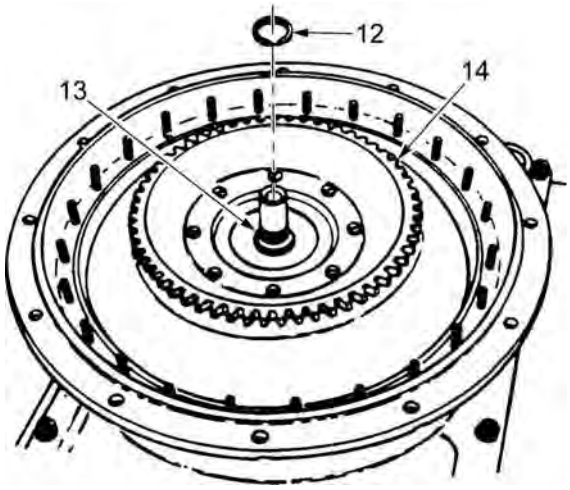


Figure 16. Retaining Ring Installation on Turbine Shaft.

NOTE

Do not lubricate the seal ring.

16. Install new seal ring (Figure 17, Item 10) in the clutch backing plate (Figure 17, Item 11).

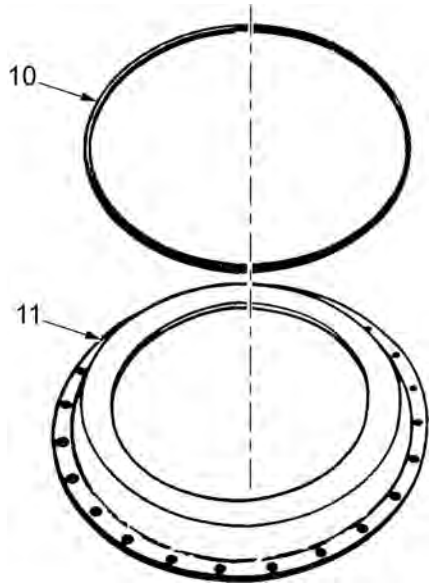


Figure 17. Seal Ring Installation on Clutch Backing Plate.

NOTE

Balance marks are used on the clutch backing plate and on the converter pump housing. Install the clutch backing plate so that these two balance marks are aligned, as shown in Figure 18.

17. Install the clutch backing plate (Figure 19, Item 11) on the torque converter turbine assembly (Figure 19, Item 14) and on the converter pump assembly (Figure 19, Item 17) studs so that the balance marks align.

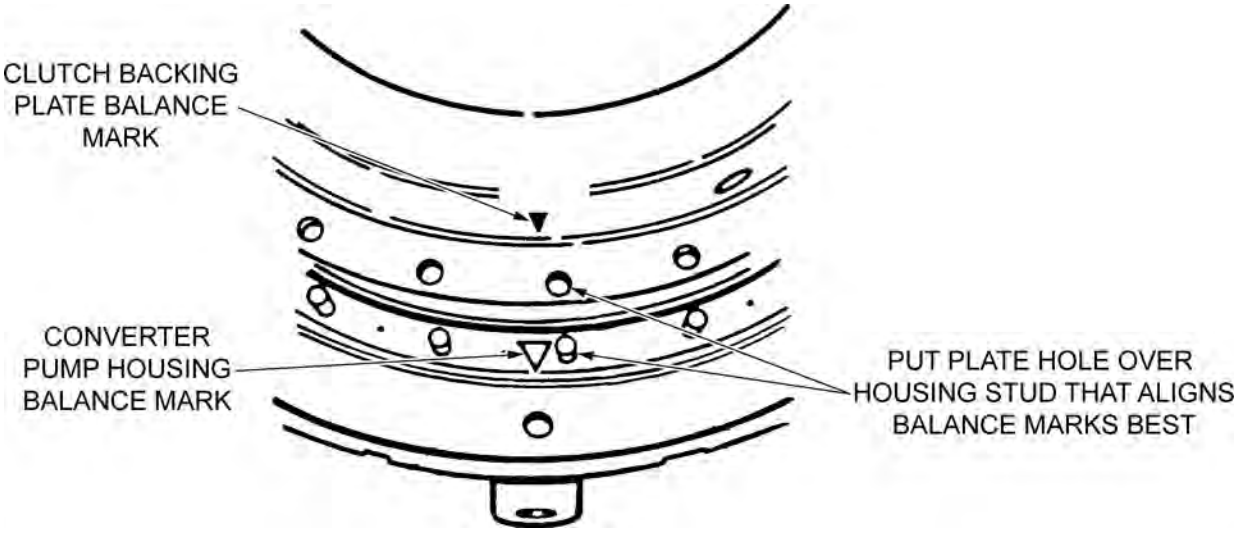


Figure 18. Balance Marks.

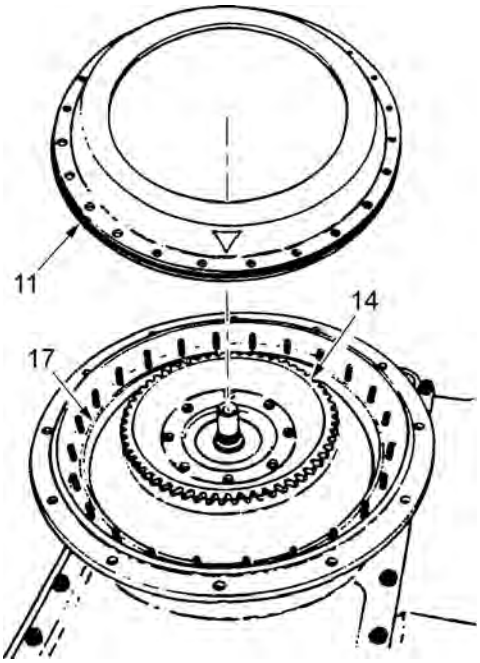


Figure 19. Clutch Backing Plate Installation.

NOTE

Put the clutch plate fully into a container of lubricating oil for a minimum of two minutes before you install it.

18. Put the clutch plate (Figure 20, Item 9) fully into a container of lubricating oil.
19. Install the clutch plate (Figure 20, Item 9) on the clutch backing plate (Figure 20, Item 11) so that inside of clutch plate engages the splined area of the torque converter turbine assembly (Figure 20, Item 14).

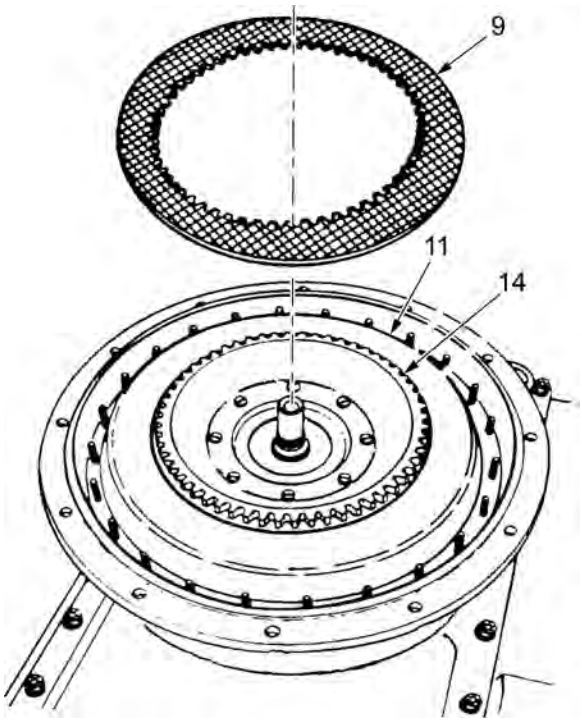


Figure 20. Clutch Plate Installation.

NOTE

The converter pump cover assembly has a balance mark. This balance mark must align with the balance mark on the clutch backing plate. Align the pump cover holes with the pump housing studs so that clutch backing plate balance mark will be at the nearest point under the converter pump cover assembly balance mark.

20. Dry the edge of the converter pump cover assembly (Figure 21, Item 1) that is nearest the balance mark (Figure 21, Item 33) with a wiping rag.
21. Put a mark across the edge of the converter pump cover assembly (Figure 21, Item 1) at the point nearest the pump cover balance mark (Figure 21, Item 33) using a black marker.
22. Lift the converter pump cover assembly (Figure 21, Item 1) by the two studs on top and hold the pump cover above the clutch backing plate (Figure 21, Item 11) so that the black mark on the edge of the pump cover (Figure 21, Item 32) aligns with the balance mark on the clutch backing plate (Figure 21, Item 11).
23. Put the converter pump cover assembly (Figure 21, Item 1) on the converter pump assembly (Figure 21, Item 17) studs so that the balance mark and black mark on the converter pump cover assembly (Figure 21, Item 1) are at the nearest point to the balance mark on the clutch backing plate (Figure 21, Item 11).
24. Tap the converter pump cover assembly (Figure 21, Item 1) to install the cover on the converter pump assembly (Figure 21, Item 17) studs.

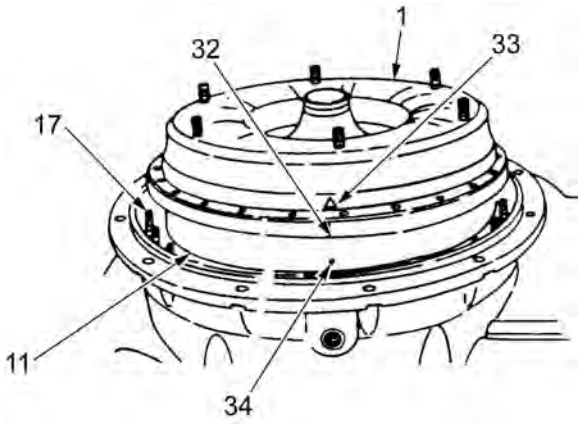


Figure 21. Converter Pump Cover Installation.

25. Install a pry bar (Figure 22, Item 6) between two studs on top of the converter pump cover assembly (Figure 22, Item 1), if necessary, to keep the cover from turning when you install self-locking nuts (Figure 22, Item 8).
26. Install 24 new self-locking nuts (Figure 22, Item 8) on the converter pump housing studs (Figure 22, Item 21) that attach the converter pump cover assembly (Figure 22, Item 1).
27. Torque 24 nuts (Figure 22, Item 8) to 19 to 23 lb-ft (26 to 31 N·m).

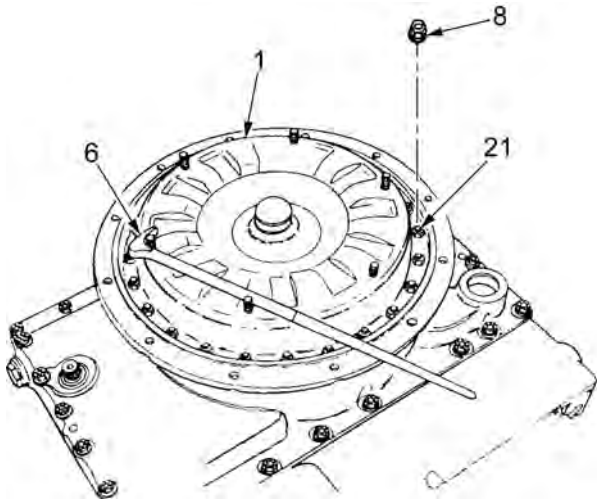


Figure 22. Converter Pump Cover Assembly Hardware Installation.

NOTE

Remove or install the external-splined ring gear only when the external-splined ring gear fails or when the converter pump cover assembly is replaced.

28. Install the ring gear (Figure 23, Item 5) over six studs (Figure 23, Item 7) on top of the converter pump cover assembly (Figure 23, Item 1).
29. Using plastic-faced hammer, tap ring gear (Figure 23, Item 5) until it is installed on the converter pump cover assembly (Figure 23, Item 1).
30. Use pry bar (Figure 23, Item 6) between two studs (Figure 23, Item 7) on top of the converter pump cover assembly (Figure 23, Item 1) to keep cover and ring gear (Figure 23, Item 5) from turning.
31. Install six new f ex disk nuts (Figure 23, Item 4) on the studs (Figure 23, Item 7) that attach the ring gear (Figure 23, Item 5) to the converter pump cover assembly (Figure 23, Item 1).
32. Torque six nuts (Figure 23, Item 4) to 41 to 44 lb-ft (56 to 60 N·m).

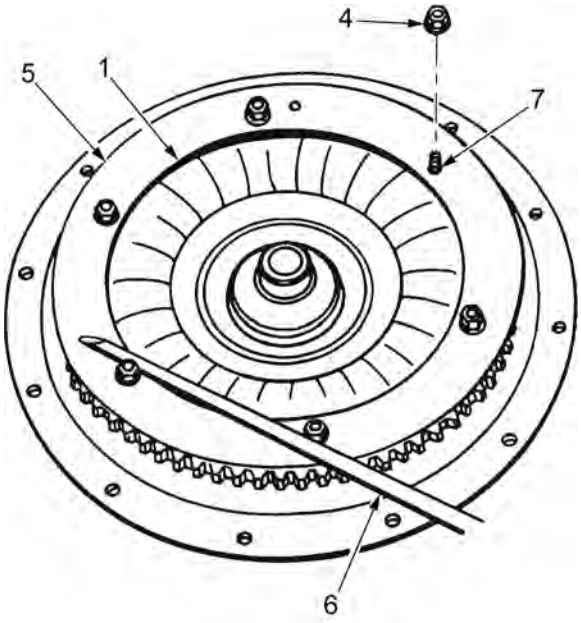


Figure 23. External-Splined Ring Gear Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR CONVERTER PUMP COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Chisel, Cold, 3/8”, Flat (WP 0079, Item 7)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)

Materials/Parts
Lubricating Oil, Engine (WP 0078, Item 10)
O-Ring (WP 0080, Item 11)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal Ring, Transmission (WP 0080, Item 10)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Converter element components removed (WP 0038)

REPAIR CONVERTER ELEMENT COMPONENTS

Disassemble Converter Pump Cover Assembly

1. Remove retaining ring (Figure 1, Item 1).
2. Turn converter pump assembly over (studs up) and let assembly fall on work bench to remove piston (Figure 1, Item 2).
3. Remove transmission seal ring (Figure 1, Item 5) from piston (Figure 1, Item 2), and O-ring (Figure 2, Item 3) from retainer (Figure 1, Item 4). Discard transmission seal ring (Figure 1, Item 5) and O-ring (Figure 2, Item 3).

NOTE

Do Step 4 only if retainer needs to be replaced.

4. Remove retainer (Figure 1, Item 4) from converter pump assembly (Figure 1, Item 6).

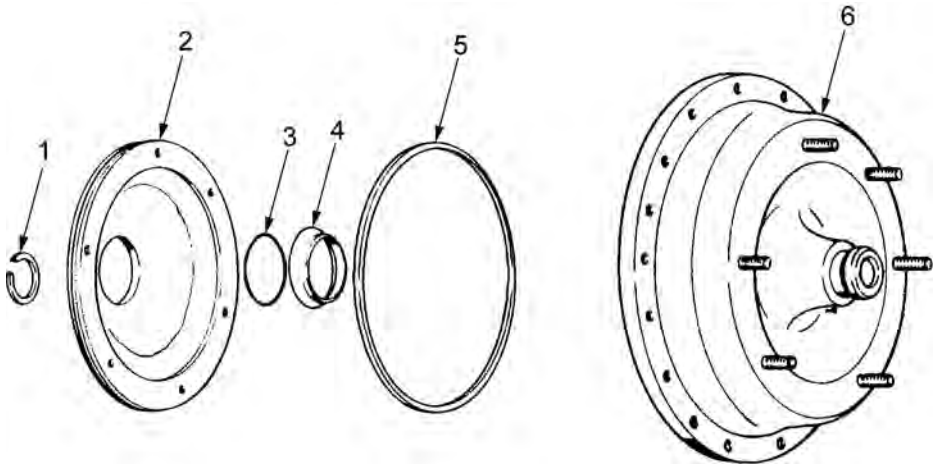


Figure 1. Converter Element Components Disassembly.

Assemble Converter Pump Cover Assembly

1. Install retainer (Figure 2, Item 4) to a seat in pump cover (Figure 2, Item 6).
2. Install new transmission seal ring (Figure 2, Item 5) onto piston (Figure 2, Item 2) and new O-ring (Figure 2, Item 3) onto retainer (Figure 2, Item 4). Apply lubricating oil to O-ring (Figure 2, Item 3) and transmission seal ring (Figure 2, Item 5).
3. Install piston (Figure 2, Item 2) into converter pump cover assembly (Figure 2, Item 6), aligning bleed hole (Figure 3, Item 7) in piston (Figure 3, Item 2) with stud in cover (Figure 2, Item 6).
4. Install retaining ring (Figure 2, Item 1).

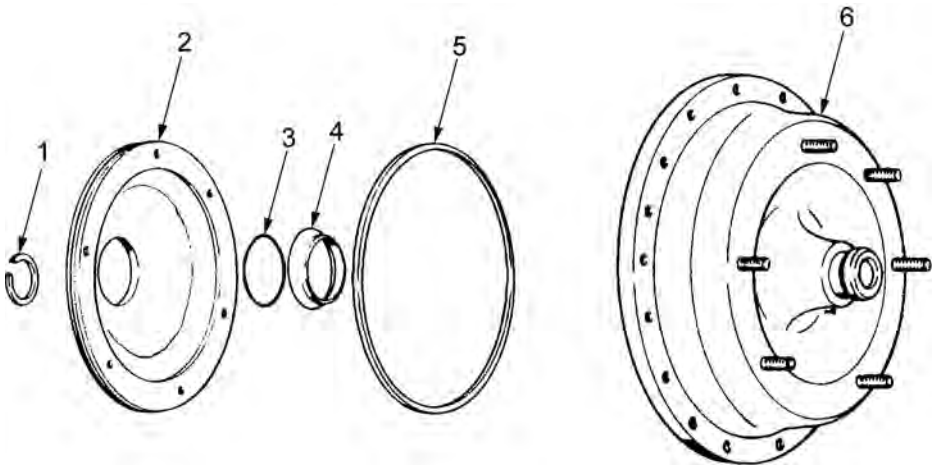


Figure 2. Converter Element Components Assembly.

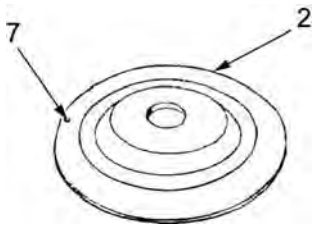


Figure 3. Bleed Hole in Piston.

Disassemble Stator Group

1. Remove retaining ring (Figure 4, Item 8) from stator (Figure 4, Item 19).
2. Pull up on race (Figure 4, Item 9). Remove rear stator washer (Figure 4, Item 9).
3. Remove thrust washer (Figure 4, Item 10).

NOTE

Springs and rollers will fall free from cam when race is removed.

4. Remove race (Figure 4, Item 11). Springs (Figure 4, Item 13) and rollers (Figure 4, Item 14) will fall free from cam (Figure 4, Item 12). Remove cam (Figure 4, Item 12).
5. Remove thrust washer (Figure 4, Item 15).
6. Remove bearing (Figure 4, Item 16) and race (Figure 4, Item 17).
7. Remove clutch disk (front stator washer) (Figure 4, Item 18).
8. Remove retaining ring (Figure 4, Item 20).

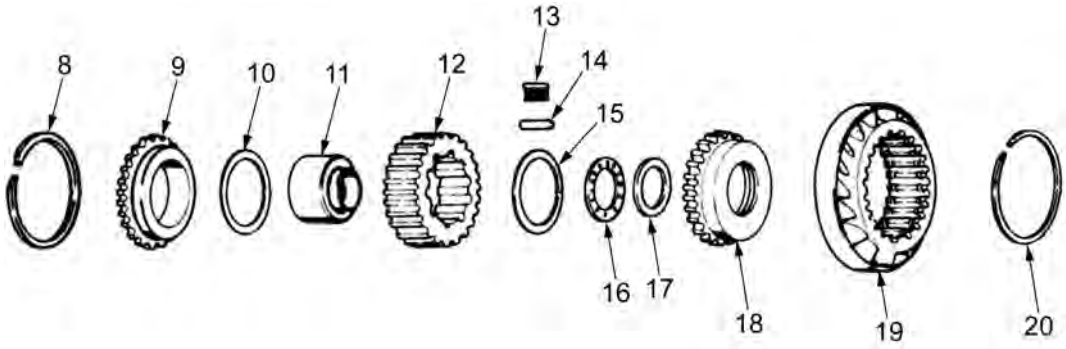


Figure 4. Stator Components Disassembly.

Assemble Stator Group

1. Install retaining ring (Figure 5, Item 20) into stator (Figure 5, Item 19).
2. Install clutch disk (front stator washer) (Figure 5, Item 18).
3. Install race (Figure 5, Item 17) and bearing (Figure 5, Item 16).
4. Install thrust washer (Figure 5, Item 15).
5. Install race (Figure 5, Item 11).
6. Install cam (Figure 5, Item 12).
7. Use petrolatum to hold parts in position and install 12 springs (Figure 5, Item 13) and rollers (Figure 5, Item 14) into cam (Figure 5, Item 12) in position shown in illustration. The open end of the spring touching the roller must be toward the center of cam (Figure 5, Item 12). Rollers (Figure 5, Item 14) are installed in the shallow ends of cam (Figure 5, Item 12) pockets.
8. Install thrust washer (Figure 5, Item 10).
9. Install rear stator washer (Figure 5, Item 9).
10. Install retaining ring (Figure 5, Item 8).

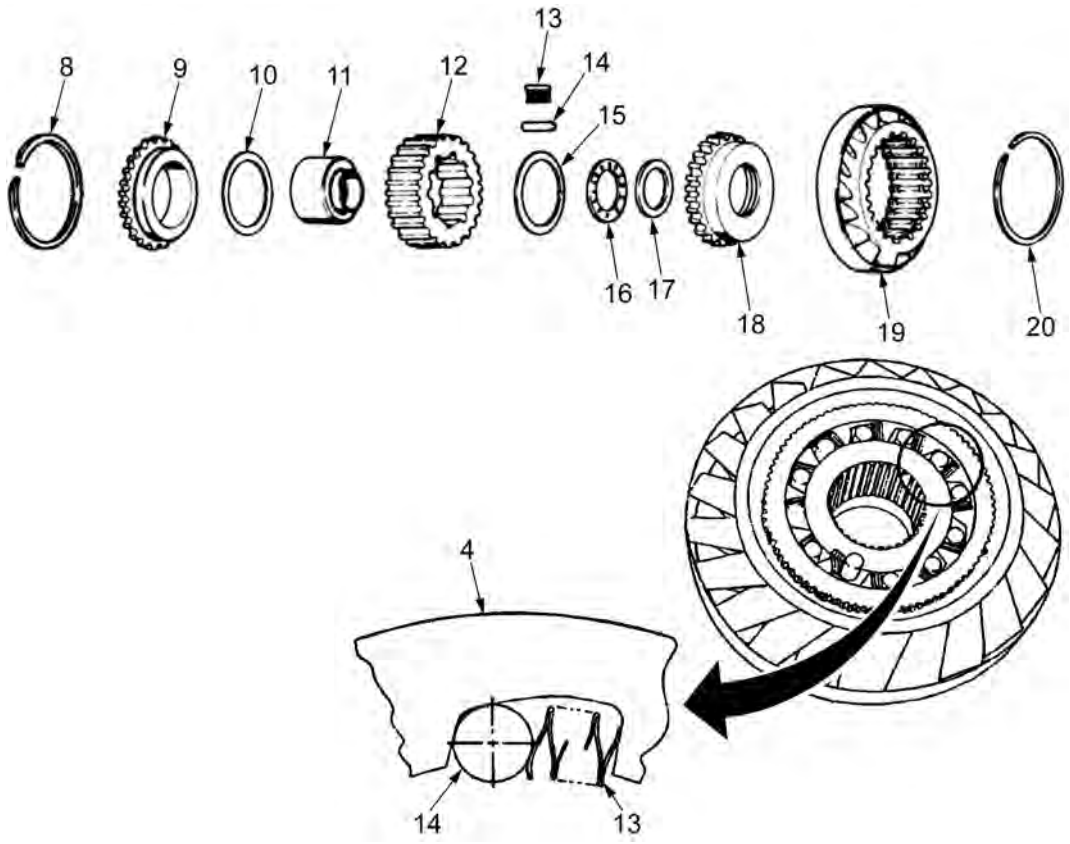


Figure 5. Stator Components Assembly.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE INPUT HOUSING ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Bar, Pry, Wrecking, 30” (WP 0079, Item 5)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Adhesive, Sealant, Silicone, RTV, Non-Corrosive, Type 1 (WP 0078, Item 1)
Gasket (WP 0080, Item 32)
Gasket (WP 0080, Item 35)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Packing, Preformed(WP 0080, Item 54)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Converter element components removed (WP 0039)

REMOVE INPUT HOUSING ASSEMBLY

NOTE

Transmission is on maintenance stand, input housing turned up.

1. Remove 11 bolts (Figure 1, Item 1) and washers (Figure 1, Item 2) from inner area of input housing (Figure 1, Item 3).
2. Remove two bolts (Figure 2, Item 4) and washers (Figure 2, Item 5) from left side of input housing (Figure 2, Item 3).

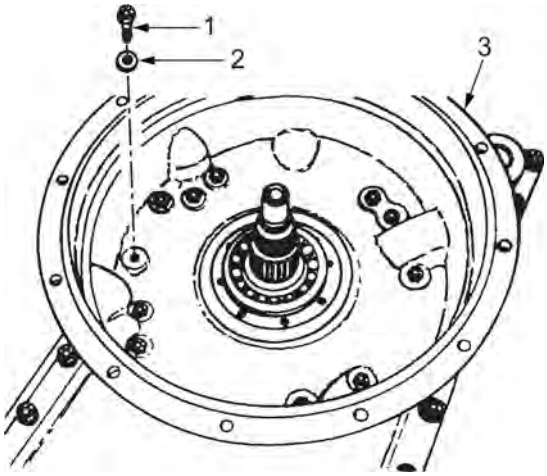


Figure 1. Input Housing Hardware Removal, Inner Area.

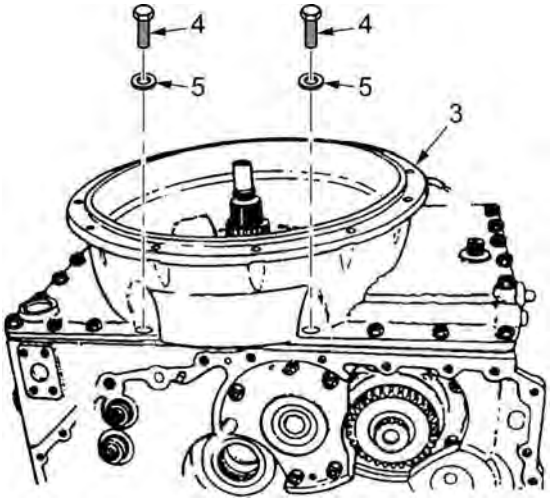


Figure 2. Input Housing Hardware Removal, Left Side.

3. Remove bolt (Figure 3, Item 10) and washer (Figure 3, Item 9).
4. Remove the remaining 24 bolts (Figure 3, Item 6) and washers (Figure 3, Item 7) that hold the input housing (Figure 3, Item 3) to the transmission (Figure 3, Item 8).
5. Install 3/8-16 x 2-3/4 inch jack bolt (Figure 4, Item 11) in jack bolt hole (Figure 4, Item 14) near center at top end of input housing (Figure 4, Item 3).
6. Install 3/8-16 x 1-1/4 inch jack bolt (Figure 4, Item 12) in jack bolt hole (Figure 4, Item 13) near center at bottom end of input housing (Figure 4, Item 3).
7. Equally tighten jack bolts (Figure 4, Item 11) and (Figure 4, Item 12) until input housing (Figure 4, Item 3) loosens from transmission (Figure 4, Item 8).
8. Remove jack bolts (Figure 4, Item 11) and (Figure 4, Item 12) from input housing (Figure 4, Item 3).
9. Remove input housing (Figure 4, Item 3) from transmission (Figure 4, Item 8).

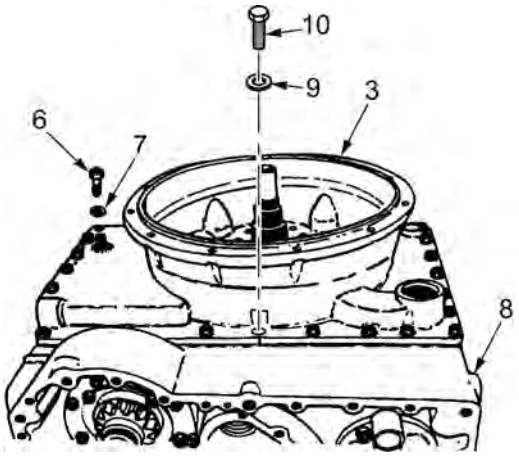


Figure 3. Input Housing Hardware Removal and Jack Bolt Installation.

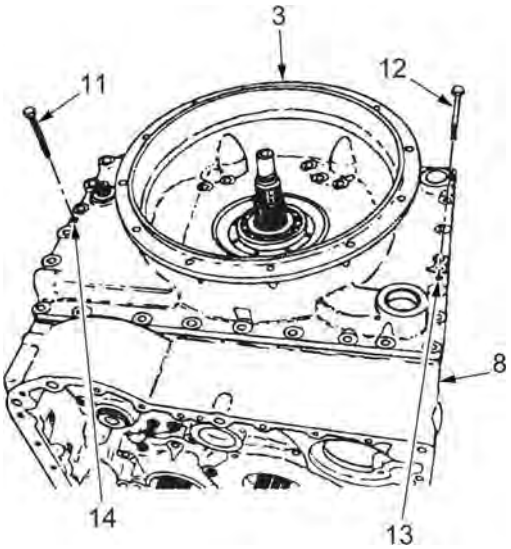


Figure 4. Input Housing Removal.

NOTE

Examine input housing seal. It is not necessary to remove seal unless defective. If seal is defective, go to Steps 10 and 11. If seal is serviceable, go to Step 12.

10. Turn input housing (Figure 5, Item 3) over, bell housing down.
11. Using hammer and center punch, drive against wall of input housing seal (Figure 5, Item 15) in two places about 180 degrees apart. Push seal (Figure 5, Item 15) down into bell housing area.

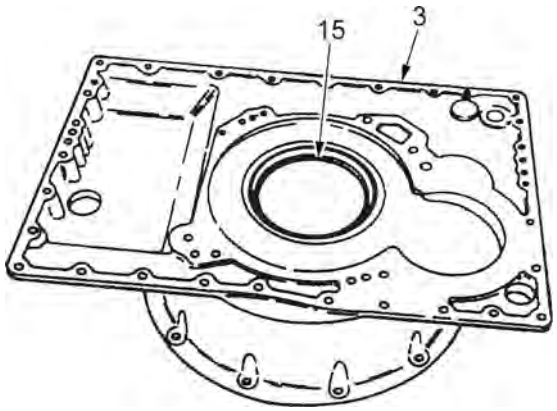


Figure 5. Input Housing Seal Removal.

12. Remove input housing gasket (Figure 6, Item 17) from transmission center housing assembly (Figure 6, Item 21). Discard gasket (Figure 6, Item 17).
13. Remove bevel gear gasket (Figure 6, Item 16) from bevel gear assembly (Figure 6, Item 18). Discard gasket (Figure 6, Item 16).
14. Remove seal (Figure 6, Item 19) from steer shaft (Figure 6, Item 20) on transmission center housing assembly (Figure 6, Item 21). Discard seal (Figure 6, Item 19).

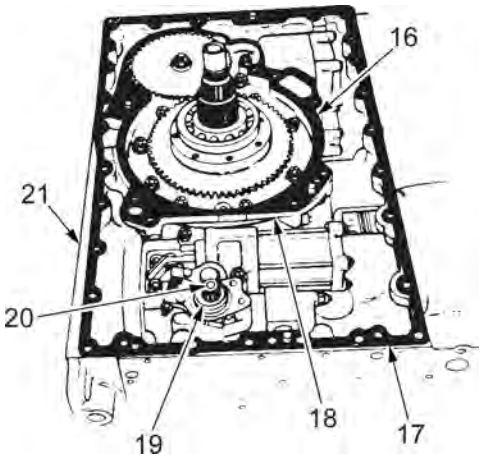


Figure 6. Input Housing Gasket, Bevel Gear Gasket, and Steer Shaft Seal Removal.

END OF TASK

INSTALL INPUT HOUSING ASSEMBLY

WARNING

Do not turn transmission over. If transmission is turned on maintenance stand before input housing is installed, bevel gear assembly will fall out and can cause injury.

NOTE

Transmission is on maintenance stand, input side turned up.

1. Install new bevel gear gasket (Figure 7, Item 16) on bevel gear assembly (Figure 7, Item 18).
2. Install new input housing gasket (Figure 7, Item 17) on center housing assembly (Figure 7, Item 21).

CAUTION

RTV adhesive-sealant starts to cure very quickly. Therefore, it is necessary for the input housing to be installed onto the transmission main housing within 30 minutes of applying RTV to steer shaft seal.

3. Install new seal (Figure 7, Item 19) on steer shaft (Figure 7, Item 20) with thin lip of seal out.
4. Apply a 0.25 in. (6.3 mm) maximum width bead of RTV adhesive-sealant around the Outside Diameter (OD) of seal.

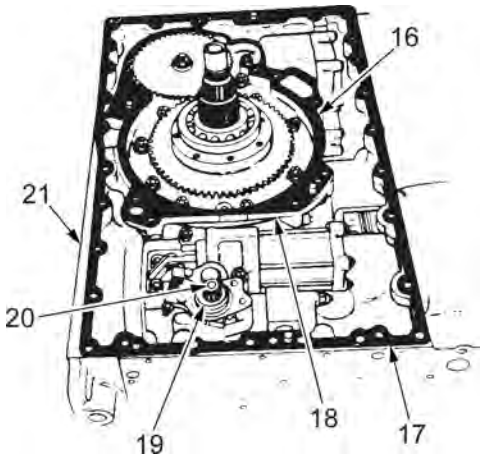


Figure 7. Input Housing Gasket, Bevel Gear Gasket, and Steer Shaft Seal Installation.

NOTE

If seal was removed, do Steps 5 and 6. If seal was not removed, go to Step 7.

5. Turn input housing over, bell housing up.

CAUTION

Be careful not to push seal too much or you will crush metal part of seal. This can cause damage to seal or damage to shoulder of input housing.

6. Using plastic-faced hammer and machinist's hammer as necessary, carefully and evenly tap new seal (Figure 8, Item 15) into input housing (Figure 8, Item 3). Push side of seal with number out, until rubber nose of seal (Figure 8, Item 15) is against shoulder of input housing (Figure 8, Item 3).
7. Do a check to make sure rubber nose of seal (Figure 8, Item 15) is sealed against shoulder of input housing (Figure 8, Item 3). If not, continue to push seal 0.002 to 0.004 in. (0.06 to 0.10 mm) at a time until rubber nose of seal (Figure 8, Item 15) is against shoulder of input housing (Figure 8, Item 3).
8. Apply petrolatum to lip of seal.

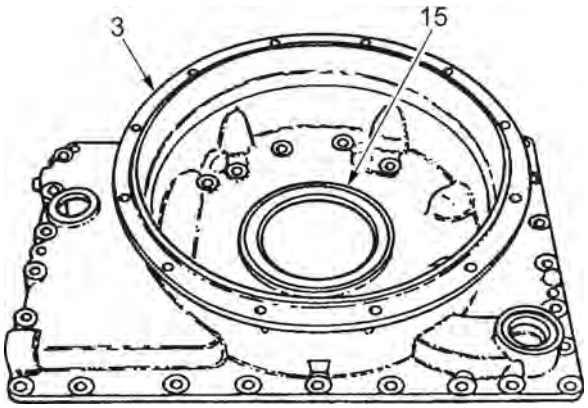


Figure 8. Seal Installation.

9. Install input housing (Figure 9, Item 3) onto center housing assembly (Figure 9, Item 21).
10. Put tip of small screwdriver between seal (Figure 9, Item 15) and shoulder of input pump drive gear (Figure 9, Item 28) to keep lip of seal turned in proper direction.

CAUTION

Do not pull bevel gear assembly and input housing together with only one bolt. Weight of bevel gear assembly will strip threads off bolt.

11. Align one bolt (Figure 9, Item 27) with hole. Start one 7/16-14 x 1-1/4 inch bolt (Figure 9, Item 26) and washer (Figure 9, Item 27). Start two remaining bolts (Figure 9, Item 26) and two washers (Figure 9, Item 27), aligning holes as necessary.
12. Start six 7/16-14 x 1-1/4 inch bolts (Figure 9, Item 24) and six washers (Figure 9, Item 25) in input housing (Figure 9, Item 3).
13. Install nine bolts (Figure 9, Item 24) and (Figure 9, Item 26) into input housing (Figure 9, Item 3) until tight.
14. Torque nine bolts (Figure 9, Item 24) and (Figure 9, Item 26) to 54 to 65 lb-ft (73 to 88 N·m).
15. Install two zinc-plated 3/8-16 x 1-1/4 inch bolts (Figure 9, Item 23) and two washers (Figure 9, Item 22) in input housing (Figure 9, Item 3).

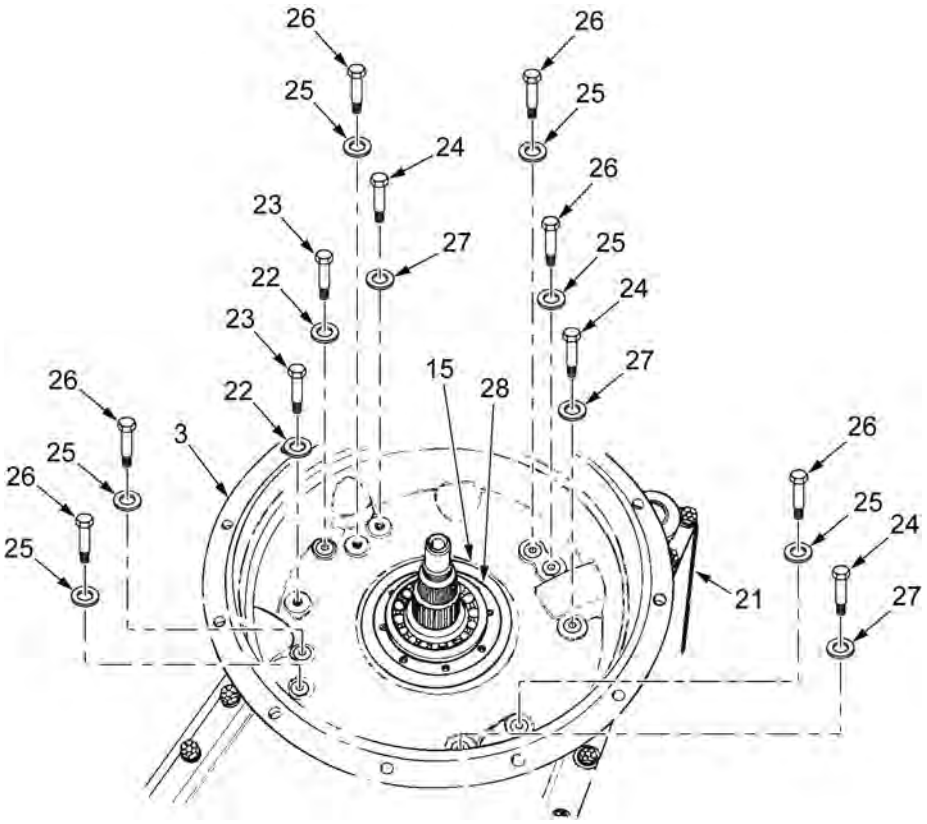


Figure 9. Input Housing Hardware Installation, Inner Area.

16. Install five zinc-plated 3/8-16 x 2-3/4 inch bolts (Figure 10, Item 29) and five washers (Figure 10, Item 30) in input housing (Figure 10, Item 3).
17. Install two zinc-plated 3/8-16 x 1-1/4 inch bolts (Figure 10, Item 4) and two washers (Figure 10, Item 5) in input housing (Figure 10, Item 3).

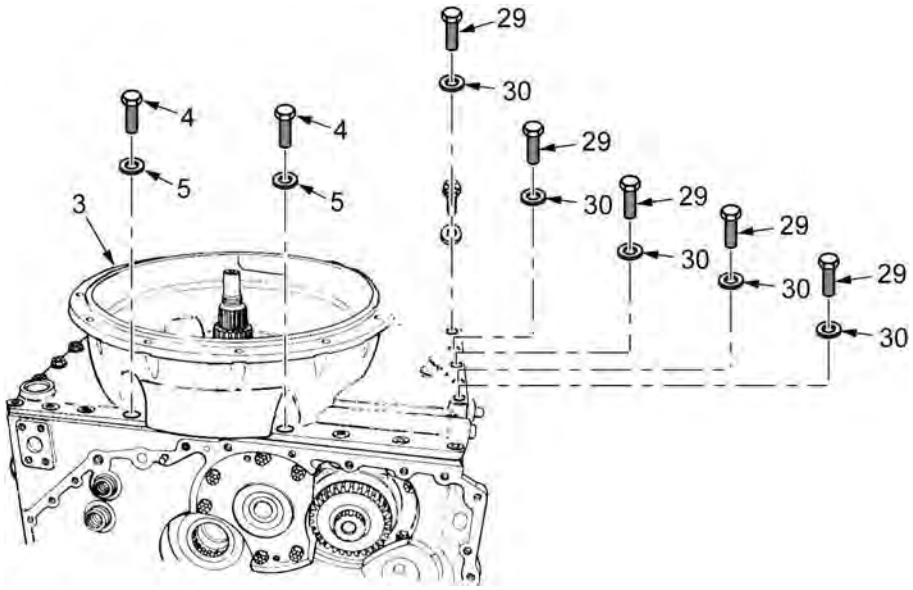


Figure 10. Input Housing Hardware Installation, Left Side.

18. Install zinc-plated 3/8-16 x 1-1/4 inch bolt (Figure 11, Item 10) and washer (Figure 11, Item 9) in input housing (Figure 11, Item 3).

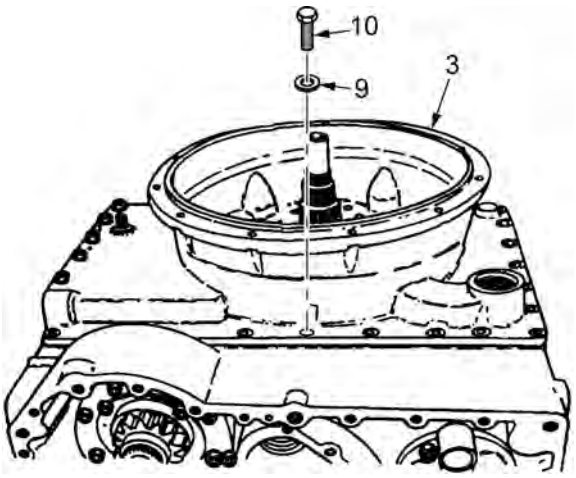


Figure 11. Hardware Installation, Center.

19. Install 19 remaining zinc-plated 3/8-16 x 1-1/4 inch bolts (Figure 12, Item 31) and washers (Figure 12, Item 32) in input housing (Figure 12, Item 3).
20. Torque 27 bolts (Figure 12, Item 5, 10, 29, 31) all around perimeter of input housing (Figure 12, Item 3) to 27 to 32 lb-ft (37 to 43 N·m).

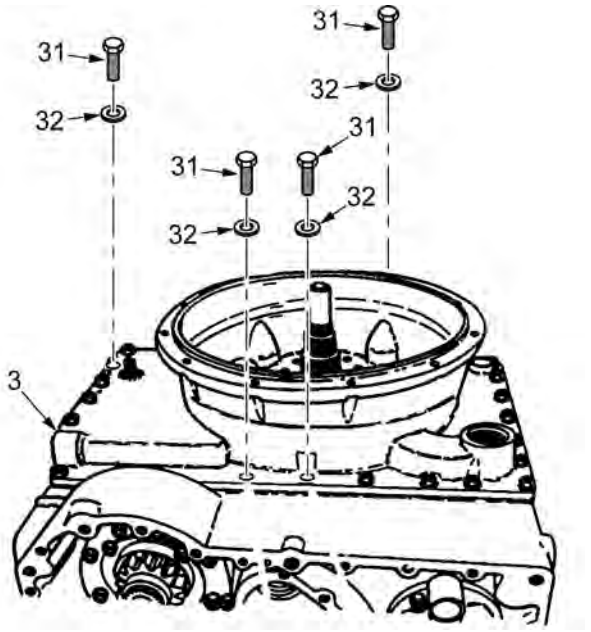


Figure 12. Hardware Installation, Perimeter.

21. Torque two bolts (Figure 13, Item 23) to 27 to 32 lb-ft (37 to 43 N·m).

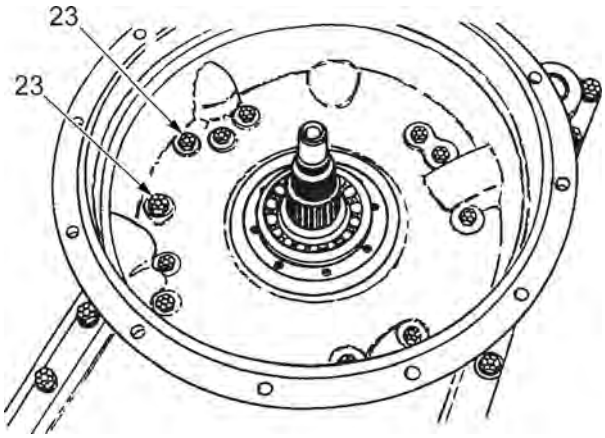


Figure 13. Final Hardware Torque.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR INPUT HOUSING ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Adapter Kit, Container (WP 0079, Item 3)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
O-Ring (WP 0080, Item 27) (2)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Sealant, Lubricating, Thread-Locking (WP 0078, Item 15)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Input housing assembly removed (WP 0041)

NOTE

Input housing assembly does not have to be removed from the transmission to do maintenance procedures provided in this work package, except for removal and installation of f at aluminum plug.

However, text and illustrations in this work package are based upon the input housing assembly being removed from the transmission.

DISASSEMBLE INPUT HOUSING ASSEMBLY

NOTE

Input housing assembly is turned outside up.

1. Remove steering adjustment access plug (Figure 1, Item 3) and O-ring (Figure 1, Item 2) from input housing assembly (Figure 1, Item 4). Discard O-ring (Figure 1, Item 2).
2. Remove pipe plug (Figure 1, Item 1) from input housing assembly (Figure 1, Item 4).
3. Remove pipe plug (Figure 1, Item 6) from input housing assembly (Figure 1, Item 4).
4. Remove pipe plug (Figure 1, Item 5) and O-ring (Figure 1, Item 2) from input housing assembly (Figure 1, Item 4). Discard O-ring (Figure 1, Item 2).

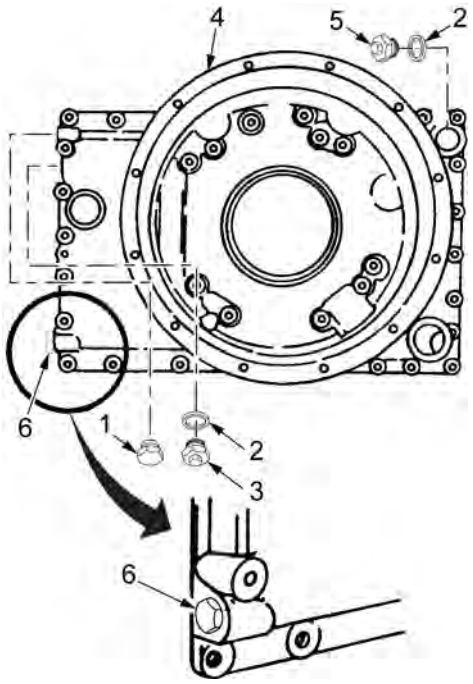


Figure 1. Plugs and O-Rings Removal.

5. Place two wooden blocks under input housing assembly (Figure 2, Item 4).

NOTE

Do Step 6 and Step 7 if the aluminum plug needs to be replaced.

6. Put punch into oil cooler-out port (Figure 2, Item 7) so that tip of punch is against aluminum plug (Figure 2, Item 8).
7. Remove plug (Figure 2, Item 8) from input housing assembly (Figure 2, Item 4).

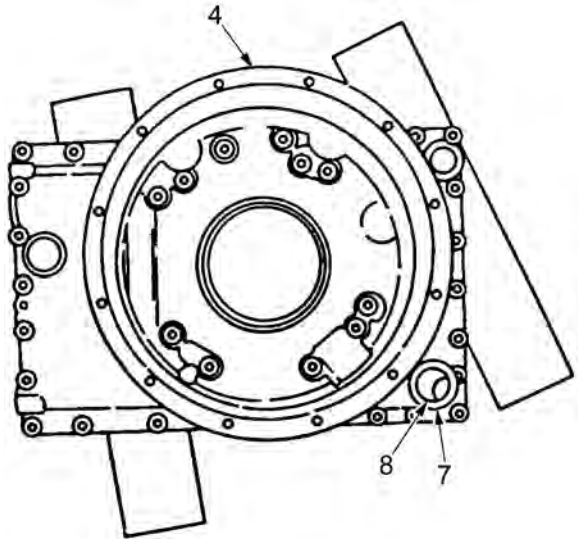


Figure 2. Aluminum Plug Removal.

END OF TASK

ASSEMBLE INPUT HOUSING ASSEMBLY

NOTE

Do Step 1 and Step 2 if aluminum plug was removed from the input housing. If aluminum plug was not removed, go to Step 3.

1. Turn input housing assembly (Figure 3, Item 4) over, inside up.
2. If aluminum plug (Figure 3, Item 8) was removed, install new plug (Figure 3, Item 8) in input housing assembly (Figure 3, Item 4). Push plug f ush to 0.010 in. (0.254 mm) below surface of input housing.

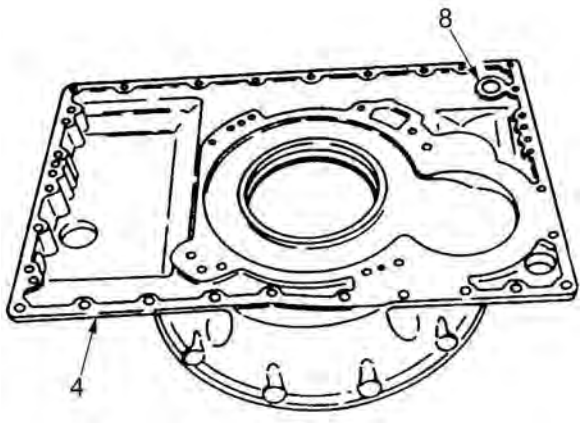


Figure 3. Aluminum Plug Installation.

3. Turn input housing assembly (Figure 4, Item 4) over, outside up.
4. Install new O-ring (Figure 4, Item 2) on plug (Figure 4, Item 5).
5. Apply petrolatum to O-ring (Figure 4, Item 2).
6. Install plug (Figure 4, Item 5) into input housing assembly (Figure 4, Item 4).
7. Torque plug (Figure 4, Item 5) to 40 to 50 lb-ft (54 to 68 N·m).
8. Apply sealant to threads of two pipe plugs (Figure 4, Item 1) and (Figure 4, Item 6).
9. Install pipe plugs (Figure 4, Item 1) and (Figure 4, Item 6) in input housing assembly (Figure 4, Item 4).
10. Torque plugs (Figure 4, Item 1) and (Figure 4, Item 6) to 8 to 10 lb-ft (11 to 14 N·m).
11. Install new O-ring (Figure 4, Item 2) and (Figure 5, Item 2) on steering adjustment access plug (Figure 4, Item 3) and (Figure 5, Item 3).
12. Apply petrolatum to O-ring (Figure 4, Item 2).
13. Install plug (Figure 4, Item 3) in input housing assembly (Figure 4, Item 4).
14. Torque plug (Figure 4, Item 3) to 50 to 60 lb-ft (68 to 81 N·m).

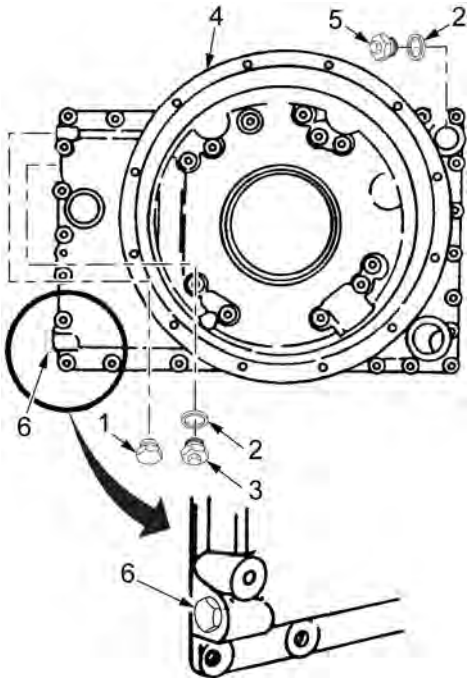


Figure 4. Plugs and O-Rings Installation.

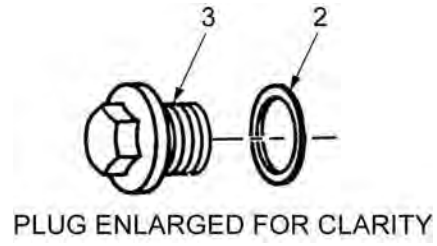


Figure 5. Steer Adjustment Access Plug.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR CENTER HOUSING COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Adapter Kit, Container (WP 0079, Item 3)
Die and Tap Set, Rethreading (WP 0079, Item 12)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Insert Installer, Remover (WP 0075, Item 6)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Dial, 3/8" Drive, 300 lb-in. (WP 0079, Item 50)

Materials/Parts
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Gloves, Leather (WP 0078, Item 8)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0037
WP 0049
WP 0075

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)
Left cover assembly removed (WP 0033)
Bevel gear assembly removed (WP 0058)

REPAIR CENTER HOUSING COMPONENTS

NOTE

Do not remove center housing components unless repair is necessary.

Remove Center Housing Components

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

NOTE

Left side of center housing has a bearing race. This is the outer race for bearing on hydrostatic pump idler gear. This bearing can be disassembled into two parts and is a matched set consisting of an outer race and an inner race and rollers. DO NOT REPLACE this inner race unless you also replace the outer race and rollers of the related bearing. Refer to WP 0049 for removal of the inner races and rollers.

1. Apply heat to center housing (Figure 1, Item 2) with heat gun near bearing race (Figure 1, Item 3) for one hour.
2. Remove bearing race (Figure 1, Item 3).

NOTE

Left side of center housing has outer race and rollers. This is for bearing on range input drive gear. This bearing can be disassembled into two pieces and is a matched set consisting of an inner race and an outer race and rollers. Do not replace this outer race and rollers unless you replace the inner race of the related bearing. Refer to Replace Range Input Gears and Hydrostatic Drive Gear (WP 0037) for removal of the inner race for range input gear.

3. Apply heat to center housing (Figure 1, Item 2) with heat gun near outer race and rollers (Figure 1, Item 1) for one hour.
4. Remove outer race and rollers (Figure 1, Item 1).

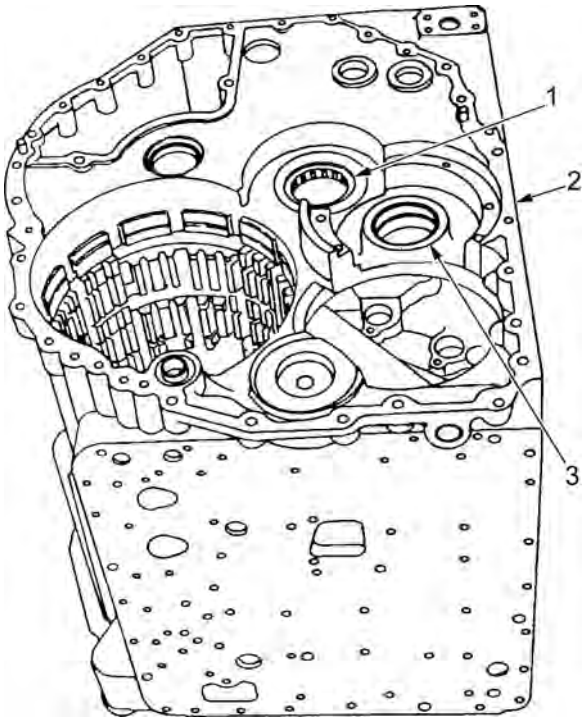


Figure 1. Center Housing, Left Side, Bearing Race, Outer Race, and Rollers Removal.

5. Remove oil transfer sleeve (Figure 2, Item 5) from left side of center housing (Figure 2, Item 2).
6. Remove two headless straight pins (Figure 2, Item 4) from left side of center housing (Figure 2, Item 2).
7. Remove sleeve spacer (tube) (Figure 2, Item 6) from left side of center housing (Figure 2, Item 2).
8. Remove pipe plug (Figure 3, Item 7) from back side of center housing (Figure 3, Item 2).
9. Remove f ve pipe plugs (Figure 3, Item 8).

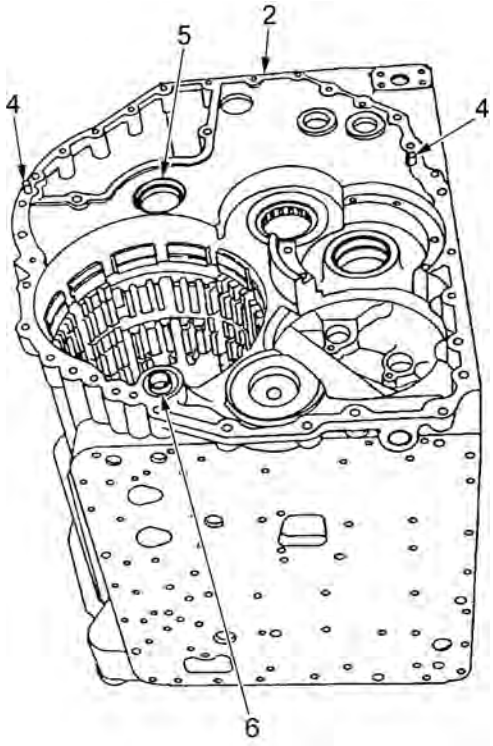


Figure 2. Center Housing Components, Left Side, Removal.

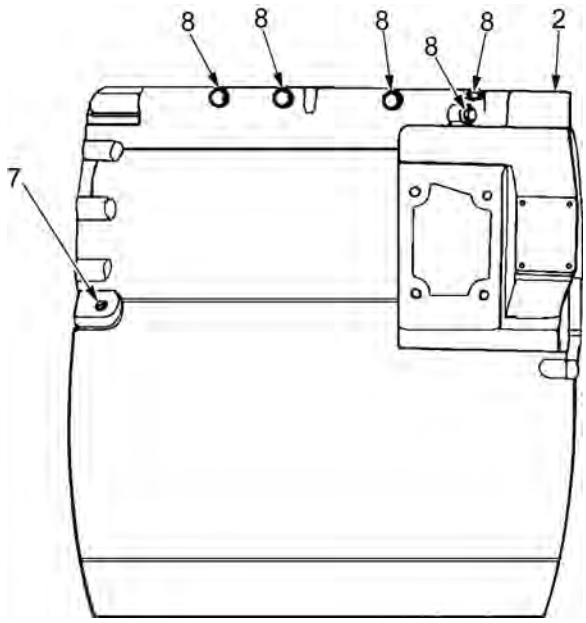


Figure 3. Pipe Plugs Removal.

10. Use wrench pliers to remove two headless straight pins (Figure 4, Item 9) from front side of center housing (Figure 4, Item 2).
11. Remove two headless straight pins (brake reaction pins) (Figure 5, Item 10) from right side of center housing (Figure 5, Item 2).
12. Remove two headless straight pins (dowels pins) (Figure 5, Item 13) from right side of center housing (Figure 5, Item 2).
13. Remove one headless straight pin (dowel pin) (Figure 5, Item 14) from right side of center housing (Figure 5, Item 2).
14. Remove needle roller bearing (Figure 5, Item 12) from right side of center housing. Remove thrust washer (Figure 5, Item 11).

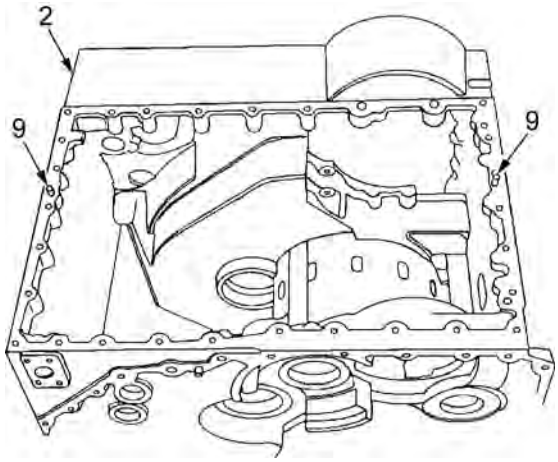


Figure 4. Center Housing Components, Input Housing Side, Removal.

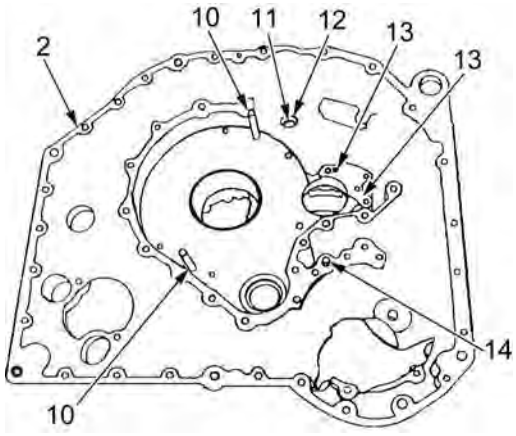


Figure 5. Center Housing Components, Right Side, Removal.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

NOTE

Center housing has bearing races. These are for bearings on left steer and output sun gear. Each of these bearings can be disassembled into two pieces and is a matched set consisting of an outer race and an inner race and rollers. DO NOT REPLACE these two outer races unless you replace the inner races and rollers of the related bearings. Refer to WP 0049 for removal of the inner races and rollers.

15. Apply heat to center support near bearing races (Figure 6, Item 15) and (Figure 6, Item 16) with heat gun for one hour.
16. Remove bearing races (Figure 6, Item 15) and (Figure 6, Item 16).

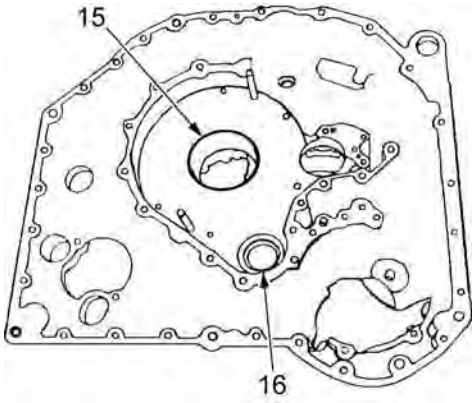


Figure 6. Center Support Bearing Races Removal.

Replace Helical Coil Inserts

NOTE

Use coil thread insert tool kit to replace any of eight screw thread inserts (helical coil inserts).

1. Pry out end of insert (Figure 7, Item 17) and (Figure 8, Item 17).
2. Remove insert (Figure 7, Item 17) and (Figure 8, Item 17).
3. Clean threads on center housing (Figure 7, Item 2) and (Figure 8, Item 2).
4. Retap threads at locations of removed inserts (Figure 7, Item 17) and (Figure 8, Item 17).

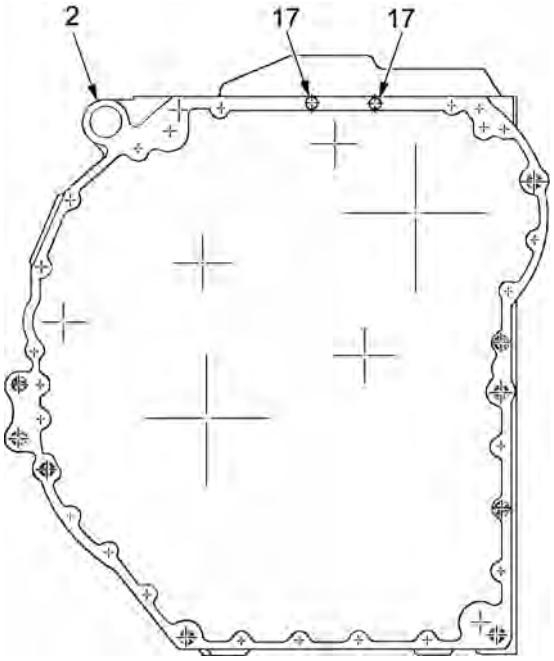


Figure 7. Helical Coil Inserts, Right Side, Removal.

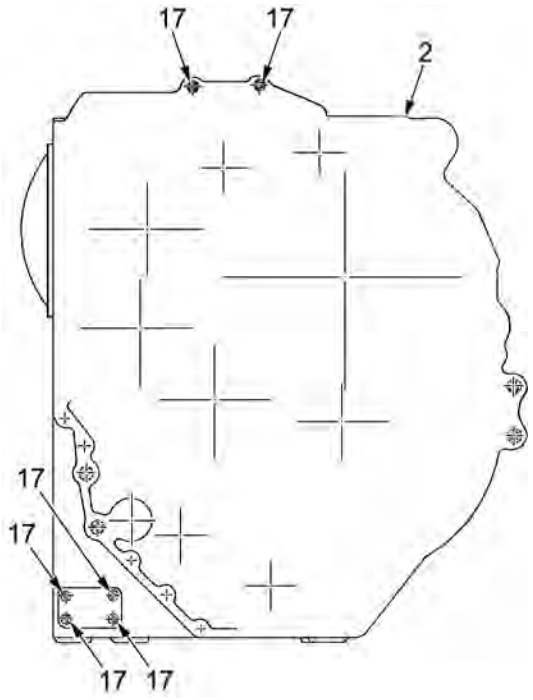


Figure 8. Helical Coil Inserts, Left Side, Removal.

WARNING

Compressed air used for testing must not exceed 30 pounds of pressure per square inch. Use only with good chip guards and protective personal equipment, including goggles or face shield and gloves. Never blow compressed air toward another person. Failure to comply may cause injury or death.

5. Clean insert hole in center housing (Figure 9, Item 2) with compressed air.
6. Put new insert (Figure 9, Item 17) onto insertion tool of coil thread insert kit.
7. Use insertion tool to install new insert (Figure 9, Item 17) one to two turns below surface of center housing (Figure 9, Item 2).
8. Put locking keys in position.
9. Remove insertion tool. Remove tang.

Replace Screw Thread Inserts

1. Refer to Table 1 and Figure 9 for location of inserts and correct size of bolt, nut, and flat washer to use for replacement of any screw thread inserts (Figure 9, Item 18) and (Figure 9, Item 19) and (Figure 9, Item 20).

Table 1. Insert Screw Threads.

Insert Item Number	Insert Part Number	Bolt Size	Nut Size	Washer Size	Wrench Size	Installation Depth Below Center Housing
18	23049119	3/8-16 x 2 in.	3/8-16	3/8 in.	9/16 in.	0.005 – 0.062 in. (0.13 – 1.57 mm)
19	23049118	5/16-18 x 2 in.	5/16-18	5/16 in.	1/2 in.	0.005 – 0.057 in. (0.13 – 1.57 mm)
20	23018271	1/2-13 x 2 in.	1/2-13	1/2 in.	3/4 in.	0.005 – 0.077 in. (0.13 – 1.95 mm)

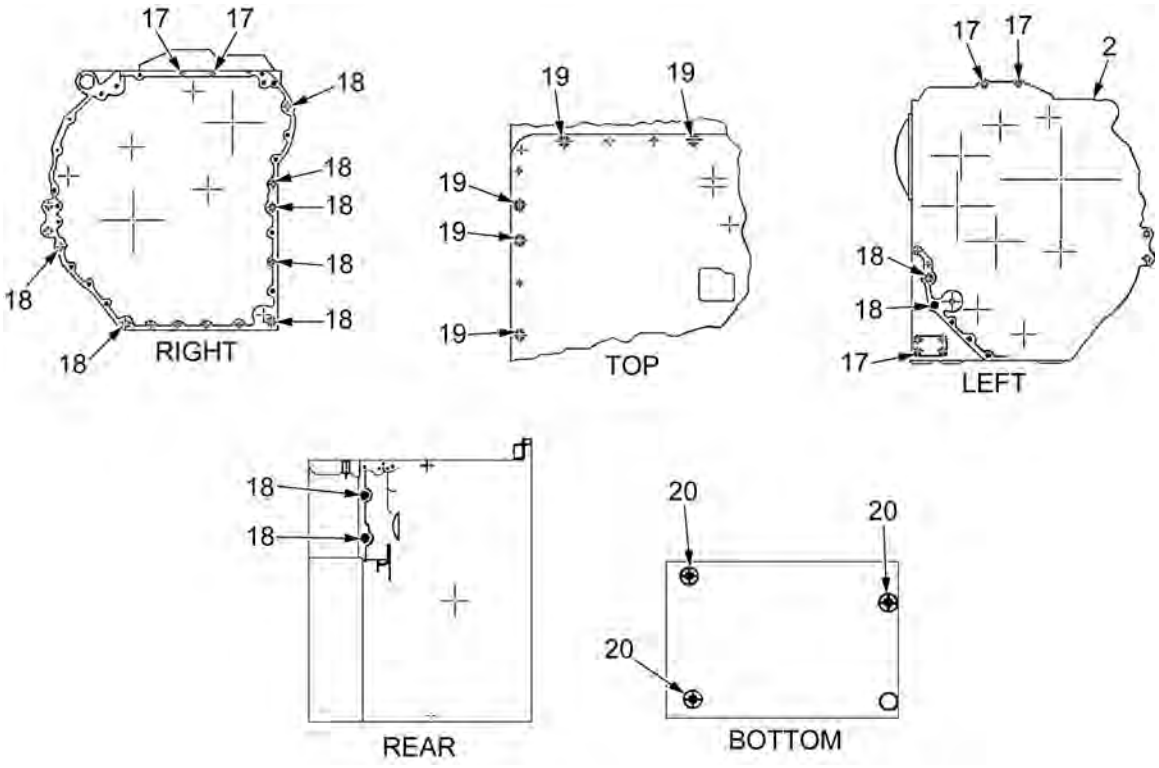


Figure 9. Locations of Inserts on Center Housing.

2. Assemble bolt, nut, and f at washer selected from Table 1. Refer to Illustrated List of Manufactured Items (WP 0075, Item 6) to make a spacer for the related insert to be replaced. Refer to Figure 10.
3. Install tip of bolt into one insert (Figure 9, Item 18), (Figure 9, Item 19), and (Figure 9, Item 20) in center housing.
4. Use combination wrenches selected from Table 1 to turn bolt to the left (counterclockwise) and remove insert (Figure 9, Item 18) and (Figure 9, Item 19) and (Figure 9, Item 20).

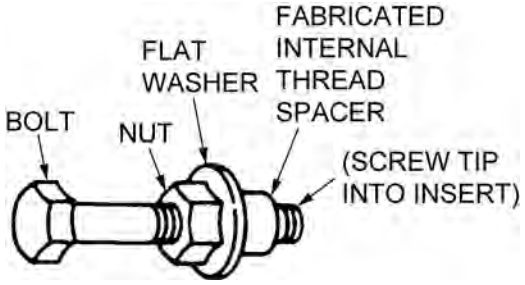


Figure 10. Insert Removal Tool.

5. Assemble bolt, nut, and insert selected from Table 1. Install nut against insert. Refer to Figure 11.
6. Use combination wrenches selected from Table 1 to install insert (Figure 9, Item 18), (Figure 9, Item 19), and (Figure 9, Item 20) into center housing to dimension shown in Table 1.

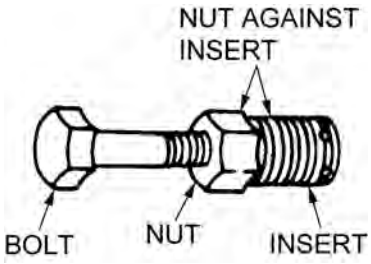


Figure 11. Insert Installation Tool.

Install Center Housing Components

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

1. Apply heat to center housing near locations for bearing races (Figure 12, Item 15) and (Figure 12, Item 16) with heat gun for one hour.

WARNING

Frozen parts can bond to your f ngers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

2. Freeze new bearing races (Figure 12, Item 15) and (Figure 12, Item 16) in carbon dioxide for one hour
3. Install new bearing races (Figure 12, Item 15) and (Figure 12, Item 16) into bores in center housing against the shoulders in the bores.
4. Let center housing (Figure 12, Item 2) return to room temperature.
5. Install thrust washer (Figure 12, Item 11) in right side of center housing (Figure 12, Item 2).
6. Use an arbor press to push against numbered end of bearing (Figure 12, Item 12) to install bearing (Figure 12, Item 12). Push bearing (Figure 12, Item 12) to a depth of 6.28 in. (159.5 mm) below the outer surface of the right side of center housing (Figure 12, Item 2).
7. Install one pin (Figure 12, Item 14) to a height of 0.40 in. (10.2 mm) above the surface of the right side of center housing (Figure 12, Item 2)

8. Install two pins (Figure 12, Item 13) to a height of 0.25 in. (6.4 mm) above the surface of the right side of center housing (Figure 12, Item 2).
9. Install two pins (Figure 12, Item 10) to a height of 0.31 in. (8.00 mm) above the surface of the right side of center housing (Figure 12, Item 2).

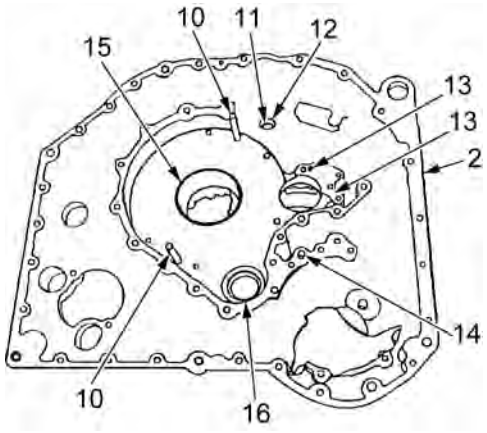


Figure 12. Bearing Races Installation.

10. Install two pins (Figure 13, Item 9) to a height of 0.38 in. (9.7 mm) above the front side of center housing.
11. Install f ve pipe plugs (Figure 14, Item 8).
12. Torque f ve plugs (Figure 14, Item 8) to 50 to 60 lb-in. (6 to 7 N·m).
13. Install pipe plug (Figure 14, Item 7) in back side of center housing.
14. Torque plug (Figure 14, Item 7) to 50 to 60 lb-in. (6 to 7 N·m).

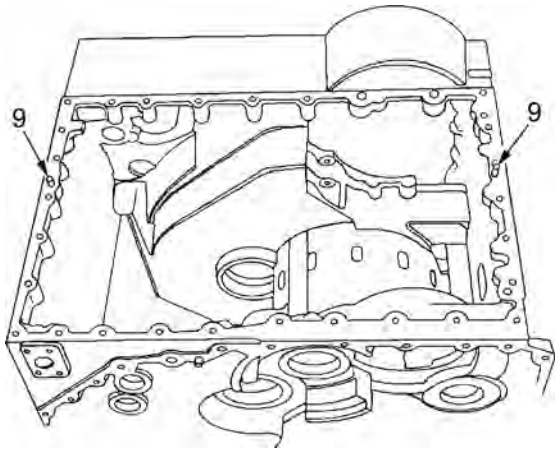


Figure 13. Straight Pins Installation.

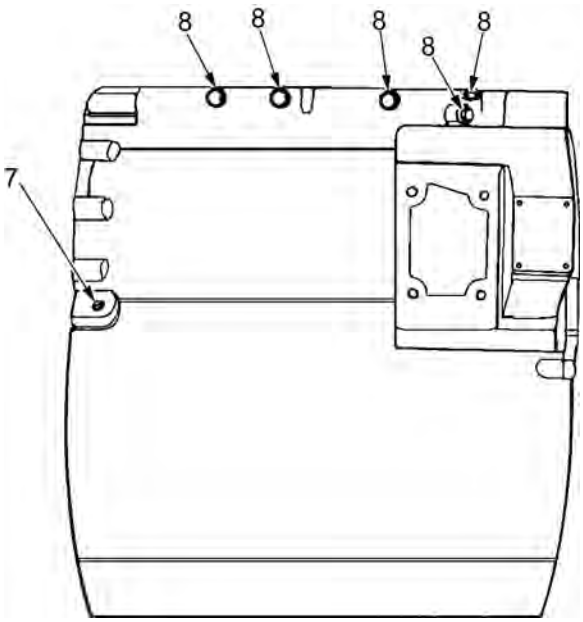


Figure 14. Pipe Plugs Installation.

15. Install sleeve spacer (tube) (Figure 15, Item 6) to a height of 0.12 in. (3.0 mm) above left side of center housing (Figure 15, Item 2).
16. Install two pins (Figure 15, Item 4) to a height of 0.38 in. (9.7 mm) above left side of center housing (Figure 15, Item 2).
17. Install oil transfer sleeve (Figure 15, Item 5) to a seat in its bore in left side of center housing (Figure 15, Item 2).

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

18. Apply heat to center housing near location for outer race and rollers (Figure 15, Item 1) with heat gun for one hour.

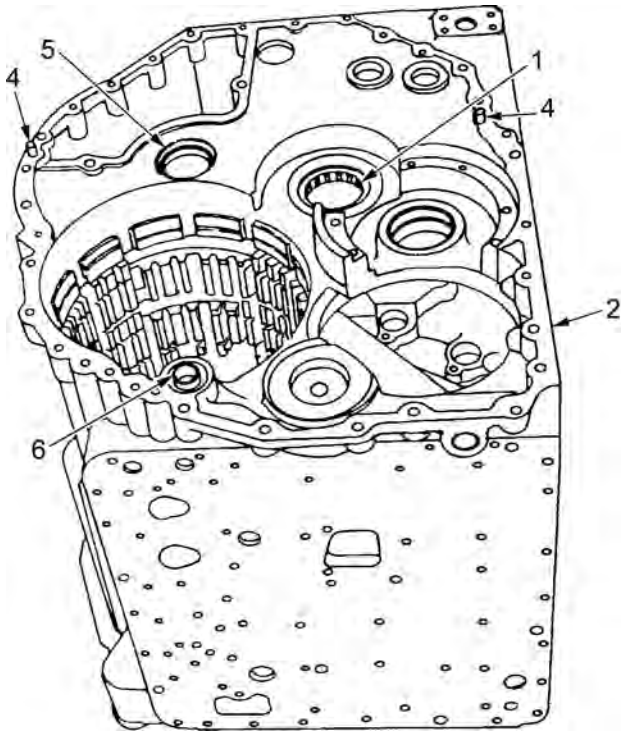


Figure 15. Center Housing Components Installation.

WARNING

Frozen parts can bond to your fingers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

19. Freeze new outer race and rollers (Figure 16, Item 1) in carbon dioxide for one hour.
20. Install new race and rollers (Figure 16, Item 1) against shoulder in bore.
21. Let center housing return to room temperature.

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

WARNING

Frozen parts can bond to your fingers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

22. Apply heat to center housing near location for bearing race (Figure 16, Item 3) with heat gun for one hour.
23. Freeze new bearing race (Figure 16, Item 3) in carbon dioxide for one hour.
24. Install new bearing race (Figure 16, Item 3) into bore in center housing against shoulder in bore.
25. Let center housing (Figure 16, Item 2) return to room temperature.

NOTE

Later manufactured housing assembly center (machined) will have an orif ce plug installed. Orif ce plug is installed f ush to 0.100 in. (2.54 mm) below housing surface. The orif ce plug was installed as an oil f ow product improvement. This orif ce plug is not maintenance signif cant. If orif ce plug is missing, do not attempt to install new one.

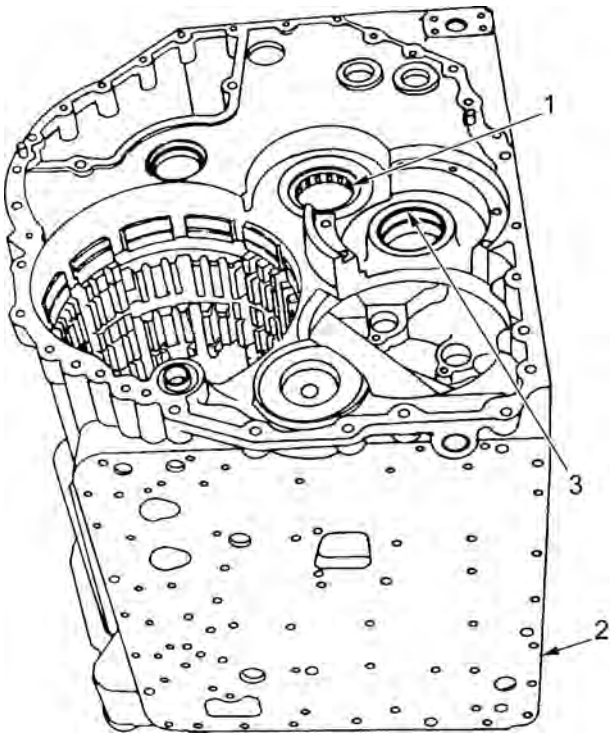


Figure 16. Center Housing Bearing Race Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE SUMP COMMUNICATION TUBE

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Input housing assembly removed (WP 0042)

REMOVE SUMP COMMUNICATION TUBE

NOTE

If sump communication tube is in position, tube does not need to be removed unless bevel gear assembly is to be removed or tube is defective. If tube must be removed, proceed with Steps 1, 2, and 3.

1. Use the rotary control handle on the maintenance stand to turn the transmission so that input housing (Figure 1, Item 1) is in up position.
2. Tap end of sump communication tube (Figure 1, Item 3) at center housing assembly (Figure 1, Item 2) on left until tube moves into center housing assembly.

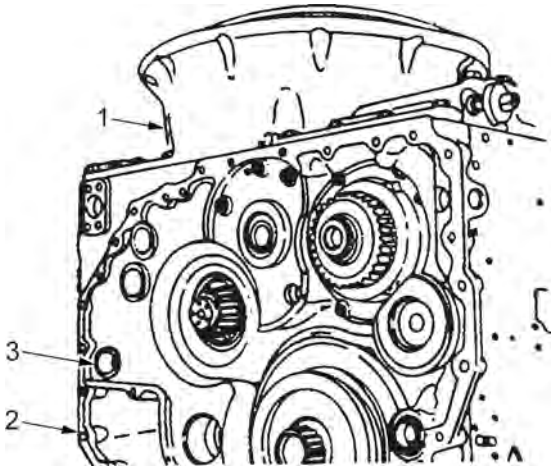


Figure 1. Sump Communication Tube, Tap Out from Left End.

3. Pull sump communication tube (Figure 2, Item 3) from right of center housing assembly (Figure 2, Item 2).

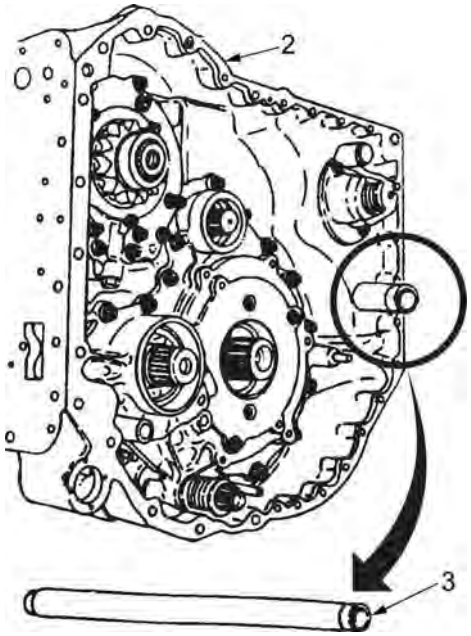


Figure 2. Sump Communication Tube, Remove from Right End.

END OF TASK

INSTALL SUMP COMMUNICATION TUBE

NOTE

Make sure that the transmission is on maintenance stand with the input end turned up.

After sump communication tube has been removed, right cover assembly must stay off transmission until sump communication tube has been installed.

Sump communication tube is not installed until after bevel gear assembly has been installed.

1. Apply petrolatum to machined end (smaller end) of sump communication tube (Figure 3, Item 3).
2. Install sump communication tube (Figure 3, Item 3), small end first, through tube bore in right end of transmission center housing assembly (Figure 3, Item 2).

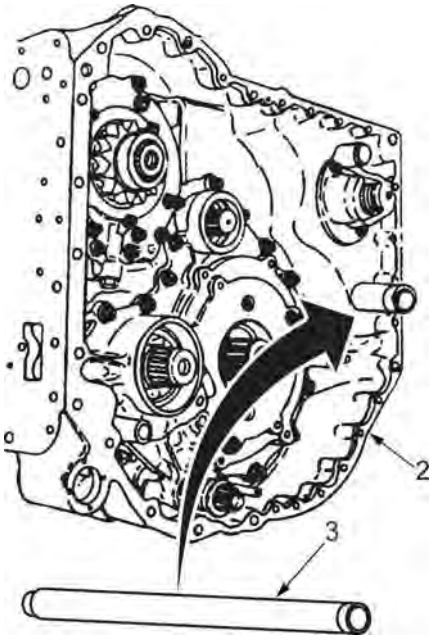


Figure 3. Sump Communication Tube, Install from Right End.

3. Look through sump communication tube (Figure 4, Item 3) and make sure that you can see the tube bore in left end of center housing assembly (Figure 4, Item 2). Push small end of tube into left end bore.
4. Tap end of sump communication tube (Figure 4, Item 3) at right end until the small end of tube is installed in left end bore and large end of tube is flush at right end bore.

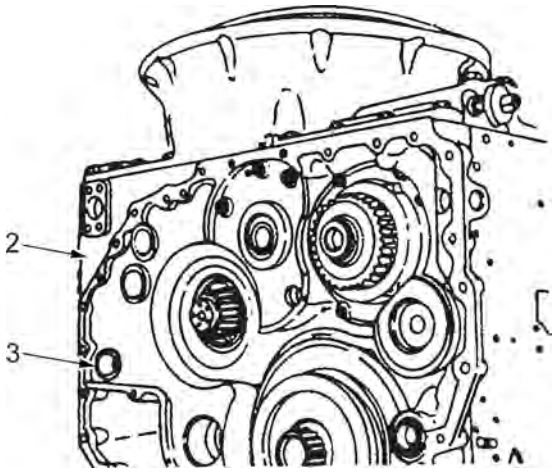


Figure 4. Sump Communication Tube, Flush at Left End.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE LEFT BRAKE ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Shim (WP 0075, Item 5)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Dial, 3/8" Drive, 300 lb-in. (WP 0079, Item 50)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Bands, Rubber No. 19 (WP 0078, Item 2) (2)
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Gasket (WP 0080, Item 50)
Lubricating Oil, Engine (WP 0078, Item 10)
O-Ring (WP 0080, Item 51)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Ring Retaining (Seal Ring, Metal) (WP 0080, Item 15)
Sealant, Lubricating, Thread-Locking (WP 0078, Item 15)
Seal Ring, Metal (WP 0080, Item 13)
Seal Ring, Metal (WP 0080, Item 16)
Seal, Brake Coolant (WP 0080, Item 34)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
TM 9-214
WP 0046
WP 0047

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE LEFT BRAKE ASSEMBLY

NOTE

Transmission is on maintenance stand, right end turned up.

1. Remove 15 bolts (Figure 1, Item 1) and 15 washers (Figure 1, Item 2) from left brake support (Figure 1, Item 3).

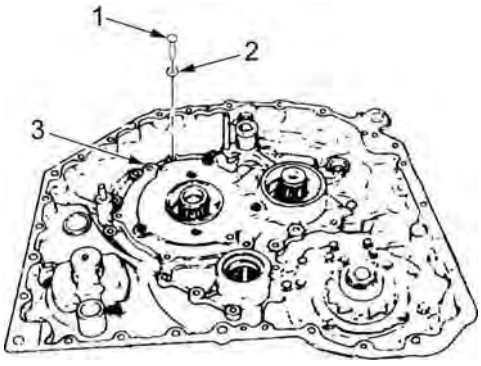


Figure 1. Right Cover Assembly Hardware Removal from Left Brake Support.

NOTE

When left brake support is removed, the brake cam may come out of the brake assembly with the support or it may stay in the center housing.

2. Pry under opposite ends of left brake support (Figure 2, Item 3) using two pry bars (Figure 2, Item 4) to loosen support. Remove brake support (Figure 2, Item 3).

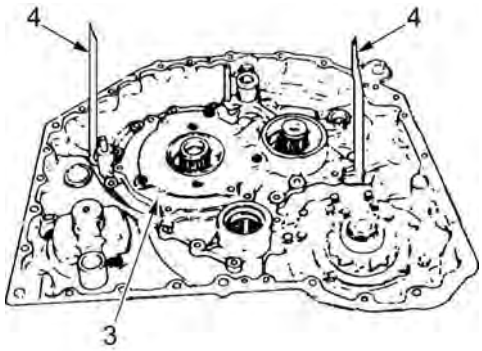


Figure 2. Left Brake Support Removal.

3. Position left brake support (Figure 3, Item 3) on wooden blocks (Figure 3, Item 9) as shown in Figure 3.
4. Loosen two retainer bolts (Figure 3, Item 7). Loosen three stationary cam bolts (Figure 3, Item 5). Loosen bolts (Figure 3, Item 7) and (Figure 3, Item 5) until bolt heads are approximately 0.25 in. (6.5 mm) out of holes in left brake support (Figure 3, Item 3).
5. Tap bolt heads (Figure 3, Item 7) and (Figure 3, Item 5) to loosen retainer and stationary cam located below left brake support (Figure 3, Item 3).
6. Remove two bolts (Figure 3, Item 7) and two washers (Figure 3, Item 8) from left brake support (Figure 3, Item 3). Remove three bolts (Figure 3, Item 5) and three washers (Figure 3, Item 6) from left brake support (Figure 3, Item 3).

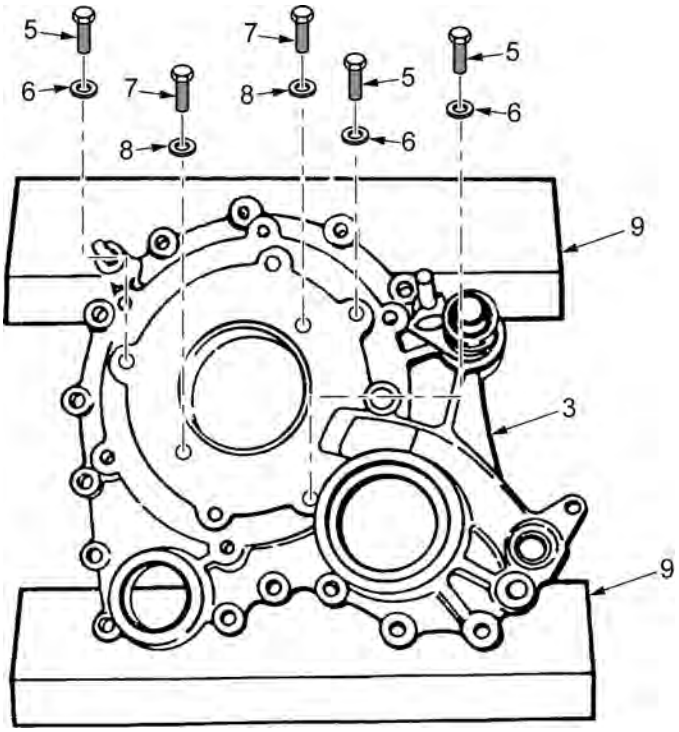


Figure 3. Left Brake Support Hardware Removal.

7. Turn left brake support (Figure 4, Item 3) over as shown in Figure 4.
8. Remove packing retainer (Figure 4, Item 11) and stationary cam (Figure 4, Item 12) from left brake support (Figure 4, Item 3).
9. Remove seal ring (Figure 4, Item 10) from retainer (Figure 4, Item 11). Discard seal ring (Figure 4, Item 10).

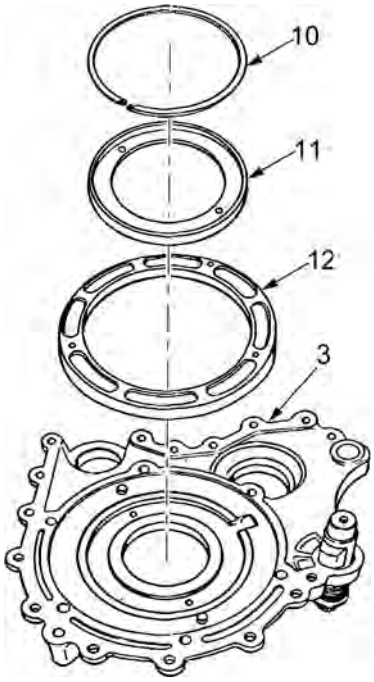


Figure 4. Packing Retainer, Stationary Cam, and Seal Ring Removal.

10. Remove retaining ring (Figure 5, Item 18) from end of control cam (Figure 5, Item 13).
11. Remove washer (Figure 5, Item 17) from control cam (Figure 5, Item 13).
12. Remove torsion helical spring (Figure 5, Item 16) from control cam (Figure 5, Item 13).
13. Remove control cam (Figure 5, Item 15) from control cam (Figure 5, Item 13).
14. Remove retaining ring (Figure 5, Item 14) from control cam (Figure 5, Item 13).
15. Remove control cam (Figure 5, Item 13) from left brake support (Figure 5, Item 3).

NOTE

The left brake support has the bearing races for the output driven gear, output drive gear, and steer gear.

Refer to WP 0046 for repair of left brake support.

16. Do a check of left brake support (Figure 5, Item 3) including bearing races (refer to TM 9-214) to make sure left brake support (Figure 5, Item 3) and bearing races are serviceable.

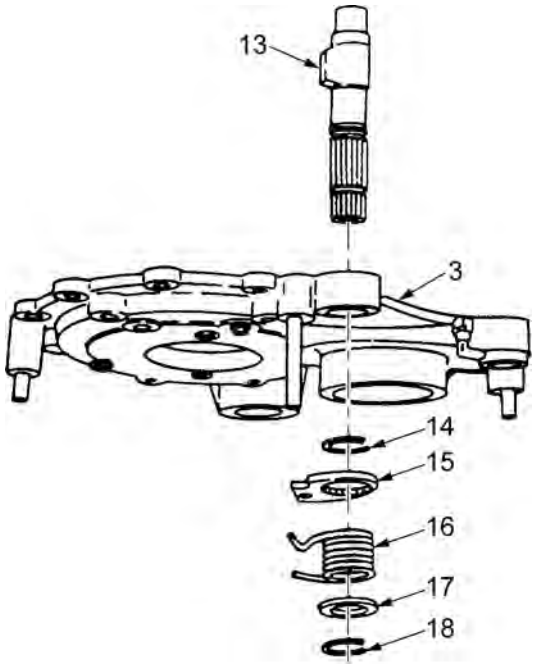


Figure 5. Left Brake Components Disassembly.

17. Remove brake cam (Figure 6, Item 19) with eight balls (Figure 6, Item 20) and brake adjusting linkage (Figure 6, Item 21).
18. Remove eight balls (Figure 6, Item 20) from brake cam (Figure 6, Item 19). Place balls (Figure 6, Item 20) in a container.

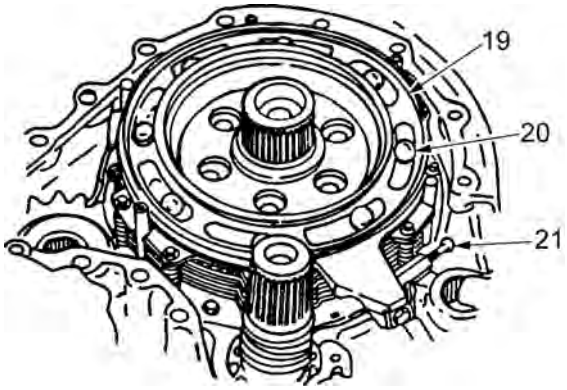


Figure 6. Brake Cam Removal.

19. Remove seals (Figure 7, Item 22) and (Figure 7, Item 23) from brake cam (Figure 7, Item 19). Discard seals (Figure 7, Item 22) and (Figure 7, Item 23).
20. Remove preformed packings (Figure 7, Item 26) and (Figure 7, Item 27) from face of brake cam (Figure 7, Item 19). Discard preformed packings (Figure 7, Item 26) and (Figure 7, Item 27).
21. Remove bolt (Figure 7, Item 28) and two spring tension clips (Figure 7, Item 29) from brake cam (Figure 7, Item 19).
22. Remove brake adjusting linkage (Figure 7, Item 21) from brake cam (Figure 7, Item 19).
23. Remove inner brake adjusting linkage (Figure 7, Item 24) from outer brake adjusting link (Figure 7, Item 25).

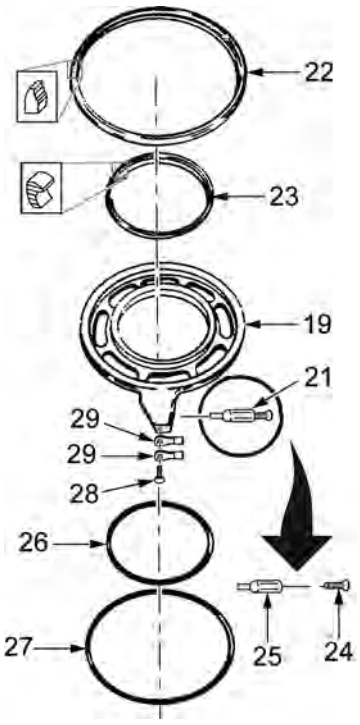


Figure 7. Brake Cam Disassembly.

NOTE

Refer to WP 0047 for repair of inner brake adjusting link pin.

Two pins are part of center housing and not removed.

24. Remove four brake reaction pins (Figure 8, Item 34). Do not remove two pins (Figure 8, Item 33).
25. Remove spur gear cluster (Figure 8, Item 30).
26. Remove thrust washer bearing (Figure 8, Item 31) from outer carrier assembly (Figure 8, Item 32) or from bottom of spur gear cluster (Figure 8, Item 30).

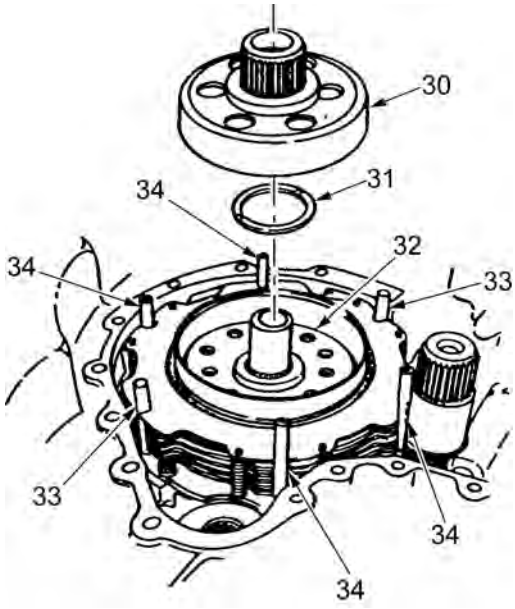


Figure 8. Pins, Spur Gear Cluster, and Thrust Washer Bearing Removal.

27. Remove outer carrier (Figure 9, Item 32), brake clutch drum (Figure 9, Item 36) and retaining ring (Figure 9, Item 35), as an assembly and turn it over for disassembly.

NOTE

Thrust washer bearing may stay on the underside of the outer carrier assembly or left steer and output sun gear.

28. Remove thrust washer bearing (Figure 10, Item 37) from bottom of assembly removed in Step 27 or from left steer and output sun gear (Figure 10, Item 38).
29. Remove retaining ring (Figure 9, Item 38) from brake clutch drum (Figure 9, Item 36).
30. Remove output planetary (Figure 9, Item 38) from brake clutch drum (Figure 9, Item 36).
31. Press down with one hand on clutch plate (Figure 10, Item 39), against spring force, near retaining ring (Figure 10, Item 40). Remove retaining ring (Figure 10, Item 40). Use the same method to remove f ve more retaining rings (Figure 10, Item 40).
32. Remove clutch plate (Figure 10, Item 39).

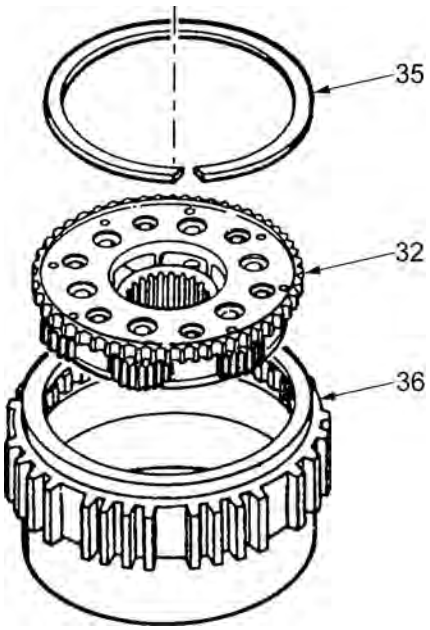


Figure 9. Output Carrier Assembly Disassembly.

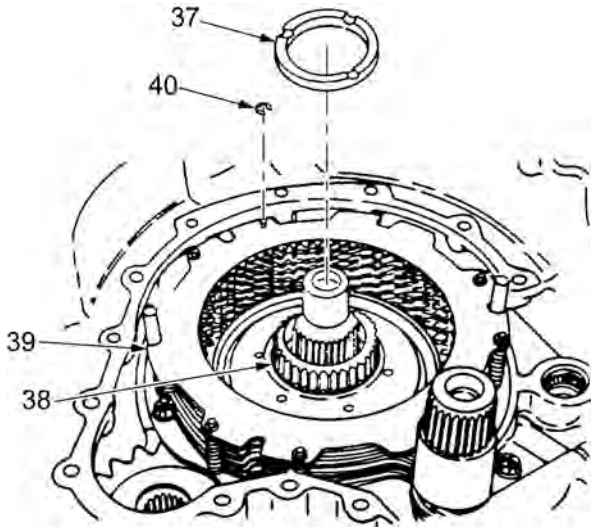


Figure 10. Brake Clutch Drum Disassembly.

CAUTION

When you remove handle or install clutch packs, make sure all clutch plates point in the same direction. Under heat and pressure, clutch plates can take on a conical shape, called coning. Each plate will be different in degree of coning. When coned plates are mixed or turned over, they cannot install properly against each other. This can keep plates from making suff cient surface contact with each other for the clutch pack to operate correctly.

When one clutch plate needs to be replaced, replace the entire clutch pack. Individual clutch plates should not be replaced, because such new plates will not have the surface contour of adjacent older plates, decreasing the effect of the clutch pack.

33. Remove left brake clutch pack (Figure 11, Item 41), which has 11 plates.
34. Remove six helical compression springs (Figure 11, Item 42).

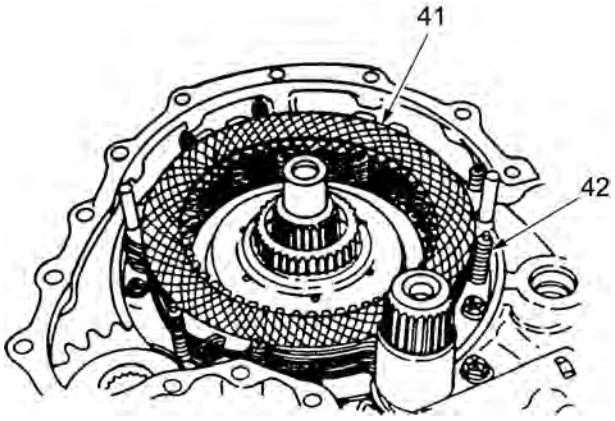


Figure 11. Left Brake Clutch Pack and Springs Removal.

35. Remove brake coolant seal (Figure 12, Item 45). Discard seal (Figure 12, Item 45).
36. Remove f ve bolts (Figure 12, Item 43) and f ve washers (Figure 12, Item 44) which hold brake backing plate (Figure 12, Item 47) to center housing.

CAUTION

When using pry bars, make sure you do not damage inner lip on brake backing plate.

37. Remove brake backing plate (Figure 12, Item 47) from large pins (Figure 12, Item 33) using two pry bars (if necessary).
38. Remove six headless straight pins (Figure 12, Item 46).

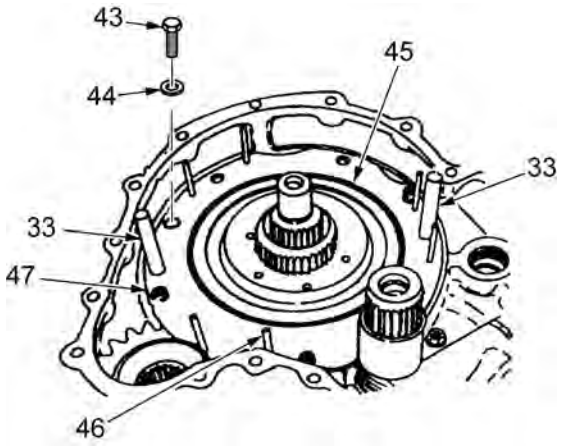


Figure 12. Brake Backing Plate Disassembly.

END OF TASK

INSTALL LEFT BRAKE ASSEMBLY

1. Install six headless straight pins (Figure 13, Item 46) in brake backing plate (Figure 13, Item 47). Wind rubber bands around pins (Figure 13, Item 46) to hold them in position.

NOTE

When you remove rubber bands from six pins, one pin (shown bottom right in Figure 13) will drop down. To help with assembly, a thickness gage (shim) must be positioned under the pin to retain it in an up position.

2. Install brake backing plate (Figure 13, Item 47), along with pins (Figure 13, Item 46). Remove rubber bands and put thickness gage blade (shim) under bottom left pin to keep pin (Figure 13, Item 46) up until assembly is complete.
3. Install f ve washers (Figure 14, Item 44) and f ve bolts (Figure 14, Item 43) that keep backing plate (Figure 14, Item 47) in position.
4. Torque f ve bolts (Figure 14, Item 43) to 36 to 43 lb-ft (49 to 68 N·m).
5. Install new brake coolant seal (Figure 14, Item 45).
6. Install four brake reaction pins (Figure 14, Item 34).
7. Install six springs (Figure 14, Item 42) over six pins (Figure 14, Item 46).

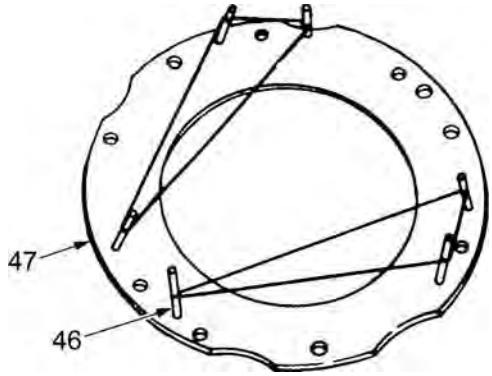


Figure 13. Brake Backing Plate Pin Installation.

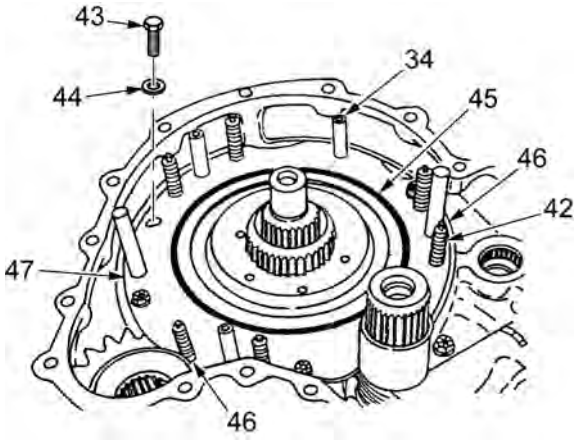


Figure 14. Brake Backing Plate Installation.

8. Apply petrolatum to thrust washer (Figure 15, Item 37) and install it on output carrier (Figure 15, Item 32).
9. Install output carrier (Figure 15, Item 32) and thrust washer (Figure 15, Item 37) into brake clutch drum (Figure 15, Item 36).
10. Install retaining ring (Figure 15, Item 35) to keep output carrier (Figure 15, Item 32) in position in brake clutch drum (Figure 15, Item 36).
11. Turn the components assembled in Step 10 upside down, and install the assembly into the center housing.
12. Apply petrolatum to thrust washer (Figure 16, Item 31) and install in bottom of spur gear cluster (Figure 16, Item 30).
13. Install gear cluster (Figure 16, Item 30) and thrust washer (Figure 16, Item 31) into clutch drum (Figure 16, Item 36).
14. Soak six friction plates (Figure 16, Item 49) in lubricating oil for two minutes before installation. Install one friction plate (Figure 16, Item 49), then one reaction plate (Figure 16, Item 48).
15. Repeat Step 14 until all six friction plates (Figure 16, Item 49) and (Figure 16, Item 47) and all f ve reaction plates (Figure 16, Item 48) and (Figure 16, Item 46) are installed.

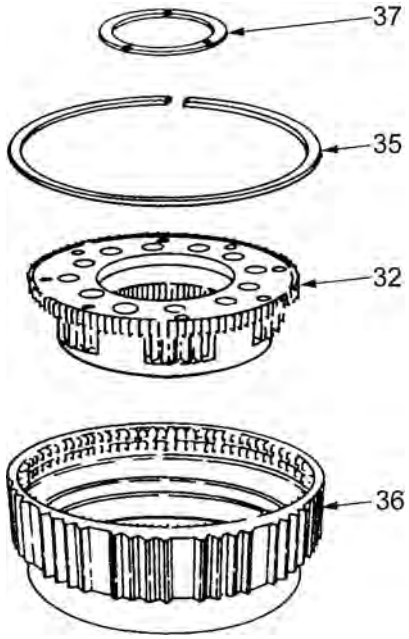


Figure 15. Output Carrier and Brake Clutch Drum Assembly.

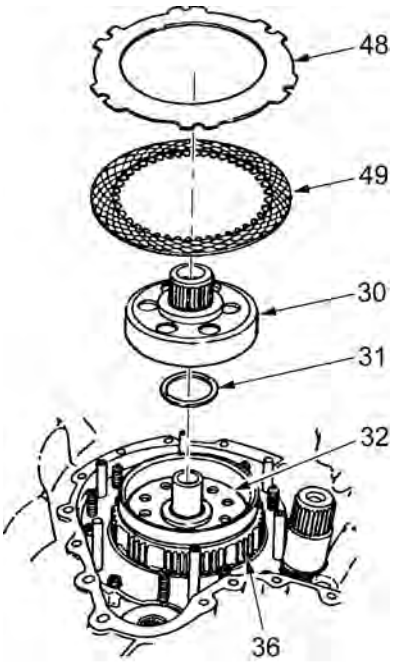


Figure 16. Friction and Reaction Plates Installation.

16. Install clutch plate (Figure 17, Item 39) onto clutch stack. Make sure six pins (Figure 17, Item 46) are engaged.
17. Press down on clutch plate (Figure 17, Item 39) with one hand, against spring force, near one pin (Figure 17, Item 46). Install retaining ring (Figure 17, Item 40). Use the same method to install f ve more retaining rings (Figure 17, Item 40). Remove thickness gage (shim) installed previously to keep pin (Figure 17, Item 46) in an up position.

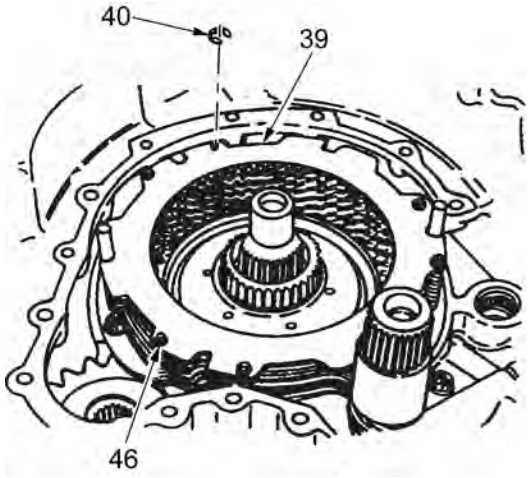


Figure 17. Clutch Plate Installation.

18. Install two new preformed packings (Figure 18, Item 26) and (Figure 18, Item 27) into face of brake cam (Figure 18, Item 19).

CAUTION

Make sure you install seals so seal lips are in direction shown in Figure 18. If seals are not installed correctly, components will not function correctly.

19. Install new seal (Figure 18, Item 23), seal lip down.
20. Install new seal (Figure 18, Item 22), seal lip up.
21. Apply petrolatum to packings (Figure 18, Item 26) and (Figure 18, Item 27) and seals (Figure 18, Item 22) and (Figure 18, Item 23).
22. Hold two spring tension clips (Figure 18, Item 25) in position on brake cam (Figure 18, Item 19) as shown in Figure 18.
23. Install bolt (Figure 18, Item 28) to keep clips (Figure 18, Item 29).
24. Torque bolt (Figure 18, Item 28) to 108 to 132 lb-in. (12 to 15 N·m).
25. Assemble inner brake adjusting link (Figure 18, Item 24) and outer brake adjusting link (Figure 18, Item 25) so you cannot see threads on inner link (Figure 18, Item 24).
26. Install slotted end of outer link (Figure 18, Item 25) into brake cam (Figure 18, Item 19) so that f at on link (Figure 18, Item 25) is against free ends of spring tension clips (Figure 18, Item 29).

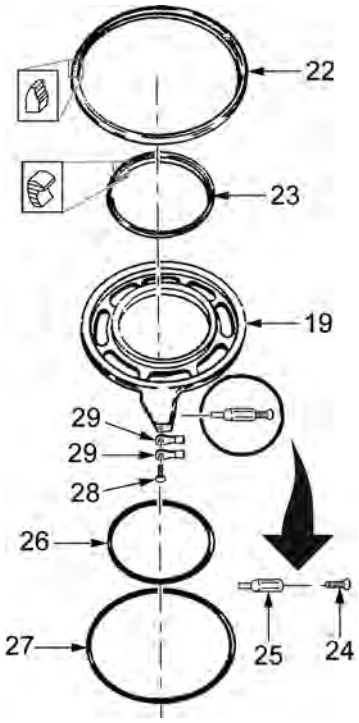


Figure 18. Brake Cam Assembly.

27. Put left brake support (Figure 19, Item 3), inside surface up, on 2 x 4 x 24 inch soft wood lumber wooden blocks (Figure 19, Item 9).
28. Install stationary cam (Figure 19, Item 12) onto two pins (Figure 19, Item 50) in support (Figure 19, Item 3). Make sure bolt holes are aligned.
29. Tap stationary cam (Figure 19, Item 12) onto pins (Figure 19, Item 50) until cam (Figure 19, Item 12) is installed.
30. Turn support (Figure 19, Item 3) over and place on 2 x 4 x 24 inch soft wood lumber wooden blocks (Figure 19, Item 3).
31. Install three washers (Figure 20, Item 6) and three bolts (Figure 20, Item 5).
32. Torque three bolts (Figure 20, Item 5) to 17 to 20 lb-ft (23 to 27 N·m).
33. Turn support (Figure 20, Item 3) over and place on 2 x 4 x 24 inch soft wood lumber wooden blocks (Figure 20, Item 9).
34. Install new hook-type metal seal ring (Figure 19, Item 10) onto retainer (Figure 19, Item 11).
35. Apply petrolatum to seal ring (Figure 19, Item 10).
36. Tilt support (Figure 19, Item 3) on edge.
37. Install retainer (Figure 19, Item 11), flat side first, into support (Figure 19, Item 3). Start two washers (Figure 20, Item 8) and two bolts (Figure 20, Item 7) into support (Figure 20, Item 3) to keep retainer (Figure 19, Item 11) in position.
38. Turn support (Figure 20, Item 3) over and place on 2 x 4 x 24 inch soft wood lumber wooden blocks (Figure 20, Item 9).
39. Torque two bolts (Figure 20, Item 7) to 10 to 12 lb-ft (14 to 16 N·m).

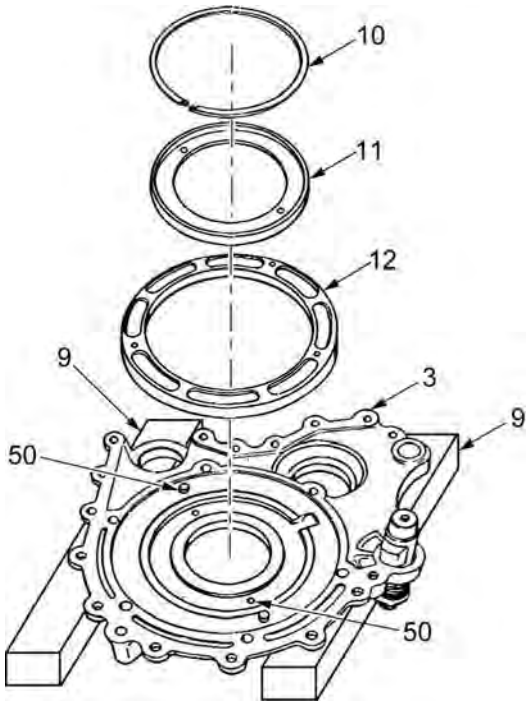


Figure 19. Packing Retainer, Stationary Cam, and Seal Ring Installation.

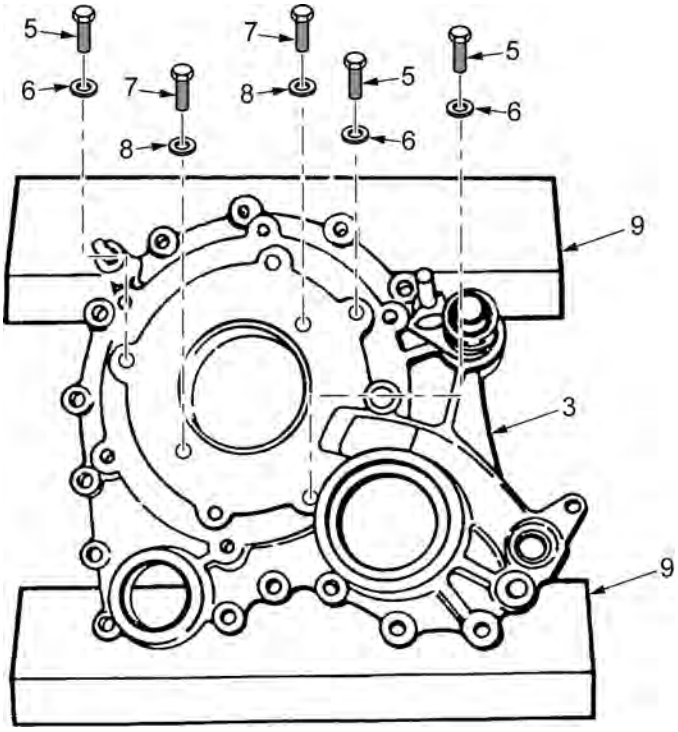


Figure 20. Left Brake Support Hardware Installation.

40. Turn support (Figure 21, Item 3) over and position on 2 x 4 x 24 inch soft wood lumber wooden blocks.
41. Install control cam (cam shaft) (Figure 21, Item 13) into support (Figure 21, Item 3).
42. Install retaining ring (Figure 21, Item 14) onto cam shaft (Figure 21, Item 133).
43. Turn support (Figure 21, Item 3) over and position on 2 x 4 x 24 inch soft wood lumber wooden blocks.
44. Install control cam (stop) (Figure 21, Item 15) onto cam shaft (Figure 21, Item 13).
45. Install torsion helical spring (Figure 21, Item 16) onto cam shaft (Figure 21, Item 13). Engage straight end of spring (Figure 21, Item 16) behind pin in support (Figure 21, Item 3), Engage hook end of spring (Figure 21, Item 16) with hole in stop.
46. Install washer (Figure 21, Item 17) onto cam shaft (Figure 21, Item 13).
47. Install retaining ring (Figure 21, Item 18) against washer (Figure 21, Item 17).

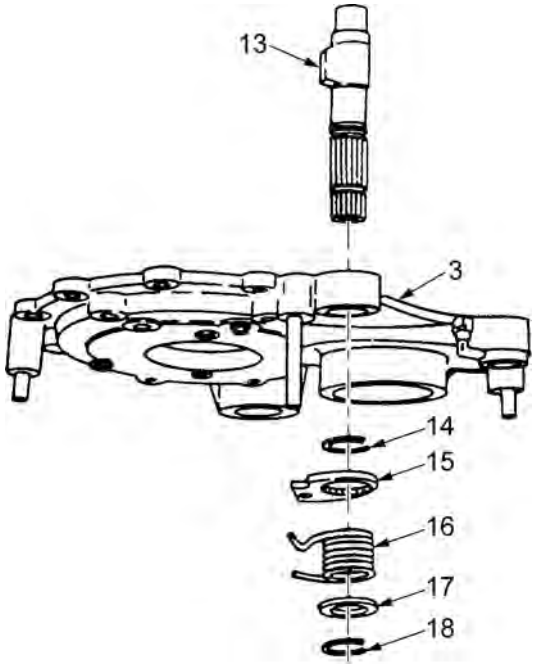


Figure 21. Left Brake Components Assembly.

48. Turn support (Figure 22, Item 3) over and place on 2 x 4 x 24 inch soft wood lumber wooden blocks.
49. Install eight balls (Figure 22, Item 20) into lowest areas of ramps on stationary cam (Figure 22, Item 12).
50. Apply petrolatum to balls (Figure 22, Item 20) and in ramps around balls.
51. Hold brake cam (Figure 22, Item 19) in position shown in Figure 22.
52. Install end of inner link (Figure 22, Item 24) in pocket of cam shaft (Figure 22, Item 13). Hold brake cam (Figure 22, Item 19) and turn and twist cam (Figure 22, Item 19) so end of link (Figure 22, Item 24) is fully inserted in pocket of cam shaft (Figure 22, Item 13).
53. Place brake cam (Figure 22, Item 19) onto stationary cam (Figure 22, Item 12). Arm on brake cam (Figure 22, Item 19) must be about two inches counterclockwise from cam shaft (Figure 22, Item 13).
54. Turn slotted end of link (Figure 22, Item 25) counterclockwise until you can feel tension. Then continue to turn 1/2 to 3/4 of a turn. Cam (Figure 22, Item 19) should not lift.

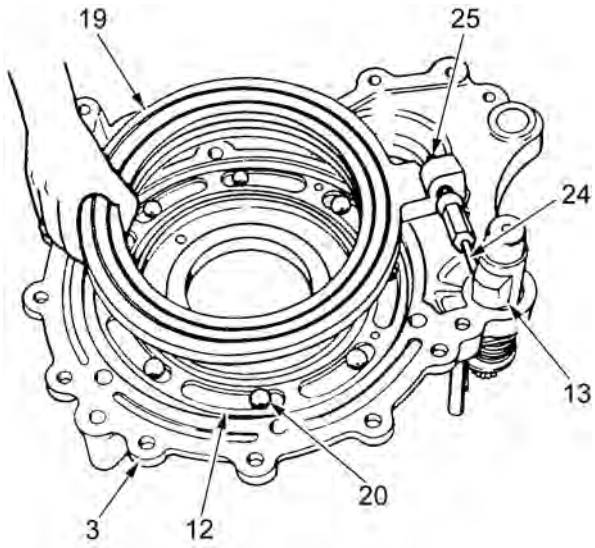


Figure 22. Brake Cam Installation.

55. Install support (Figure 23, Item 3) into center housing (Figure 23, Item 51), aligning cam shaft (Figure 23, Item 13) with bearing (Figure 23, Item 52) in center housing. Install support (Figure 23, Item 3).
56. Install 15 washers (Figure 23, Item 2) and 15 bolts (Figure 23, Item 1) that retain support (Figure 23, Item 3).
57. Use adjustable wrench to turn cam shaft (Figure 23, Item 13) a small distance to install shaft (Figure 23, Item 13) in bearing (Figure 23, Item 52).
58. Torque 15 bolts (Figure 23, Item 1) to 54 to 65 lb-ft (74 to 88 N·m).

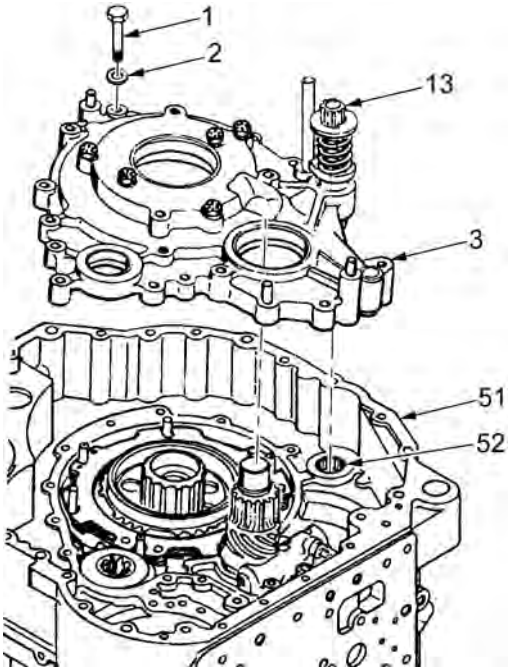


Figure 23. Left Brake Support Components Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR LEFT BRAKE SUPPORT

INITIAL SETUP:

Tools and Special Tools
Chisel, Cold, 3/8", Flat (WP 0079, Item 7)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Sander/Grinder, 4-1/2" (WP 0079, Item 31)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Carbon Dioxide, Technical (Dry Ice) (WP 0078, Item 4)
Cloth, Abrasive, Crocus (WP 0078, Item 6)
Gloves, Leather (WP 0078, Item 8)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0049

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left brake support removed (WP 0045)

NOTE

Do not remove left brake support components unless repair is necessary.

Left brake support has bearing races in position. These are for bearings on output driven gear, output drive gear, and steer gear. Each of these bearings can be separated into two pieces and is a matched set with an outer race and an inner race and rollers. DO NOT REPLACE these three outer races unless the inner races and rollers of the related bearings are also being replaced. Refer to WP 0049 for removal of the inner races and rollers from output driven gear, output drive gear, and steer gear.

REPAIR LEFT BRAKE SUPPORT

CAUTION

Be careful not to cut into left brake support when you use a grinder to cut slots in bearing races.

1. Cut two slots 180 degrees apart at base of bearing races (Figure 1, Item 1) and (Figure 1, Item 3) and (Figure 1, Item 4). Refer to Figure 2 for example of slots. Cut slots deep enough to catch the end of the chisel, but not deep enough to cut into left brake support (Figure 1, Item 2).

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

2. Apply heat to left brake support (Figure 1, Item 2) with heat gun around bearing races (Figure 1, Item 1) and (Figure 1, Item 3) and (Figure 1, Item 4) for 15 minutes.

CAUTION

Be careful not to cause damage to left brake support when removing races.

3. Turn left brake support (Figure 1, Item 2) over. Remove races (Figure 1, Item 1) and (Figure 1, Item 3) and (Figure 1, Item 4).

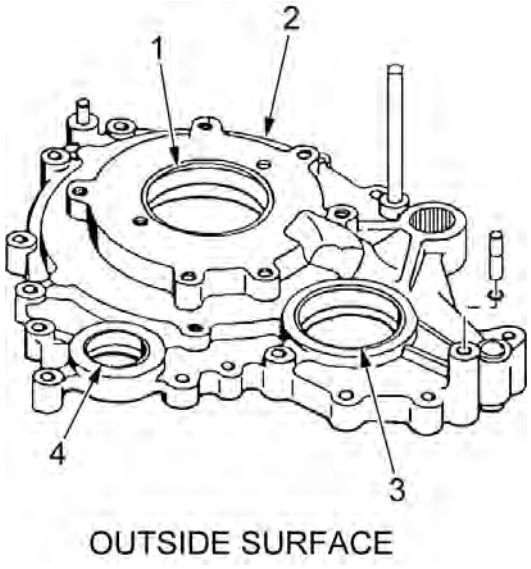


Figure 1. Bearing Races Removal.

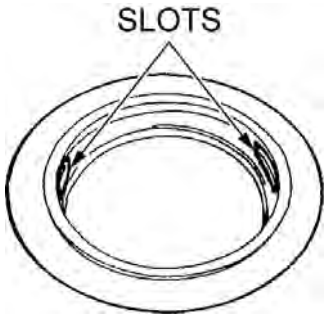


Figure 2. Bearing Race with Slots.

4. Remove two headless straight pins (Figure 3, Item 5) and (Figure 3, Item 10). Remove two retaining rings (Figure 3, Item 6) and (Figure 3, Item 11) from pins (Figure 3, Item 5) and (Figure 3, Item 10).
5. Remove two headless straight pins (Figure 3, Item 7) and (Figure 3, Item 13).
6. Remove headless straight pin (Figure 3, Item 8).
7. Remove needle roller bearing (Figure 3, Item 9).
8. Use an arbor press to remove plug valve (Figure 3, Item 12).

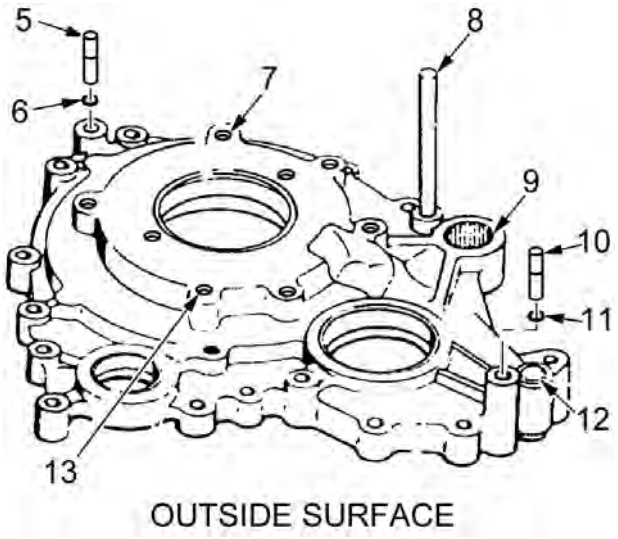


Figure 3. Pins, Retaining Rings, Needle Roller Bearing, and Plug Valve Removal.

9. Examine left brake support (Figure 4, Item 2) for damage. Smooth out scratches with abrasive crocus cloth. If there is grinding damage, replace left brake support.

CAUTION

When installed, plug valve scribe line must be within the 60-degree sector between raised lines in left brake support casting.

10. Install plug valve (Figure 4, Item 8) flush to 0.010 in. (0.25 mm) below inside surface of left brake support (Figure 4, Item 2).
11. Install needle roller bearing (Figure 4, Item 9). Push needle roller bearing (Figure 4, Item 9) to a depth of 0.310 to 0.320 in. (7.88 to 8.12 mm) below inside surface of left brake support (Figure 4, Item 2).
12. Install pin (Figure 4, Item 8) to a height of 2.88 to 2.92 in. (73.2 to 74.1 mm) above outside surface of left brake support (Figure 4, Item 2).
13. Install two pins (Figure 4, Item 7) to a height of 0.240 in. (6.10 mm) above inside surface of left brake support (Figure 4, Item 2).

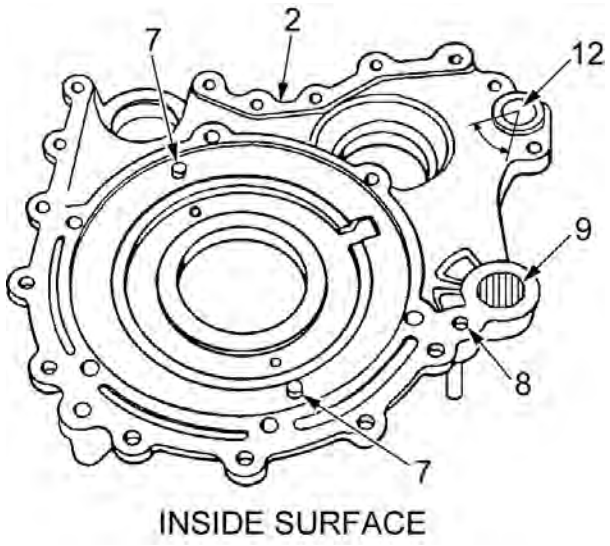


Figure 4. Pins, Needle Roller Bearing, and Plug Valve Installation.

14. Install two retaining rings (Figure 5, Item 11) onto two pins (Figure 5, Item 10).
15. Install two pins (Figure 5, Item 10) to a height of 1.01 to 1.05 in. (25.7 to 26.6 mm) above outside surface of left brake support (Figure 5, Item 2).

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

16. Apply heat to left brake support (Figure 5, Item 2) with heat gun near locations for bearing races (Figure 5, Item 1) and (Figure 5, Item 3) and (Figure 5, Item 4) for one hour.

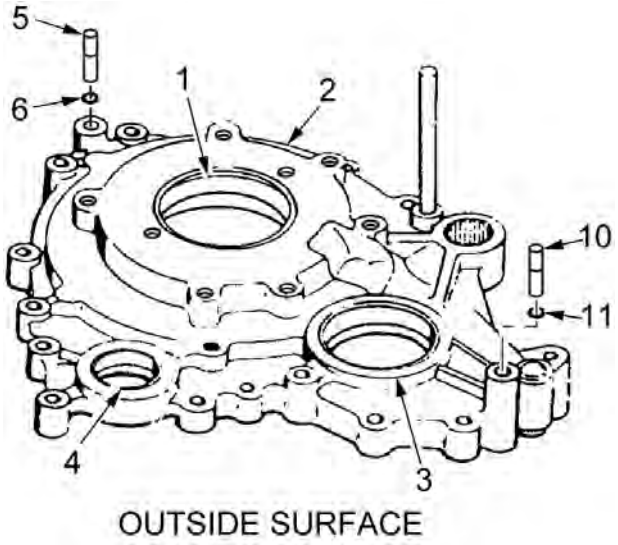


Figure 5. Retaining Rings and Pins Installation, Heat Application.

WARNING

Frozen parts can bond to your f ngers and cause serious injury. Always wear leather gloves when working with parts that have been frozen in dry ice.

17. Freeze new bearing races (Figure 6, Item 1) and (Figure 6, Item 3) and (Figure 6, Item 4) in carbon dioxide for one hour.
18. Install new bearing races (Figure 6, Item 1) and (Figure 6, Item 3) and (Figure 6, Item 4) into outside bores in left brake support (Figure 6, Item 2) to a tight position against the shoulders in the bores.
19. Let left brake support to return to room temperature.

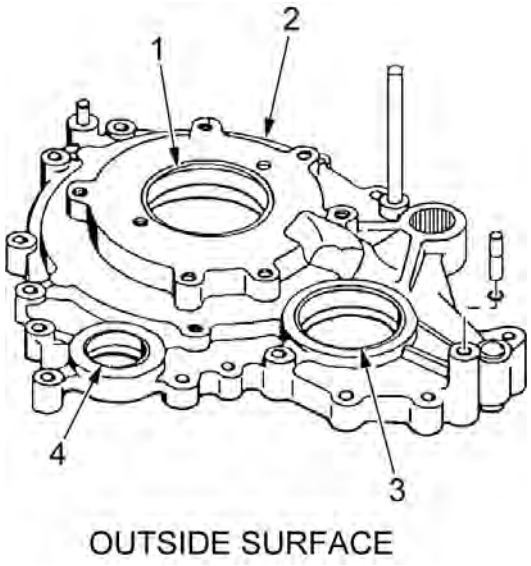


Figure 6. Bearing Races Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE INNER BRAKE ADJUSTING LINK PIN

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Pin, Spring (WP 0080, Item 6)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Inner brake adjusting link assembly removed (WP 0025)

REPLACE INNER BRAKE ADJUSTING LINK PIN

Remove Pin

1. Put inner brake adjusting link (Figure 1, Item 1) in vise.
2. Remove pin (Figure 1, Item 2) from link (Figure 1, Item 1). Discard pin (Figure 1, Item 2).

Install Pin

1. Install new pin (Figure 1, Item 2) to a height of 0.118 to 0.138 in. (3.00 to 3.50 mm) above surface of link (Figure 1, Item 1).
2. Remove link (Figure 1, Item 1) from vise.

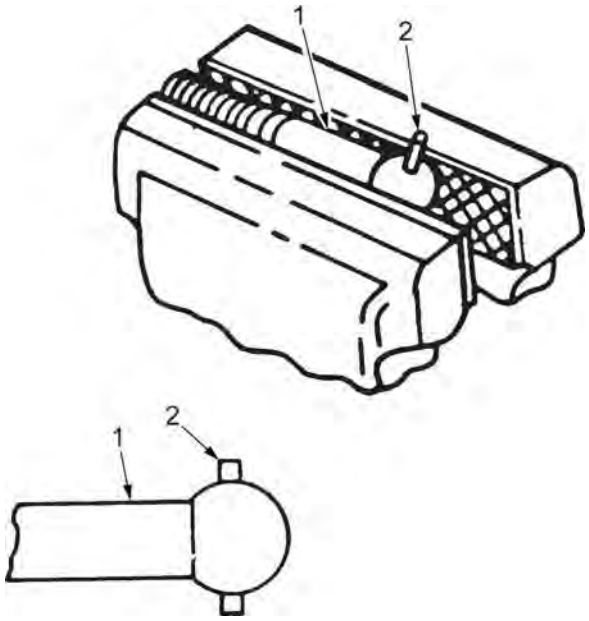


Figure 1. Inner Brake Adjusting Link Pin Replacement.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE LEFT STEER GEAR, LEFT STEER AND OUTPUT SUN GEAR, LEFT OUTPUT SHAFT, AND OUTPUT PUMP DRIVE GEAR

INITIAL SETUP:

Tools and Special Tools
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Puller Set, Mechanical, Gear and Bearing, 3-Jaw (WP 0079, Item 30)
Slide Hammer Puller (WP 0079, Item 34)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0049

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)
Left cover assembly removed (WP 0033)
Input housing assembly removed (WP 0041)

REMOVE LEFT STEER GEAR, LEFT STEER AND OUTPUT SUN GEAR, LEFT OUTPUT SHAFT, AND OUTPUT PUMP DRIVE GEAR

NOTE

Transmission is on maintenance stand, right end up.

1. Remove left steer and output sun gear (Figure 1, Item 1).
2. Remove left steer gear (Figure 1, Item 3).

NOTE

Refer to WP 0049 for replacement of bearings on spur gears.

3. Lift left output shaft (Figure 1, Item 2) from bores. If shaft (Figure 1, Item 2) does not lift out, do Step 4. If shaft (Figure 1, Item 2) is removed, go to Step 9.

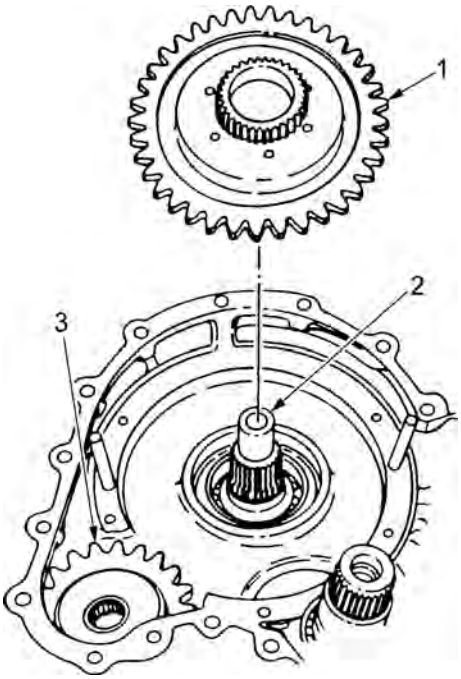


Figure 1. Left Steer Gear, Left Steer and Output Sun Gear, and Left Output Shaft Removal.

NOTE

If left cover has not been removed, go to Step 4. If left cover has been removed, go to Step 5.

4. Use puller to remove left output shaft (Figure 2, Item 2). Go to Step 9.
5. Turn transmission front up.
6. Insert drift pin (Figure 2, Item 5) through output shaft hole in left side of transmission and through output pump drive gear (Figure 2, Item 4) to bottom of left output shaft (Figure 2, Item 2) in right side of transmission.
7. Use a hammer to tap drift pin (Figure 2, Item 5) to remove left output shaft (Figure 2, Item 2) from transmission.
8. Turn transmission right end up.
9. Remove output pump drive gear (Figure 3, Item 4) from right side of transmission.

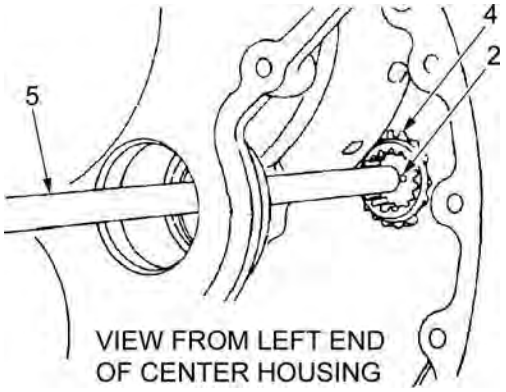


Figure 2. Left Output Shaft Removal.

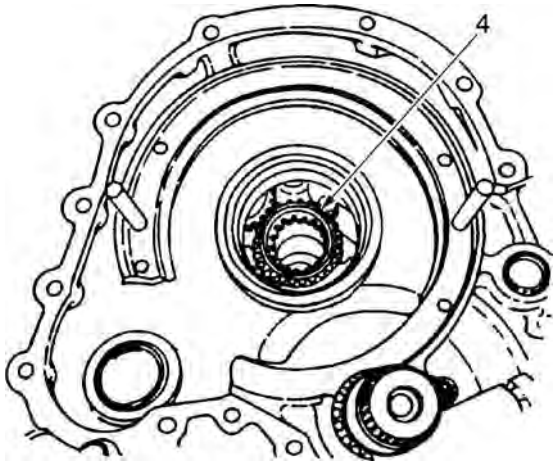


Figure 3. Output Pump Drive Gear Removal.

FOLLOW-ON MAINTENANCE

Refer to WP 0049 for replacement of bearing on left output shaft (Figure 2, Item 2).

END OF TASK

INSTALL OUTPUT PUMP DRIVE GEAR, LEFT OUTPUT SHAFT, LEFT STEER AND OUTPUT SUN GEAR, AND LEFT STEER GEAR

NOTE

Transmission is on maintenance stand, left end up.

1. Apply petrolatum to output pump drive gear (Figure 4, Item 4). Install output pump drive gear (Figure 4, Item 4) onto left output shaft (Figure 4, Item 2).
2. Install left output shaft (Figure 4, Item 2), with gear (Figure 4, Item 4) in position, into center housing.
3. Install left steer gear (Figure 5, Item 3).
4. Install left steer and output sun gear (Figure 5, Item 1).

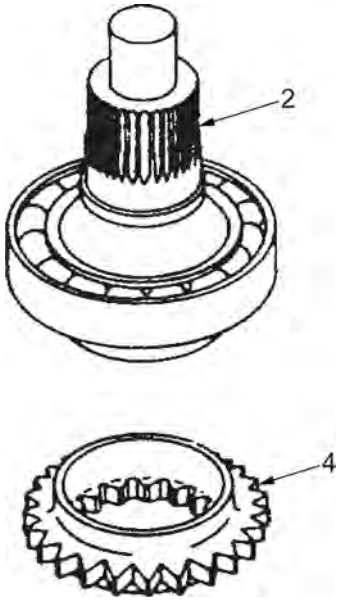


Figure 4. Output Pump Drive Gear and Left Output Shaft Installation.

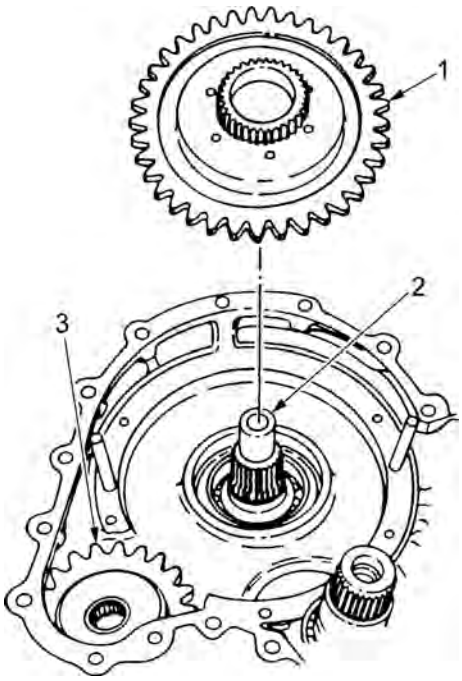


Figure 5. Left Steer Gear and Left Steer Output Sun Gear Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BEARINGS ON SPUR GEARS AND SHAFTS

INITIAL SETUP:

Tools and Special Tools
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Puller Set, Mechanical, Gear and Bearing, 3-Jaw (WP 0079, Item 30)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Gloves, Leather (WP 0078, Item 8)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0043
WP 0046

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left steer gear, left steer and output sun gear, left output shaft, and output pump drive gear removed (WP 0048)

REPLACE BEARINGS ON SPUR GEARS AND SHAFTS

NOTE

Outer races for bearings stay in center housing (left brake support) when the spur gears are removed. Each of these bearings can be disassembled into two parts and are a matched set with an outer race and an inner race and rollers. DO NOT REPLACE these inner races and rollers unless you also replace the outer races of the related bearings. Refer to WP 0046 for removal of the outer races from center housing (left brake support).

Remove Bearings

1. Remove bearing (Figure 1, Item 1) from left steer and output sun gear (Figure 1, Item 2).
2. Remove bearing (Figure 2, Item 3) from left steer gear (Figure 2, Item 4).

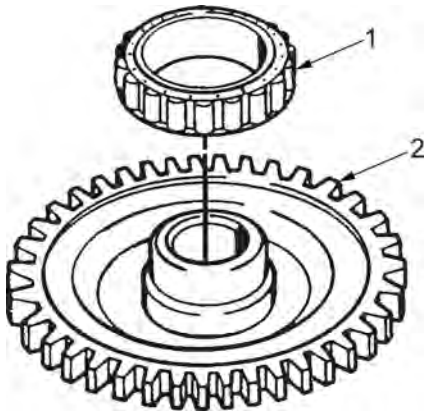


Figure 1. Left Steer and Output Sun Gear Bearing Removal.

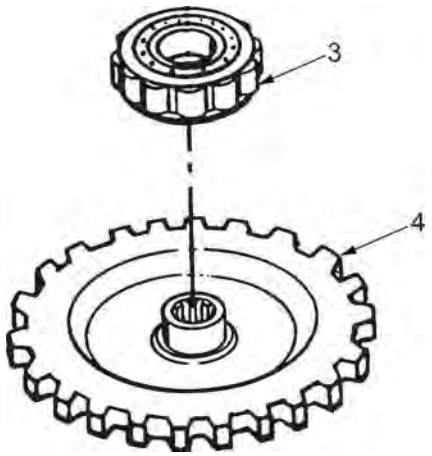


Figure 2. Left Steer Gear Bearing Removal.

3. Remove bearing (Figure 3, Item 6) from left output shaft (Figure 3, Item 5).

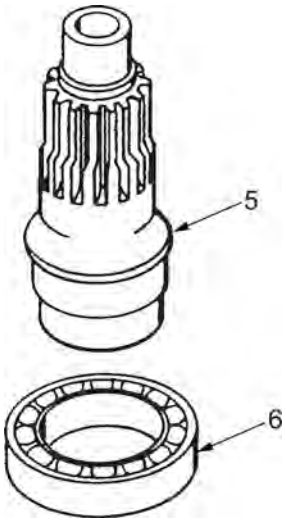


Figure 3. Left Output Shaft Bearing Removal.

NOTE

Outer race for lower bearing stays in bearing retaining plate and outer race for upper bearing stays in center housing when hydrostatic pump idler gear is removed. Each of these bearings can be disassembled into two pieces and is a matched set with an outer race and an inner race and rollers. DO NOT REPLACE these inner races and rollers unless you also replace the outer races of the related bearing. Refer to WP 0043 for removal of the outer race of bearing.

4. Remove inner race and rollers of bearings (Figure 4, Item 9) and (Figure 4, Item 7) from hydrostatic pump idler gear (Figure 4, Item 8).

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

5. Apply heat to bearing retaining plate (Figure 4, Item 10) with heat gun for one hour.
6. Push outer race of bearing (Figure 4, Item 9) from bearing retaining plate (Figure 4, Item 10).

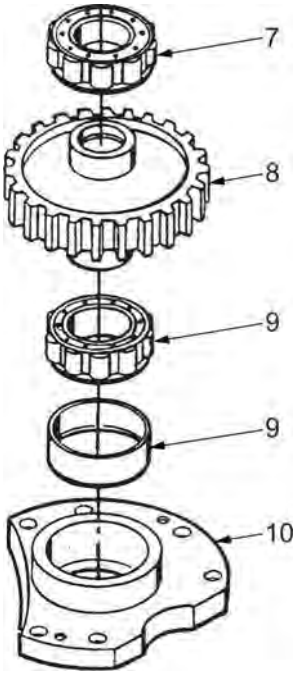


Figure 4. Hydrostatic Pump Idler Gear and Bearing Retaining Plate Bearings Removal.

Install Bearings

WARNING

Hot parts can burn you. Always wear leather gloves when working with parts that are or might be hot.

1. Apply heat to bearing retaining plate (Figure 5, Item 10) with heat gun for one hour.
2. Push new outer race of bearing (Figure 5, Item 9) against shoulder of bearing retaining plate (Figure 5, Item 10).
3. Push against the end of bearing that has numbers (Figure 5, Item 9) to install inner race and rollers of bearing (Figure 5, Item 9) against the shoulder of hydrostatic pump idler gear (Figure 5, Item 8).
4. Push against the end of bearing that has numbers (Figure 5, Item 7) to install inner race and rollers of bearing (Figure 5, Item 7) against the shoulder of hydrostatic pump idler gear (Figure 5, Item 8).

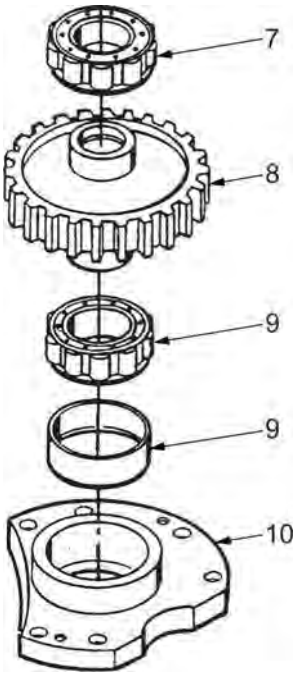


Figure 5. Hydrostatic Pump Idler Gear and Bearing Retaining Plate Bearings Installation.

5. Install bearing (Figure 6, Item 1) against shoulder on left steer and output sun gear (Figure 6, Item 2).

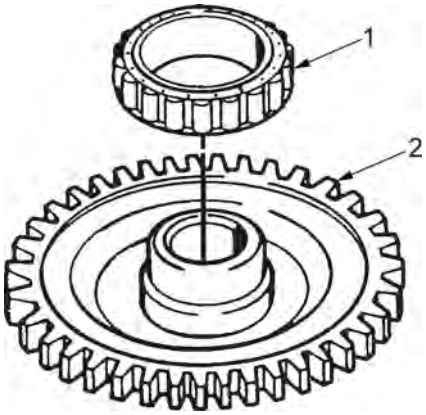


Figure 6. Left Steer and Output Sun Gear Bearing Installation.

6. Install bearing (Figure 7, Item 6) to a seat against shoulder on left output shaft (Figure 7, Item 5).
7. Install bearing (Figure 8, Item 3) to a seat against shoulder on left steer gear (Figure 8, Item 4).

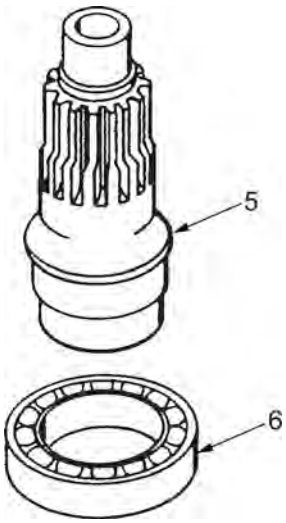


Figure 7. Left Output Shaft Bearing Installation.

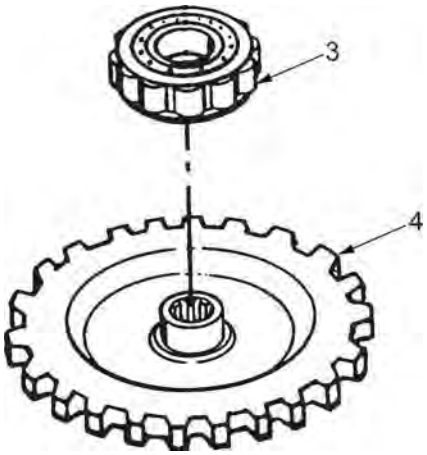


Figure 8. Left Steer Gear Bearing Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE STEER CONTROL ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Sealant, Lubricating, Thread-Locking (WP 0078, Item 15)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left steer gear, left steer and output sun gear, left output shaft, and output pump drive gear removed (WP 0048)

REMOVE STEER CONTROL ASSEMBLY

1. Remove two socket head screws (Figure 1, Item 1) that attach steer control assembly (Figure 1, Item 4) to hydrostatic pump and motor assembly (Figure 1, Item 5).
2. Remove four bolts (Figure 1, Item 2) and four washers (Figure 1, Item 3) that attach steer control assembly to hydrostatic pump and motor assembly (Figure 1, Item 5).
3. Remove steer control assembly (Figure 1, Item 4) from hydrostatic pump and motor assembly (Figure 1, Item 5).

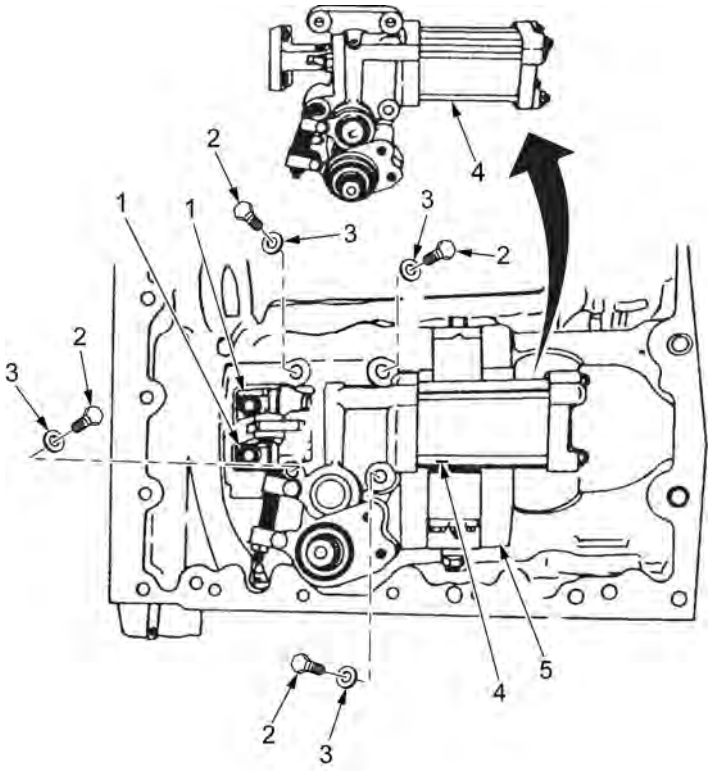


Figure 1. Steer Control Assembly Removal.

END OF TASK

INSTALL STEER CONTROL ASSEMBLY

1. Turn transmission to input side up.

CAUTION

Before you position steer control assembly on hydrostatic pump and motor assembly, do a check to make sure control rod pin is engaged into feedback lever. If control rod pin is not engaged into feedback lever, turn control rod until engaged. Refer to Figure 2. Non-engagement will cause vehicle failure of full steer during start-up.

2. Place steer control assembly (Figure 3, Item 4) on hydrostatic pump and motor assembly (Figure 3, Item 5).
3. Install two 5/16-18 x 2-1/4 inch bolts (Figure 3, Item 8) and washers (Figure 3, Item 9) in steer control assembly (Figure 3, Item 4).
4. Install two 5/16-18 x 1-1/2 inch bolts (Figure 3, Item 6) and washers (Figure 3, Item 7) in steer control assembly (Figure 3, Item 4).
5. Apply sealant on threads of two socket head screws (Figure 3, Item 1).
6. Install two socket head screws (Figure 3, Item 1) in cam lever of steer control assembly (Figure 3, Item 4).
7. Torque four bolts (Figure 3, Item 6) and (Figure 3, Item 8) to 17 to 20 lb-ft (23 to 27 N·m).
8. Torque two socket head screws (Figure 3, Item 1) to 87 to 88 lb-ft (117 to 119 N·m).

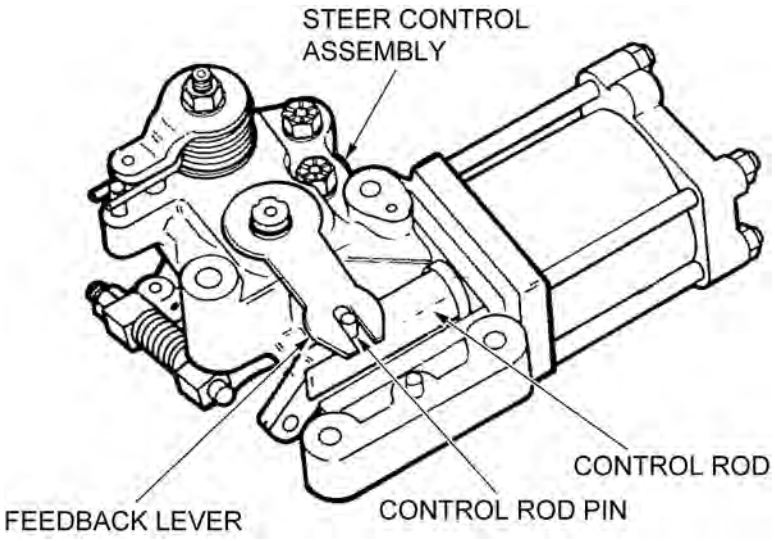


Figure 2. Pin and Rod Engagement.

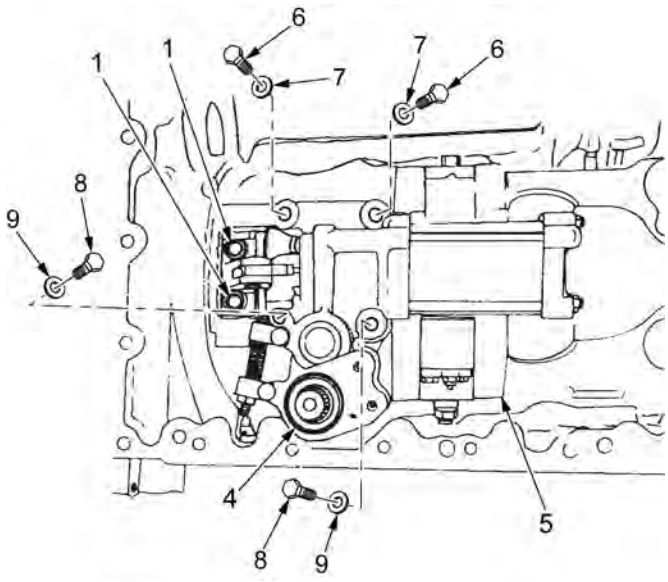


Figure 3. Steer Control Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR FORWARD CLUTCH HOUSING ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Bar and Stud Assembly (WP 0079, Item 4)
Compressor, Clutch Spring (WP 0079, Item 9)
Fixture Assembly, Leak Test (WP 0079, Item 17)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Protector, Inner Seal (WP 0079, Item 29)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal, Plain (Inner) (WP 0080, Item 56)
Seal, Plain (Outer) (WP 0080, Item 57)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Range input driven gear removed (WP 0037)

REPAIR FORWARD CLUTCH HOUSING ASSEMBLY

CAUTION

When you remove, handle, or install the clutch pack, make sure that all clutch plates and plates stay in the same order and face the same direction. Under heat and pressure, clutch plates can take on a conical shape, called coning. The degree of coning in each plate will be different. When coned plates are mixed or turned over, they do not install correctly together. This can keep plate surfaces from fully engaging. If this occurs, the clutch pack to may not operate satisfactorily.

When you replace one clutch plate or plate, replace the entire clutch pack. Do not replace only one clutch plate because a new plate will not have the correct surface contour to engage the adjacent older plates, This will make the operation of the clutch pack unsatisfactory.

Clutch assemblies operate in pairs. When one clutch pack is defective, a second clutch pack will often be defective. If one clutch pack is defective, it is necessary to inspect all clutch assemblies in the range pack.

Remove Forward Clutch Housing Assembly Components

1. Remove retaining ring (Figure 1, Item 1).
2. Remove clutch assembly (hub) (Figure 1, Item 2).
3. Remove body hub (Figure 1, Item 15).
4. Remove thrust washer (Figure 1, Item 14).
5. Remove clutch pack of f ve friction plates (Figure 1, Item 3) and f ve reaction plates (Figure 1, Item 4).
6. Compress the retaining plate (Figure 1, Item 12), using wrench, bar and stud assembly (Figure 1, Item 7), and clutch compressor (Figure 1, Item 6), to get access to the retaining ring (Figure 1, Item 13).
7. Remove retaining ring (Figure 1, Item 13).
8. Remove bar and stud assembly (Figure 1, Item 7) and clutch compressor (Figure 1, Item 6) from the housing.
9. Remove retaining plate (Figure 1, Item 12).
10. Remove 16 compression helical springs (Figure 1, Item 5).
11. Remove the piston (Figure 1, Item 11) from the clutch housing (Figure 1, Item 8).
12. Remove the inner seal (Figure 1, Item 10) and the outer seal (Figure 1, Item 9) from the piston (Figure 1, Item 11). Discard seals (Figure 1, Item 9) and (Figure 1, Item 10).

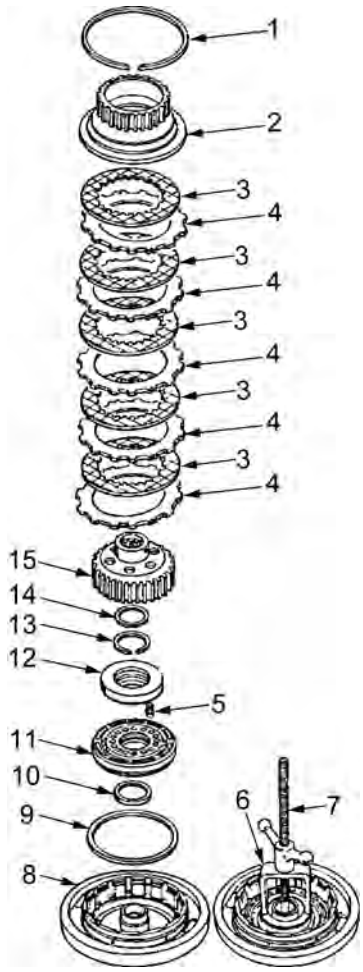


Figure 1. Forward Clutch Housing Assembly Components Removal.

Install Forward Clutch Housing Assembly Components

1. Install new outer seal (Figure 2, Item 9) and new inner seal (Figure 2, Item 10) onto the piston (Figure 2, Item 11). Apply petrolatum to the seals (Figure 2, Item 9) and (Figure 2, Item 10).
2. Apply a thin layer of petrolatum to the interior surface of the clutch housing (Figure 2, Item 8).
3. Install inner seal protector (Figure 2, Item 16) on the hub of the clutch housing (Figure 2, Item 8). Lightly apply petrolatum to the inner seal protector (Figure 2, Item 16).
4. Install the piston (Figure 2, Item 11) into clutch housing (Figure 2, Item 8) so that the spring holes point up.
5. Remove the inner seal protector (Figure 2, Item 16).
6. Install 16 springs (Figure 2, Item 5) into the spring holes in the piston (Figure 2, Item 11).
7. Install the retaining plate (Figure 2, Item 12) on the springs (Figure 2, Item 5).
8. Put the retaining ring (Figure 2, Item 13) in position on the retaining plate (Figure 2, Item 12).
9. Compress the retaining plate (Figure 2, Item 12), using the bar and stud assembly (Figure 2, Item 7) and the clutch compressor (Figure 2, Item 6), against the spring force to get access to the groove for the retaining ring (Figure 2, Item 13).
10. Install the retaining ring (Figure 2, Item 13).
11. Remove the bar and stud assembly (Figure 2, Item 7) and the clutch compressor (Figure 2, Item 6).

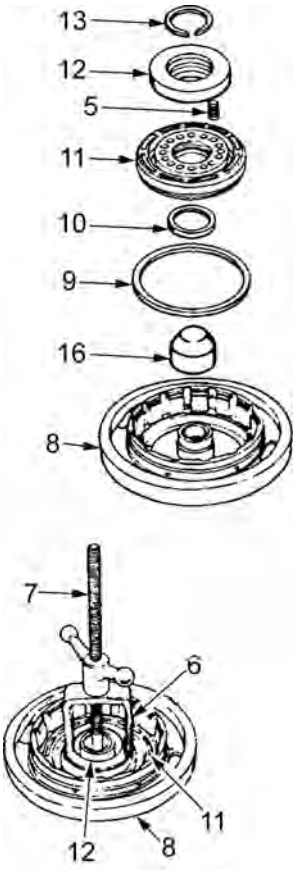


Figure 2. Outer and Inner Seals Installation.

12. Apply petrolatum to the thrust washer (Figure 3, Item 14). Install the thrust washer (Figure 3, Item 14) in bottom of the body hub (Figure 3, Item 15).
13. Install the body hub (Figure 3, Item 15) on the retaining plate (Figure 3, Item 12).
14. Soak f ve friction plates (Figure 3, Item 3) in engine lubricating oil for two minutes before you install them.
15. Install one reaction plate (Figure 3, Item 4), then one friction plate (Figure 3, Item 3). Continue until f ve friction plates (Figure 3, Item 4) and f ve reaction plates (Figure 3, Item 3) are installed.
16. Install the clutch assembly (hub) (Figure 3, Item 2).
17. Install the retaining ring (Figure 3, Item 1).

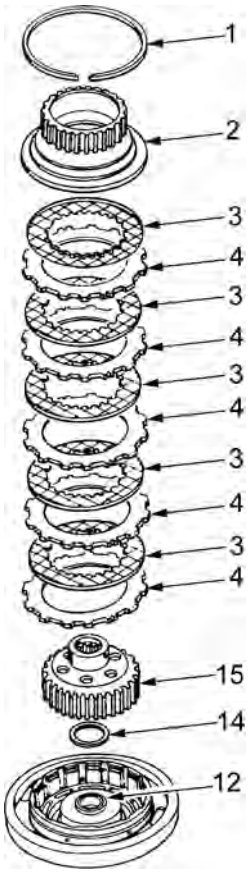


Figure 3. Forward Clutch Housing Assembly Components Installation.

Check Assembled Clutch for Damaged Seals

1. Apply petrolatum to two seals (Figure 4, Item 18) on the smaller hub of the leak test f xture assembly (Figure 4, Item 21). Install the f xture all the way into the forward clutch housing assembly (Figure 4, Item 17).

WARNING

Compressed air for testing purposes must not exceed 30 pounds of pressure per square inch. Use only with good chip guards and protective personal equipment, including goggles or face shield and gloves. Never blow compressed air toward another person. Compressed air can cause serious injury or death to personnel.

2. Connect the air hose (Figure 4, Item 19) to the coupling (Figure 4, Item 20) and try to turn the hub (Figure 4, Item 15). If you can turn the hub (Figure 4, Item 15), repeat Install Forward Clutch Housing Assembly Components task to replace seals that are damaged. If you cannot turn the hub (Figure 4, Item 15), the clutch assembly is satisfactory.

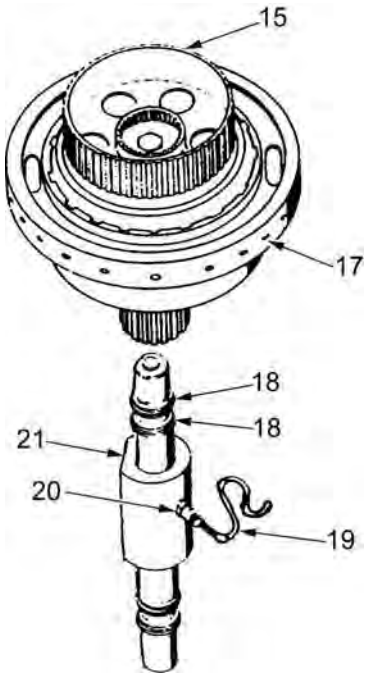


Figure 4. Leak Test Fixture Assembly.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR FOURTH AND REVERSE CLUTCH HOUSING ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Bar and Stud Assembly (WP 0079, Item 4)
Compressor, Clutch Spring (WP 0079, Item 9)
Fixture Assembly, Leak Test (WP 0079, Item 17)
Heater, Gun-Type, Electric (WP 0079, Item 20)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Protector, Inner Seal (WP 0079, Item 29)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Gloves, Leather (WP 0078, Item 8)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal, Plain (Inner) (WP 0080, Item 56)
Seal, Plain (Outer) (WP 0080, Item 57)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Forward clutch housing assembly removed (WP 0051)

REPAIR FOURTH AND REVERSE CLUTCH HOUSING ASSEMBLY

CAUTION

When you remove, handle, or install the clutch pack, make sure that all clutch plates and plates stay in the same order and face the same direction. Under heat and pressure, clutch plates can take on a conical shape, called coning. The degree of coning in each plate will be different. When coned plates are mixed or turned over, they do not install correctly together. This can keep plate surfaces from fully engaging. If this occurs, the clutch pack to may not operate satisfactorily.

When you replace one clutch plate or plate, replace the entire clutch pack. Do not replace only one clutch plate because a new plate will not have the correct surface contour to engage the adjacent older plates, This will make the operation of the clutch pack unsatisfactory.

Clutch assemblies operate in pairs. When one clutch pack is defective, a second clutch pack will often be defective. If one clutch pack is defective, it is necessary to inspect all clutch assemblies in the range pack.

Remove Fourth and Reverse Clutch Housing Assembly Components

1. Remove retaining ring (Figure 1, Item 1).
2. Remove clutch plate (backing plate) (Figure 1, Item 2).
3. Remove clutch pack of f ve friction plates (Figure 1, Item 3) and f ve reaction plates (Figure 1, Item 4).
4. Compress the retaining plate (Figure 1, Item 6), using wrench, bar and stud assembly (Figure 1, Item 13), and clutch compressor (Figure 1, Item 12), to get access to retaining ring (Figure 1, Item 5).
5. Remove retaining ring (Figure 1, Item 5).
6. Remove bar and stud assembly (Figure 1, Item 13) and clutch compressor (Figure 1, Item 12) from the housing (Figure 1, Item 11).
7. Remove retaining plate (Figure 1, Item 6).
8. Remove 16 compression helical springs (Figure 1, Item 7).
9. Remove the piston (Figure 1, Item 10) from the clutch housing (Figure 1, Item 6).
10. Remove the inner seal (Figure 1, Item 10) and outer seal (Figure 1, Item 9) from piston (Figure 1, Item 8). Discard seals (Figure 1, Item 9) and (Figure 1, Item 10).

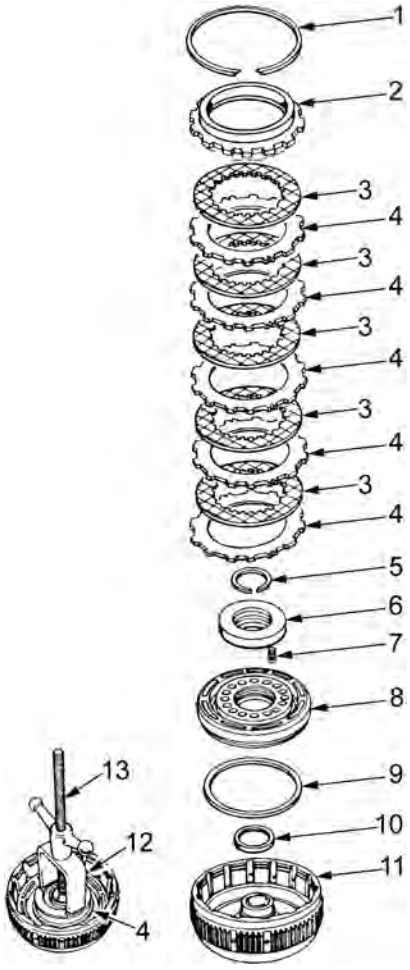


Figure 1. Fourth and Reverse Clutch Housing Assembly Components Removal.

Install Fourth and Reverse Clutch Housing Assembly Components

1. Install new outer seal (Figure 2, Item 9) and new inner seal (Figure 2, Item 10) onto the piston (Figure 2, Item 8). Apply petrolatum to the seals (Figure 2, Item 9) and (Figure 2, Item 10).
2. Apply a thin layer of petrolatum to the surface of the clutch housing (Figure 2, Item 11).
3. Install inner seal protector (Figure 2, Item 14) on ther hub of the housing assembly (Figure 2, Item 11). Lightly apply petrolatum to the inner seal protector (Figure 2, Item 14).
4. Install the piston (Figure 2, Item 8) into the clutch housing (Figure 2, Item 11) so that the spring holes point up.
5. Remove the inner seal protector (Figure 2, Item 14).
6. Install 16 springs (Figure 2, Item 7) into the spring holes in the piston (Figure 2, Item 8).
7. Install the retaining plate (Figure 2, Item 5) on the springs (Figure 2, Item 7).
8. Put the retaining ring (Figure 2, Item 5) in position on the retaining plate (Figure 2, Item 6).
9. Compress the retaining plate (Figure 2, Item 6), using wrench, the bar and stud assembly (Figure 2, Item 13), and the clutch compressor (Figure 2, Item 12), against spring force to get access to the groove for the retaining ring (Figure 2, Item 5).
10. Install the retaining ring (Figure 2, Item 5).

11. Remove the bar and stud assembly (Figure 2, Item 13) and the clutch compressor (Figure 2, Item 12) from clutch assembly.

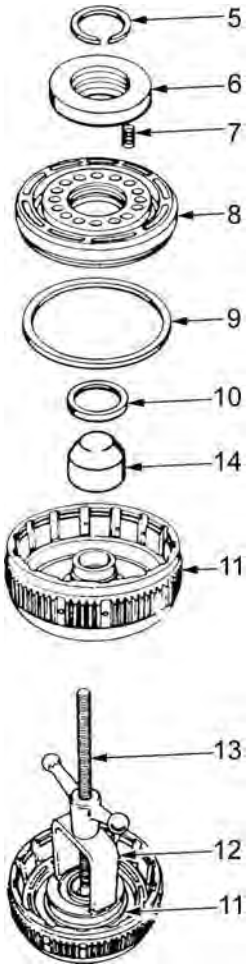


Figure 2. Inner and Outer Seals Installation.

12. Soak five friction plates (Figure 3, Item 3) in engine lubricating oil for two minutes before you install them.
13. Install one reaction plate (Figure 3, Item 4), then one friction plate (Figure 3, Item 3). Continue until five reaction plates (Figure 3, Item 4) and five friction plates (Figure 3, Item 3) are installed into clutch housing (Figure 3, Item 11).
14. Install backing plate (Figure 3, Item 2).
15. Install retaining ring (Figure 3, Item 1).

Check Assembled Clutch for Damaged Seal

1. Apply petrolatum to two seals (Figure 3, Item 16) on the larger hub of the leak test fixture assembly (Figure 3, Item 19). Install the fixture all the way into clutch assembly (Figure 3, Item 15).

WARNING

Compressed air used for testing purposes must not exceed 30 pounds of pressure per square inch. Use only with good chip guards and protective personal equipment, including goggles or face shield and gloves. Never blow compressed air toward another person. Compressed air can cause serious injury or death to personnel.

2. Connect the air hose (Figure 3, Item 17) to the coupling (Figure 3, Item 18) and observe plates (Figure 3, Item 3) and (Figure 3, Item 4). Make sure the plates (Figure 3, Item 3) and (Figure 3, Item 4) push together and engage. If the plates do not push together, repeat Remove Fourth and Reverse Clutch Housing Assembly Components task to replace the damaged seals. If plates moved, the clutch assembly is satisfactory.

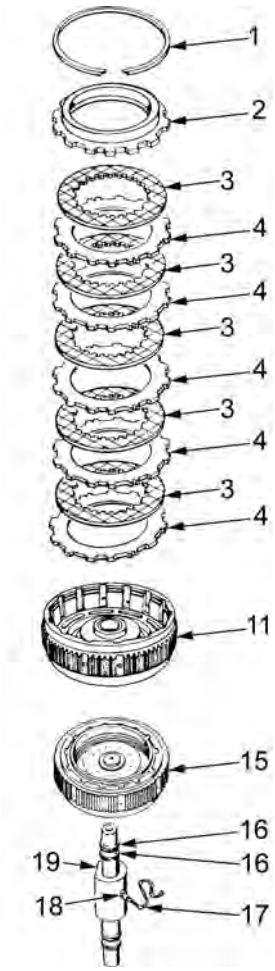


Figure 3. Fourth and Reverse Clutch Housing Assembly Components Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR SECOND AND THIRD CLUTCH PISTON HOUSING ASSEMBLIES

INITIAL SETUP:

Tools and Special Tools
Installer, Lock Ring (WP 0079, Item 25)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Push-On Nut (WP 0080, Item 9) (4)
Seal, Air, Gas, Turbine (WP 0080, Item 25)
Seal, Plain (2nd Clutch Piston Only) (WP 0080, Item 25)
Seal, Plain (3rd Clutch Piston Only) (WP 0080, Item 22)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Fourth and reverse clutch assembly removed (WP 0052)

REPAIR SECOND AND THIRD CLUTCH PISTON HOUSING ASSEMBLIES

NOTE

This work package repairs the second clutch piston housing assembly or the third clutch piston housing assembly.

Disassemble Clutch Piston Housing Assembly

1. Remove the piston assembly (Figure 1, Item 2) from the piston housing (Figure 1, Item 4).
2. Remove seals (Figure 1, Item 1) and (Figure 1, Item 3) from the piston assembly (Figure 1, Item 2). Discard seals (Figure 1, Item 1) and (Figure 1, Item 3).

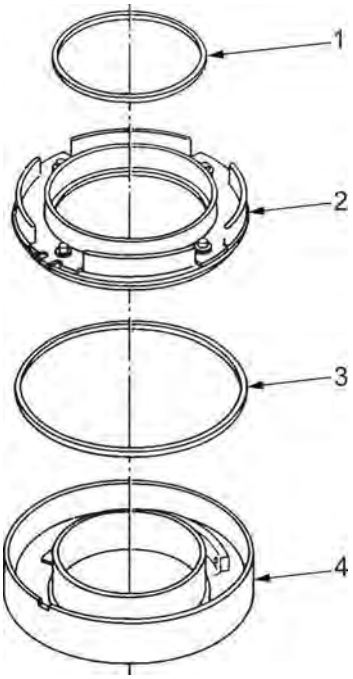


Figure 1. Piston Assembly and Seals Removal.

3. Compress the spring retainer (Figure 2, Item 5), and then cut and remove four push-on nuts (locking rings) (Figure 2, Item 6). Discard push-on nuts (locking rings) (Figure 2, Item 6).
4. Remove the spring retainer (Figure 2, Item 5).
5. Remove 12 springs (Figure 2, Item 7) from the piston (Figure 2, Item 8).

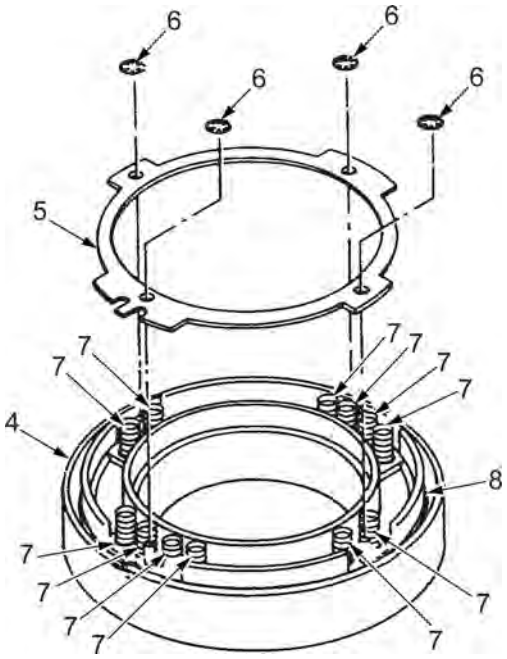


Figure 2. Spring Retainer and Springs Removal.

Assemble Clutch Piston Housing Assembly

1. Install the piston (Figure 3, Item 8) into the piston housing (Figure 3, Item 4). Do not install new seals (Figure 3, Item 1) and (Figure 3, Item 3) at this time.
2. Install 12 springs (Figure 3, Item 7) into spring holes in the piston (Figure 3, Item 8).
3. Install the spring retainer (Figure 3, Item 5). Align the spring retainer (Figure 3, Item 5) with notches in the piston housing (Figure 3, Item 4).
4. Install four new push-on nuts (locking rings) (Figure 3, Item 6) using the lock ring installer.
5. Remove the piston assembly (Figure 4, Item 2) from the piston housing (Figure 4, Item 4).
6. Install new seals (Figure 4, Item 1) and (Figure 4, Item 3) on the piston assembly (Figure 4, Item 2) so that the seal lips point down. Apply petrolatum to seals (Figure 4, Item 1) and (Figure 4, Item 3).
7. Apply a thin layer of petrolatum to the touching surfaces of the piston housing (Figure 4, Item 4).
8. Install the piston assembly (Figure 4, Item 2) into the piston housing (Figure 4, Item 4).

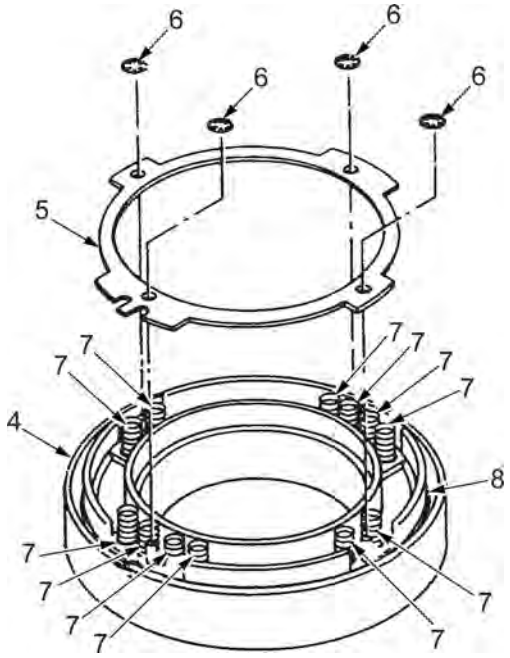


Figure 3. Spring Retainer and Springs Installation.

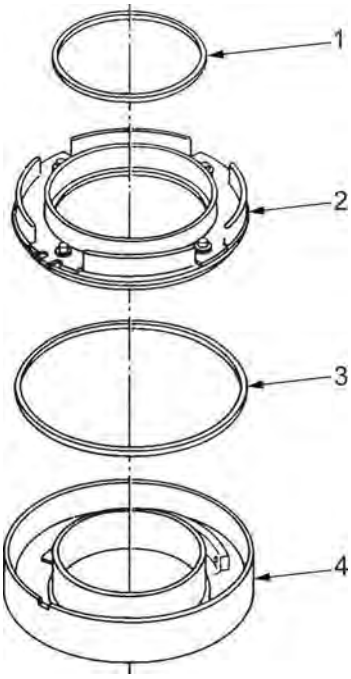


Figure 4. Piston Assembly and Seals Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE INPUT SHAFT COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Pliers Set, Retaining Ring (WP 0079, Item 27)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal Ring, Metal (WP 0080, Item 19) (2)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Second clutch piston housing assembly removed (WP 0053)

REPLACE INPUT SHAFT COMPONENTS

Disassemble Input Shaft Components

1. Remove two seal rings (Figure 1, Item 1) from the range input shaft (shouldered shaft) (Figure 1, Item 2). Discard seal rings (Figure 1, Item 1).
2. Remove the retaining ring (Figure 1, Item 4).
3. Remove the front internal gear (Figure 1, Item 3) from the range input shaft (Figure 1, Item 2).
4. Remove the range input shaft (Figure 1, Item 2) with its attached parts from the rear carrier drum (Figure 1, Item 5).
5. Remove the center carrier (Figure 1, Item 6) from the input shaft (Figure 1, Item 2).

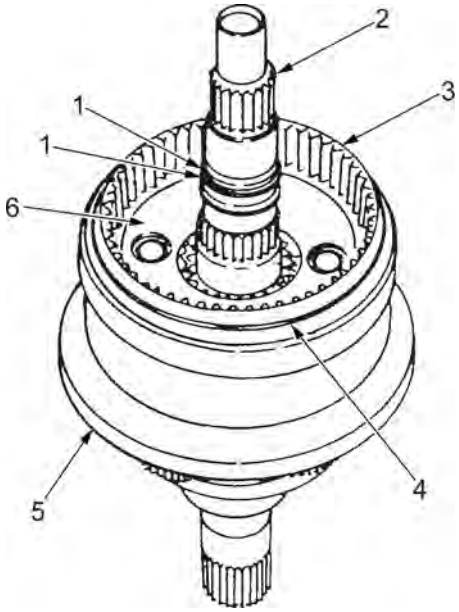


Figure 1. Range Input Shaft Disassembly.

6. Remove the retaining ring (Figure 2, Item 7) that holds the rear sun gear (spur gear) (Figure 2, Item 8) on the range input shaft (Figure 2, Item 2).
7. Remove the rear sun gear (Figure 2, Item 8) and its attached parts from the range input shaft (Figure 2, Item 2).

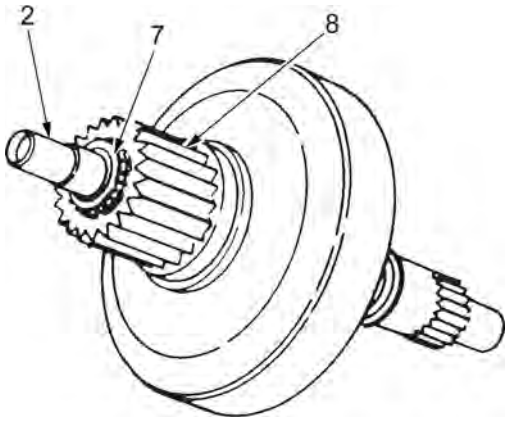


Figure 2. Rear Sun Gear and Attaching Parts Removal.

8. Remove the retaining ring (Figure 3, Item 9) that holds the rear sun gear (Figure 3, Item 8) in the internal gear (center carrier ring gear) (Figure 3, Item 10).

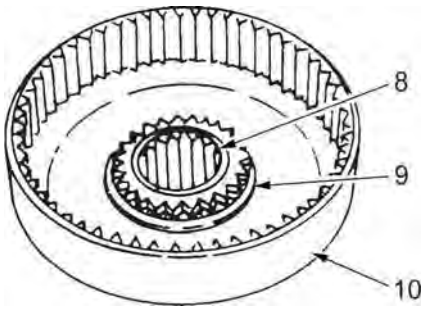


Figure 3. Retaining Ring Removal.

9. Remove the thrust washer (Figure 4, Item 11) from the range input shaft (Figure 4, Item 2).
10. Remove the center sun gear assembly (Figure 4, Item 12) from the range input shaft (Figure 4, Item 2).

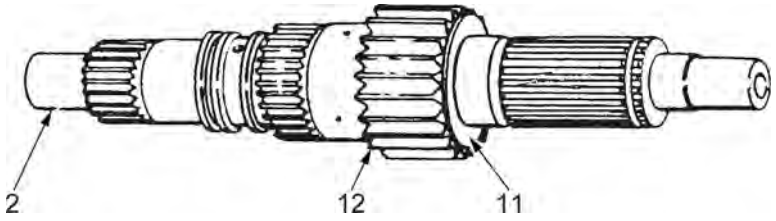


Figure 4. Center Sun Gear Assembly Removal.

11. Remove the thrust bearing races (Figure 5, Item 14) and (Figure 5, Item 15) and the thrust bearing (Figure 5, Item 13) from surface of the shaft (Figure 5, Item 17) inside the rear carrier assembly (Figure 5, Item 16).

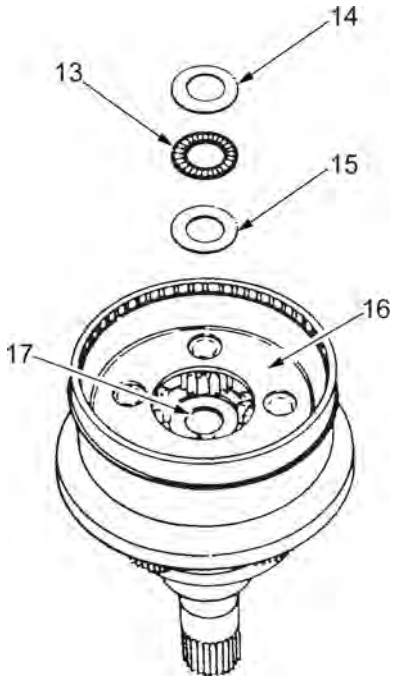


Figure 5. Rear Carrier Assembly Components Removal.

12. Remove the retaining ring (Figure 6, Item 19) that holds the drum (Figure 6, Item 5) on the rear carrier assembly (Figure 6, Item 18).
13. Remove the drum (Figure 6, Item 5) from the rear carrier assembly (Figure 6, Item 18).

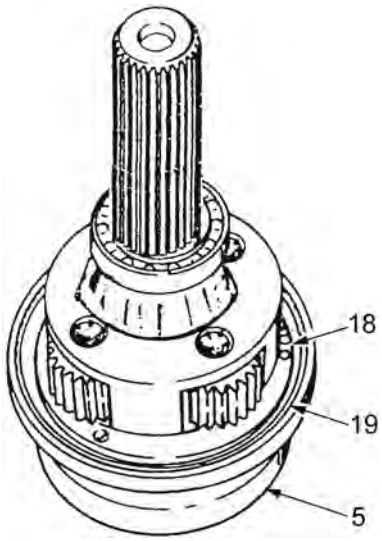


Figure 6. Drum Removal.

Assemble Input Shaft Components

NOTE

Do not remove bearing unless replacement is necessary.

1. Remove bearing (Figure 7, Item 20) from the shaft of the rear carrier assembly (Figure 7, Item 18). Discard bearing (Figure 7, Item 20).
2. Install new bearing (Figure 7, Item 20) on the rear carrier assembly (Figure 7, Item 18). Push the bearing so that it touches the shoulder of the shaft and bushing assembly (Figure 7, Item 21).

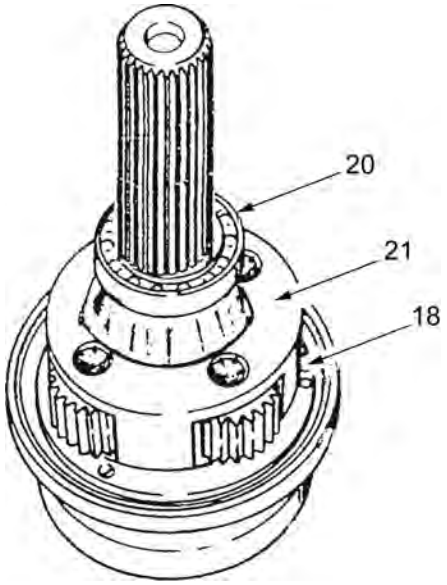


Figure 7. Rear Carrier Assembly Bearing Replacement.

3. Install the drum (Figure 8, Item 5) on the rear carrier assembly (Figure 8, Item 18).
4. Install retaining ring (Figure 8, Item 19) to hold drum (Figure 8, Item 5) onto rear carrier assembly or (Figure 8, Item 18).

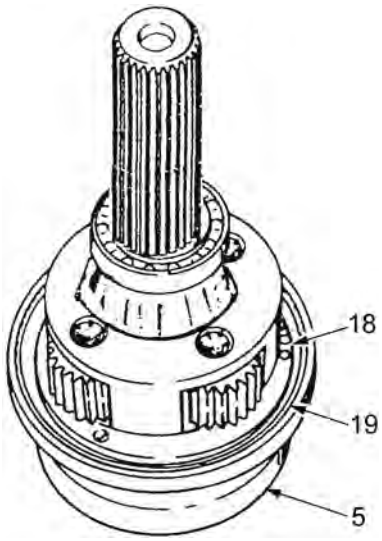


Figure 8. Drum Installation.

5. Apply petrolatum to thrust bearing races (Figure 9, Item 14) and (Figure 9, Item 15) and to thrust bearing (Figure 9, Item 13).
6. Install the race (Figure 9, Item 15), bearing (Figure 9, Item 13), and race (Figure 9, Item 14) on the surface of the shaft (Figure 9, Item 17) in the rear carrier assembly (Figure 9, Item 18).

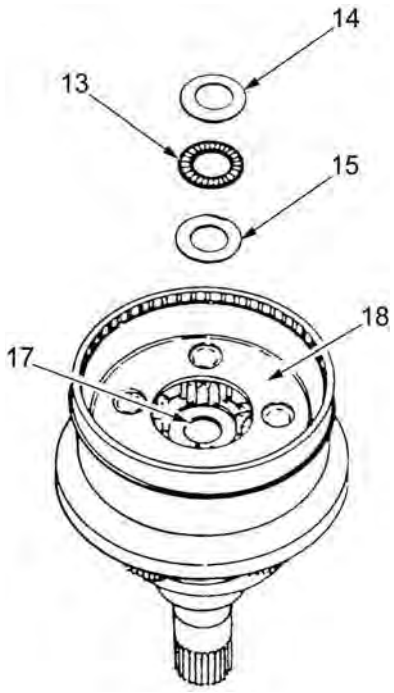


Figure 9. Rear Carrier Assembly Components Installation.

7. Install the center sun gear assembly (Figure 10, Item 12) onto the range input shaft (Figure 10, Item 2), aligning the smaller splines next to two packing grooves in the shaft (Figure 10, Item 2).
8. Install the thrust washer (Figure 10, Item 11) onto the range input shaft (Figure 10, Item 2).

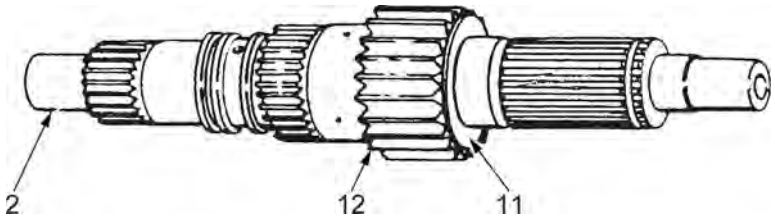


Figure 10. Center Sun Gear Assembly Installation.

9. Install retaining ring (Figure 11, Item 9) that holds the rear sun gear (Figure 11, Item 8) to the center carrier ring gear (Figure 11, Item 10).
10. Install the rear sun gear (Figure 12, Item 8) and the attached parts onto the range input shaft (Figure 12, Item 2).
11. Install the retaining ring (Figure 12, Item 7) that holds the rear sun gear (Figure 12, Item 8) to the range input shaft (Figure 12, Item 2).

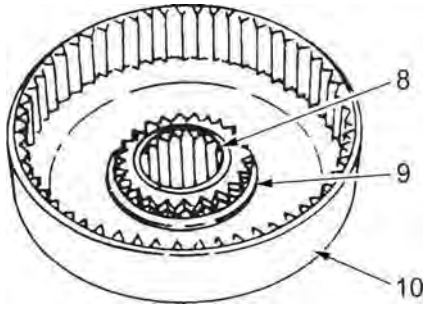


Figure 11. Retaining Ring Installation.

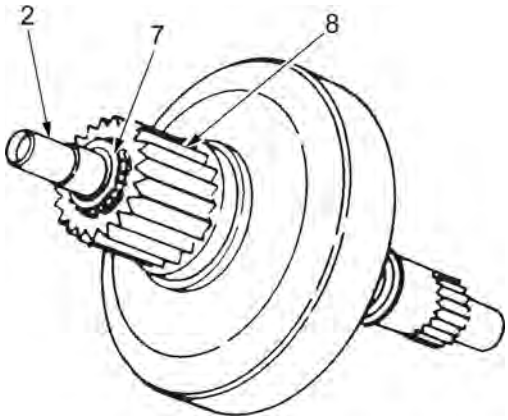


Figure 12. Rear Sun Gear and Attaching Parts Installation.

12. Install the range input shaft (Figure 13, Item 2) and attached parts into the rear carrier drum (Figure 13, Item 5).
13. Install the center carrier assembly (Figure 13, Item 6) on the range input shaft (Figure 13, Item 2).
14. Install the front internal gear (Figure 13, Item 3) with the larger end pointing down, onto the range input shaft (Figure 13, Item 2).
15. Install the retaining ring (Figure 13, Item 4).
16. Install new two seal rings (Figure 13, Item 1) onto the range input shaft (Figure 13, Item 2).

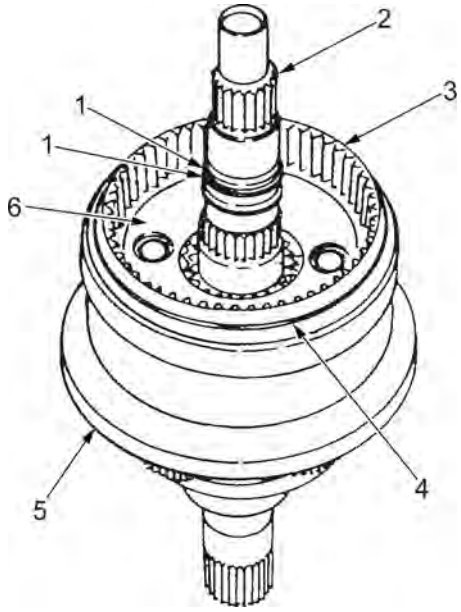


Figure 13. Range Input Shaft Assembly.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

INSTALL/REMOVE FABRICATED RANGE PACK RETAINING FIXTURE

INITIAL SETUP:

Tools and Special Tools
Retaining Fixture (WP 0075, Item 1)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left cover assembly removed (WP 0033)

INSTALL FABRICATED RANGE PACK RETAINING FIXTURE

NOTE

Retaining f xture is installed to prevent range pack from shifting when transmission is rotated.

1. Align hole in retaining f xture (Figure 1, Item 1) with one of three left cover bolt holes (Figure 1, Item 3) located nearest to forward clutch housing assembly (Figure 1, Item 2).
2. Install 3/8-16 x 3/4 in. bolt (Figure 1, Item 5) and 3/8 in. washer (Figure 1, Item 4) in selected bolt hole (Figure 1, Item 3).
3. Torque bolt (Figure 1, Item 5) to 27 to 32 lb-ft (37 to 43 N·m).

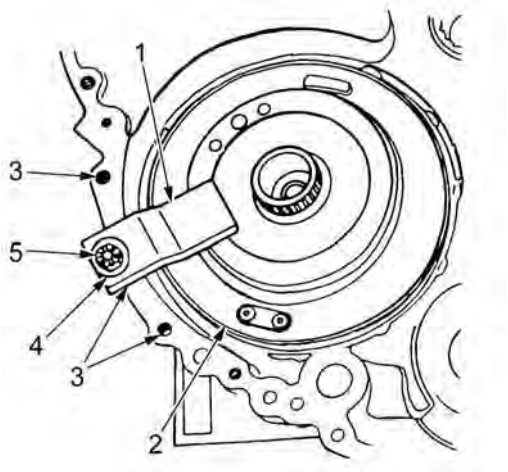


Figure 1. Range Pack Retaining Fixture Installation.

END OF TASK

REMOVE FABRICATED RANGE PACK RETAINING FIXTURE

1. Turn transmission to left end up.
2. Remove bolt (Figure 2, Item 5) and washer (Figure 2, Item 4) from retaining f xture (Figure 2, Item 1). Remove retaining f xture (Figure 2, Item 1). Keep bolt (Figure 2, Item 5), washer (Figure 2, Item 4), and retaining f xture (Figure 2, Item 1).

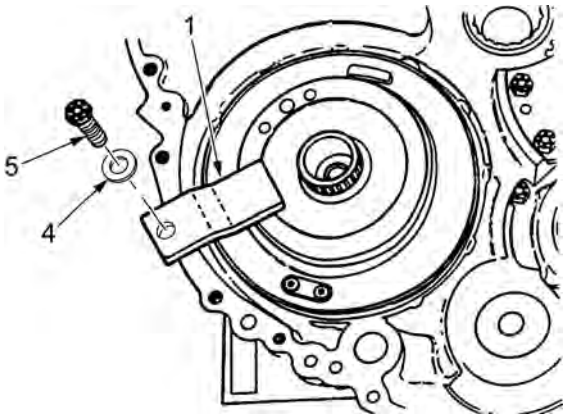


Figure 2. Range Pack Retaining Fixture Removal.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE RANGE PACK

INITIAL SETUP:

Tools and Special Tools
Bar and Stud Assembly (WP 0079, Item 4)
Compressor, Clutch Spring (WP 0079, Item 8)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Hook, Chain, S (WP 0079, Item 22)
Inserter and Remover, Seal (WP 0079, Item 24)
Insert Installer, Remover (WP 0075, Item 6)
Lifter, Pump Support (WP 0079, Item 26)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Retaining, Fixture (WP 0075, Item 1)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Torque, Dial, 3/8" Drive, 300 lb-in. (WP 0079, Item 50)

Materials/Parts
Lubricating Oil, Engine (WP 0078, Item 10)
Marker, Tube-Type, Black (WP 0078, Item 11)
O-Ring (WP 0080, Item 17) (2)
O-Ring (WP 0080, Item 18) (2)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Seal, Plain (WP 0080, Item 20)
Seal, Transmission (WP 0080, Item 21)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0051
WP 0052
WP 0053
WP 0054
WP 0055

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Oil transfer plate assembly removed (WP 0015)
Left cover assembly removed (WP 0033)

REMOVE RANGE PACK

NOTE

Transmission is on maintenance stand, left end up.

Procedures for installing the fabricated range pack retaining f xture are given in WP 0055.

1. Remove bolt (Figure 1, Item 7) that holds previously installed fabricated retaining f xture (Figure 1, Item 2) to center housing (Figure 1, Item 1).
2. Turn forward clutch housing assembly (Figure 1, Item 6) so that one opening that has slots (Figure 1, Item 3) is positioned over pitot (Figure 1, Item 5).
3. Remove two screws (Figure 1, Item 4).
4. Remove pitot (Figure 1, Item 5).

NOTE

Refer to WP 0051 for repair of forward clutch housing assembly.

5. Remove forward clutch housing assembly (Figure 1, Item 6). Move forward clutch housing assembly (Figure 1, Item 6) back and forth to free it, if necessary.

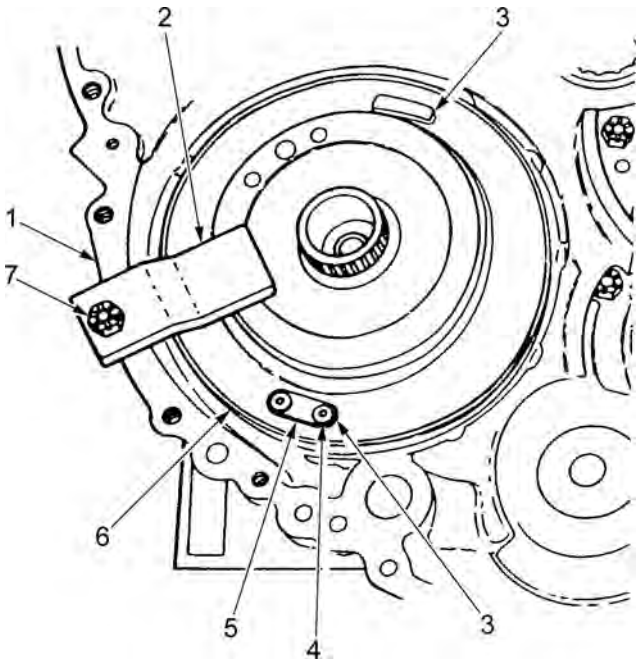


Figure 1. Forward Clutch Housing Assembly Removal.

6. Remove thrust washer bearing (Figure 2, Item 8).

NOTE

Refer to WP 0052 for repair of fourth and reverse clutch assembly (Figure 2, Item 9).

7. Remove fourth and reverse clutch assembly (Figure 2, Item 9).

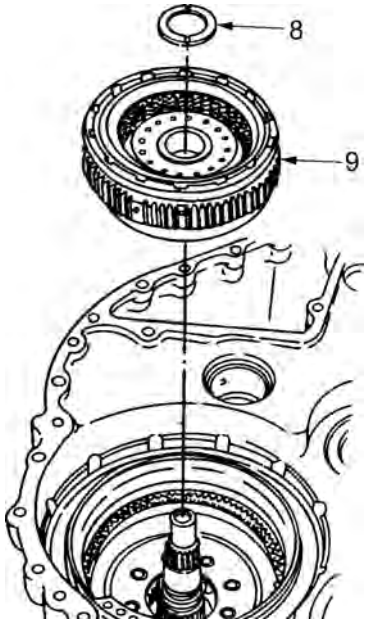


Figure 2. Fourth and Reverse Clutch Assembly Removal.

8. Using fingers, install 5/16-18 x 1-1/2 inch bolt (Figure 3, Item 11) two or three turns into one pitot tube (Figure 3, Item 13).
9. Pull pitot tube (Figure 3, Item 13) out of center housing (Figure 3, Item 1).
10. Remove O-rings (Figure 3, Item 10) and (Figure 3, Item 12) from pitot tube (Figure 3, Item 13). Discard O-rings (Figure 3, Item 10) and (Figure 3, Item 12).
11. Repeat Steps 8, 9, and 10 for other pitot tube (Figure 3, Item 13), then go to Step 12.

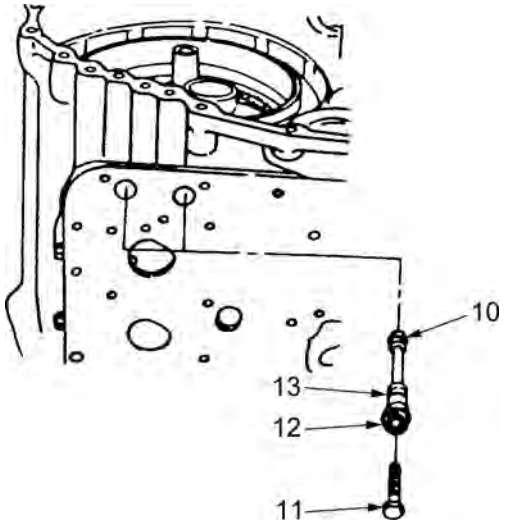


Figure 3. Pitot Tubes Removal.

12. Remove retaining ring (Figure 4, Item 15) that holds clutch plate (third clutch backing plate) (Figure 4, Item 16) in position.
13. Use two pry bars to gently move third clutch backing plate (Figure 4, Item 16) back and forth to loosen it. Remove third clutch backing plate (Figure 4, Item 16).
14. Remove pin (Figure 4, Item 14) that was loosened when third clutch backing plate (Figure 4, Item 16) was removed.

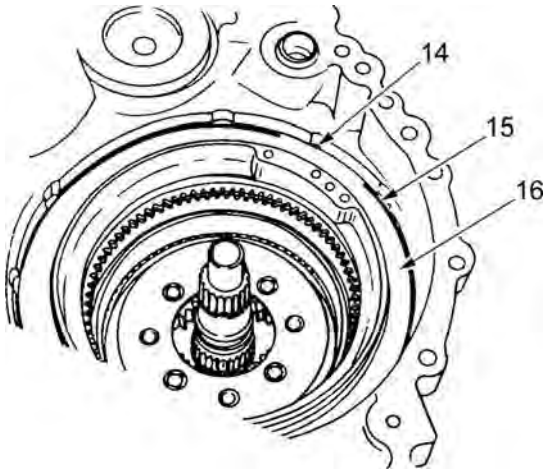


Figure 4. Third Clutch Backing Plate and Pin Removal.

CAUTION

When you remove, handle, or install clutch packs, keep all clutch plates in the same order and pointing in the same direction. Under heat and pressure, clutch plates can take on a conical shape, called coning. Each plate will be different in degree of coning. When coned plates are mixed or turned over, they cannot install properly against each other. This can prevent plates from making adequate surface contact with each other for the clutch pack to operate effectively.

When one clutch plate needs to be replaced, replace the entire clutch pack. Individual clutch plates should not be replaced, because new plates will not have the surface contour of adjacent older plates, decreasing effectiveness of the clutch pack.

Clutch assemblies function in pairs. When one clutch pack fails, a second clutch pack will often be defective. Failure of one clutch pack requires inspection of all clutch assemblies in the range pack.

15. Remove third clutch pack (Figure 5, Item 17) which has three friction plates and four steel reaction plates.

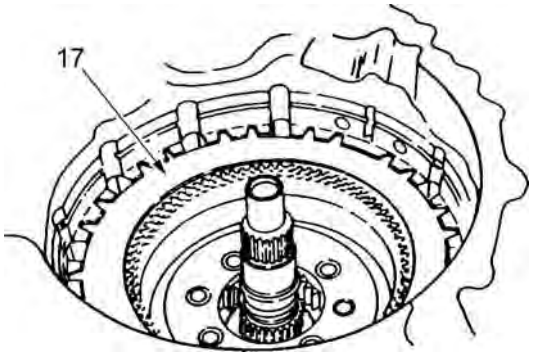


Figure 5. Third Clutch Pack Removal.

16. Remove two bolts (Figure 6, Item 19) and two washers (Figure 6, Item 18) that attach second and third clutch housings in center housing (Figure 6, Item 1).

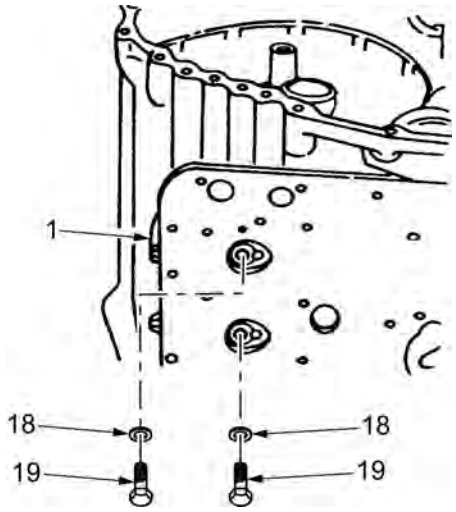


Figure 6. Second and Third Clutch Housings Hardware Removal.

17. Remove retaining ring (Figure 7, Item 20) that attaches third clutch piston housing (Figure 7, Item 21).

NOTE

Refer to WP 0053 for repair of third clutch piston housing.

18. Use two pry bars to gently move third clutch piston housing (Figure 7, Item 21) back and forth to loosen it. Remove third clutch piston housing (Figure 7, Item 21).

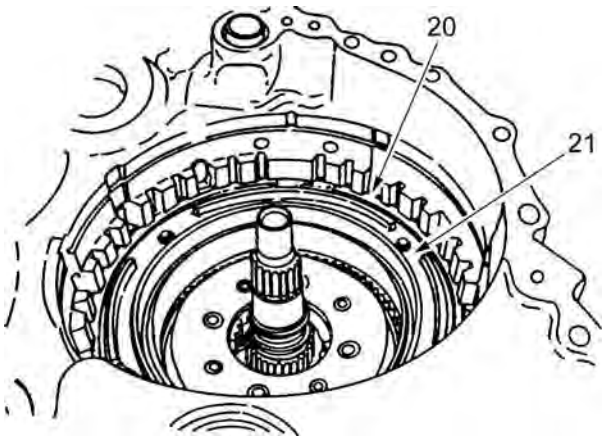


Figure 7. Third Clutch Piston Housing Assembly and Retaining Ring Removal.

19. Remove front carrier assembly (Figure 8, Item 24).
20. Remove thrust washer (Figure 8, Item 23) from inside front carrier assembly (Figure 8, Item 24).
21. Remove thrust washer (Figure 8, Item 25) from bottom of front carrier assembly (Figure 8, Item 24) or from top of center carrier assembly (Figure 8, Item 27).
22. Remove retaining ring (Figure 8, Item 22) that has second clutch pack (Figure 8, Item 26).
23. Remove second clutch pack (Figure 8, Item 26) that has four friction plates and f ve steel reaction plates.

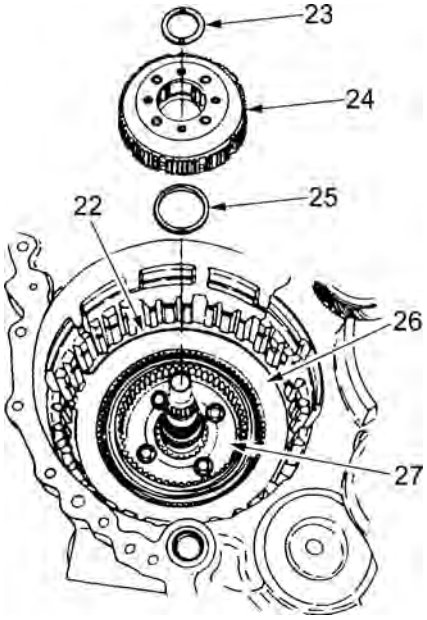


Figure 8. Front Carrier Assembly Removal.

24. Remove retaining ring (Figure 9, Item 28) that holds second clutch piston housing assembly (Figure 9, Item 29).

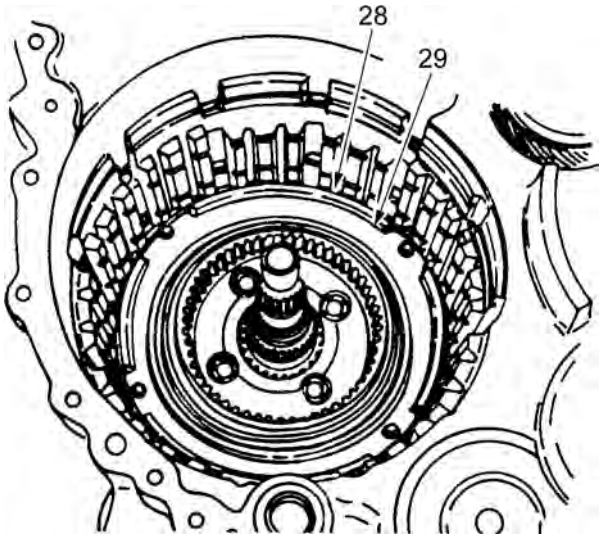


Figure 9. Second Clutch Piston Housing Assembly Retaining Ring Removal.

25. Put lifter (Figure 10, Item 32) over end of shouldered shaft (range input shaft) (Figure 10, Item 35) and put lower end of lifter (Figure 10, Item 32) in groove below area of center sun gear (Figure 10, Item 34) that has splines.
26. Using thumb screw (Figure 10, Item 33) on lifter (Figure 10, Item 32), tighten bottom of lifter (Figure 10, Item 32) in groove.
27. Install tool hook (Figure 10, Item 31) in top of tool lifter (Figure 10, Item 32).
28. Use hoist (Figure 10, Item 30), trestle, tool hook (Figure 10, Item 31) and tool lifter (Figure 10, Item 32) to raise range input shaft (Figure 10, Item 35) and attached center carrier assembly (Figure 10, Item 27) until second clutch piston housing assembly (Figure 10, Item 29) is high enough to get hands under it.
29. Lower range input shaft (Figure 10, Item 35) and center carrier assembly (Figure 10, Item 27) back into center housing (Figure 10, Item 1).
30. Remove hoist Figure 10, Item 30) and tool hook Figure 10, Item 31) from tool lifter Figure 10, Item 32).

NOTE

Second clutch piston housing assembly has to be pulled up (one side, then the other) using two hands, to get it free.

Refer to WP 0053 for repair of second clutch piston housing assembly.

31. Remove second clutch piston housing assembly (Figure 10, Item 29).

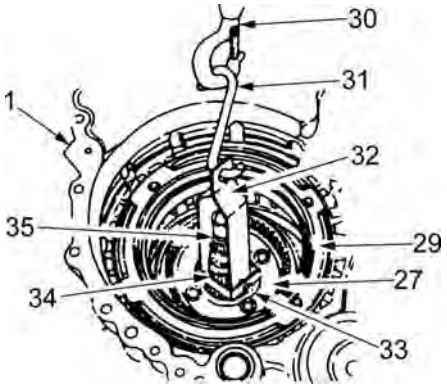


Figure 10. Second Clutch Piston Housing Assembly Removal.

32. Attach tool hook (Figure 11, Item 31) and hoist (Figure 11, Item 30) to tool lifter (Figure 11, Item 32) and remove range input shaft (Figure 11, Item 35) and center carrier assembly (Figure 11, Item 27).

NOTE

Refer to WP 0054 for replacement of range input shaft components.

33. Remove tool hook (Figure 11, Item 31) and tool lifter (Figure 11, Item 32) from range input shaft (Figure 11, Item 35).

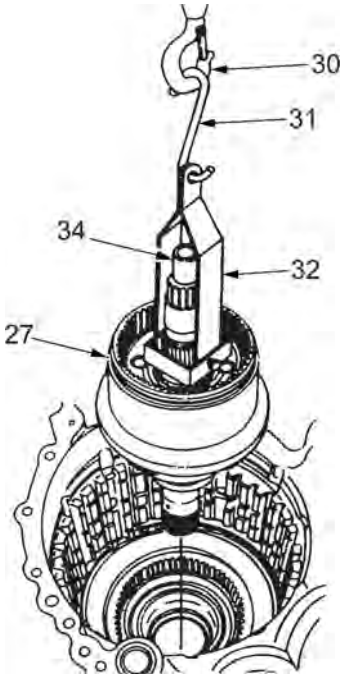


Figure 11. Range Input Shaft and Center Carrier Assembly Removal.

34. Remove two retaining rings (Figure 12, Item 37) and (Figure 12, Item 36).

NOTE

To keep all of clutch pack together and in correct order, reach inside internal gear and back under entire clutch pack. If gear only is pulled out, three clutch plates will stay in center housing.

35. Remove backing plate (Figure 12, Item 38) and first clutch pack (Figure 13, Item 39) which has nine plates, along with internal gear (Figure 13, Item 40).

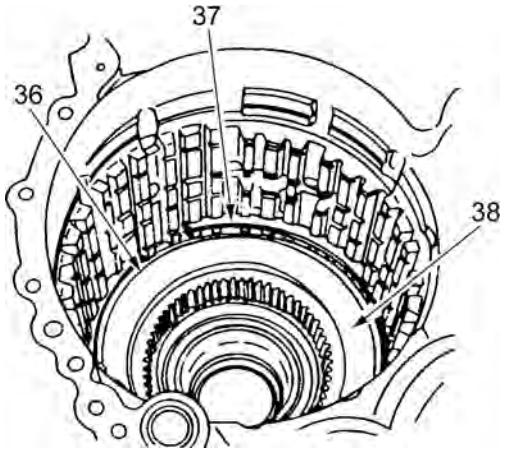


Figure 12. Retaining Rings and Backing Plate Removal.

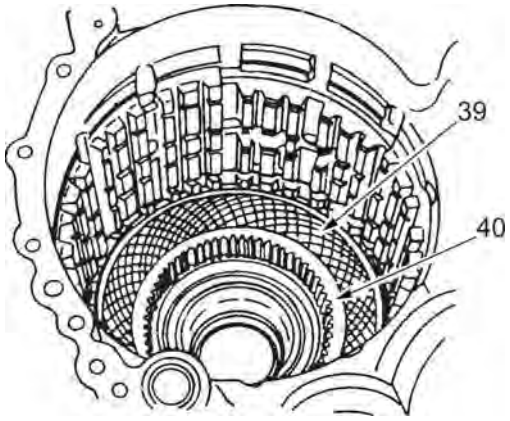


Figure 13. First Clutch Pack Removal.

36. Remove wing nut (Figure 14, Item 43) from tool bar and stud assembly (Figure 14, Item 41) and tool clutch compressor (Figure 14, Item 42).

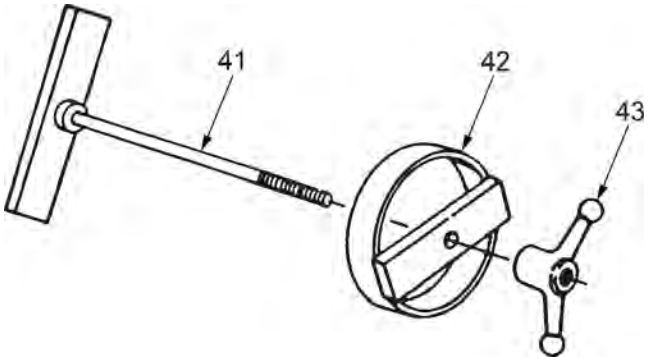


Figure 14. Bar and Stud Assembly for Retaining Ring Removal.

37. Put tool bar and stud assembly (Figure 15, Item 41) inside center housing through first clutch piston assembly (Figure 15, Item 4) in range pack bore and hold with one hand.
38. Install tool clutch compressor (Figure 15, Item 42) over stud of tool bar and stud assembly (Figure 15, Item 41) with other hand, then install wing nut (Figure 15, Item 43) on stud.
39. Turn wing nut (Figure 15, Item 43) onto tool clutch compressor (Figure 15, Item 42) until piston spring retainer ring (Figure 15, Item 44) is compressed enough to take force from retaining ring (Figure 15, Item 45).

NOTE

When removed from groove, retaining ring will stay under tool clutch compressor until tool is removed.

40. Reach through opening in tool clutch compressor (Figure 15, Item 42) and remove retaining ring (Figure 15, Item 45) from its groove.
41. Remove wing nut (Figure 15, Item 43), tool clutch compressor (Figure 15, Item 42) and tool bar and stud assembly (Figure 15, Item 41) from inside range pack bore.
42. Remove retaining ring (Figure 15, Item 45) and piston spring retainer (Figure 15, Item 44).

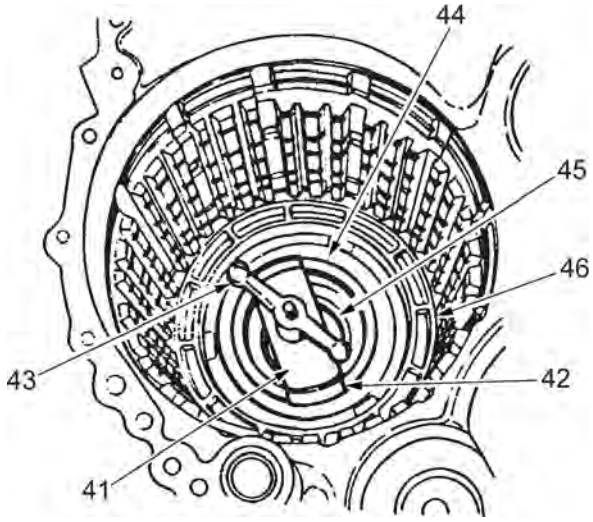


Figure 15. Bar and Stud Assembly and Compressor Installed for Retaining Ring Removal.

43. Remove 26 springs (Figure 16, Item 47).
44. Hold cross members on first clutch piston (Figure 16, Item 48) at two points, 180 degrees apart, and remove first clutch piston (Figure 16, Item 48).
45. Turn first clutch piston (Figure 16, Item 48) over.
46. Remove seals (Figure 17, Item 49) and (Figure 17, Item 50) from first clutch piston (Figure 17, Item 48). Discard seals (Figure 17, Item 49) and (Figure 17, Item 50).

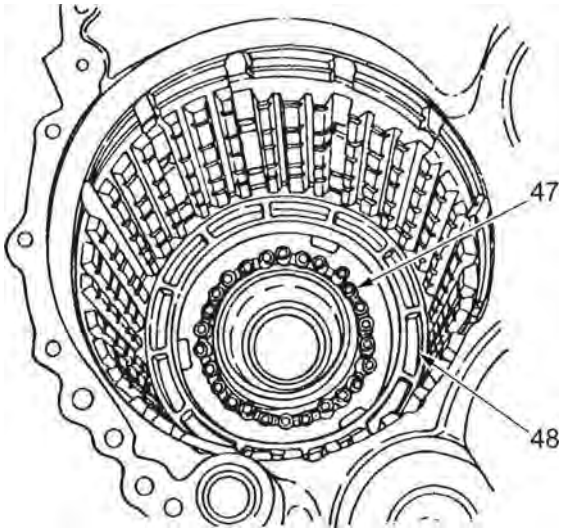


Figure 16. First Clutch Piston Removal.

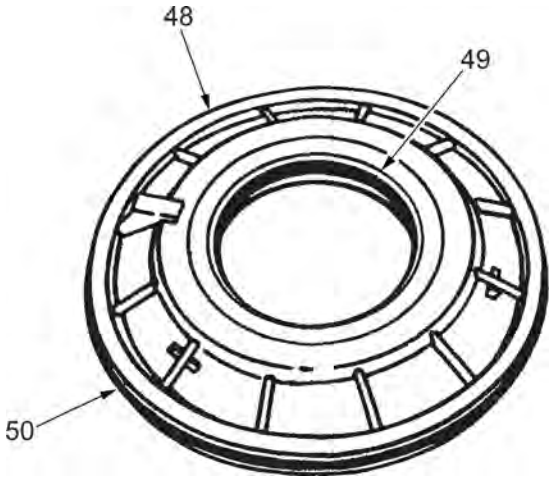


Figure 17. First Clutch Piston Seals Removal.

END OF TASK

INSTALL RANGE PACK

1. Install new seals (Figure 18, Item 49) and (Figure 18, Item 50) onto f rst clutch piston (Figure 18, Item 48). Apply petrolatum to seals (Figure 18, Item 49) and (Figure 18, Item 50).
2. Using seal inserter and remover, install inserter and remover (Figure 19, Item 51) into center housing.
3. Mark outer piston face with black tube-type marker across from tang. Mark range bore above slot in center housing. This will help locate f rst clutch piston (Figure 18, Item 48) in center housing.
4. Hold cross members on f rst clutch piston (Figure 18, Item 48) at two points, 180 degrees apart and install f rst clutch piston (Figure 18, Item 48) into center housing. Align the tang on piston with the slot in center housing.
5. Remove seal assembly inserter and remover (Figure 19, Item 51).

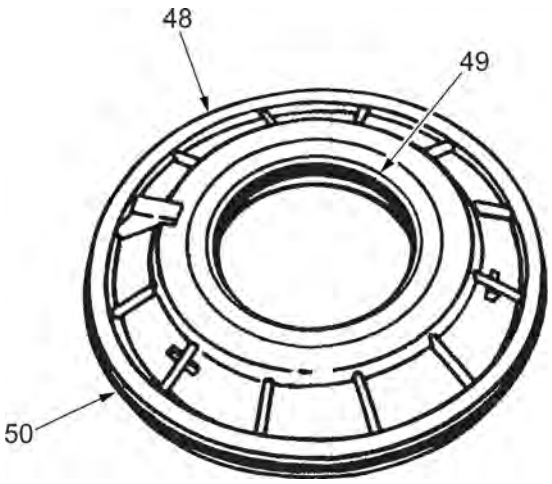


Figure 18. First Clutch Piston Seals Installation.

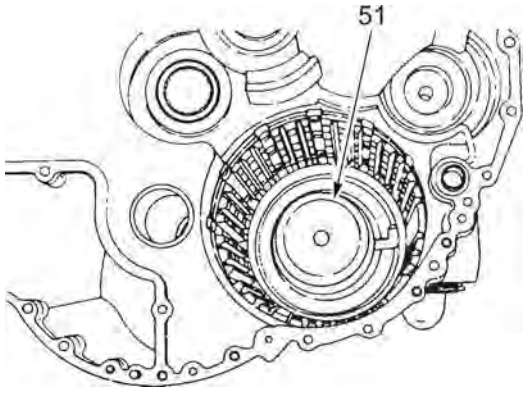


Figure 19. Seal Assembly Inserter and Remover.

6. Install 26 springs (Figure 20, Item 47) into spring pockets in f rst clutch piston (Figure 20, Item 46).
7. Install piston spring retainer (Figure 20, Item 44) over springs (Figure 20, Item 47). Make sure 26 springs (Figure 20, Item 47) are installed in piston spring retainer (Figure 20, Item 44).

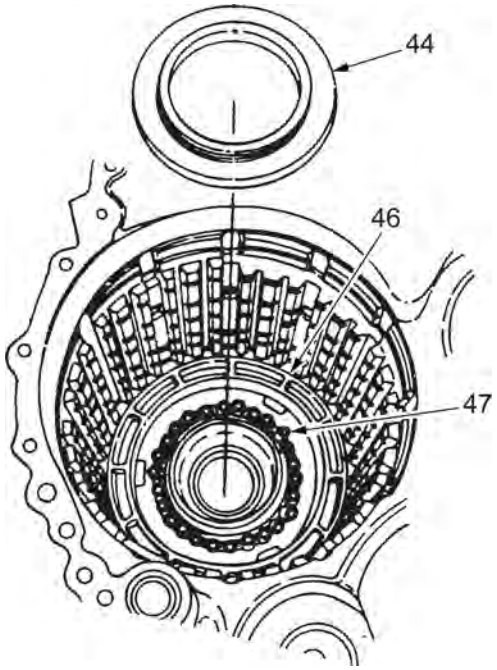


Figure 20. Springs and First Clutch Piston Installation.

8. Remove wing nut (Figure 21, Item 43) from bar and stud assembly (Figure 21, Item 41) and spring clutch compressor (Figure 21, Item 42).

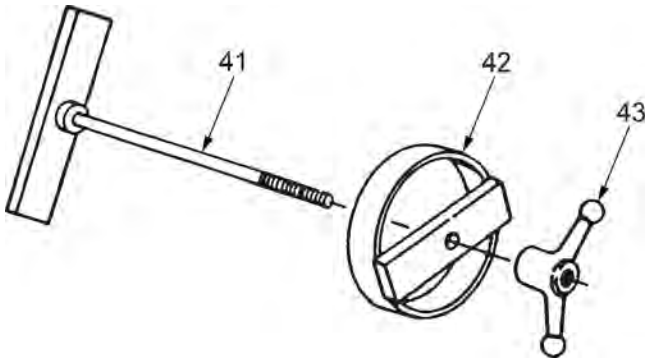


Figure 21. Bar and Stud Assembly for Retaining Ring Installation.

9. Put bar and stud assembly (Figure 22, Item 41) inside transmission through first clutch piston (Figure 22, Item 46) in range pack bore and hold in place. Put shim under bar and stud assembly (Figure 22, Item 41) so bar and stud assembly is level, centered, and compresses spring retainer equally.
10. Install clutch compressor bar and stud assembly (Figure 22, Item 42) over stud, then install wing nut bar and stud assembly (Figure 22, Item 43).
11. Turn wing nut (Figure 22, Item 43) on clutch compressor (Figure 22, Item 42) until piston spring retainer (Figure 22, Item 44) compresses enough to allow installation of retaining ring (Figure 22, Item 45).
12. Reach through opening in clutch compressor (Figure 22, Item 42) and install retaining ring (Figure 22, Item 45).
13. Remove wing nut (Figure 22, Item 43) and clutch compressor (Figure 22, Item 42).

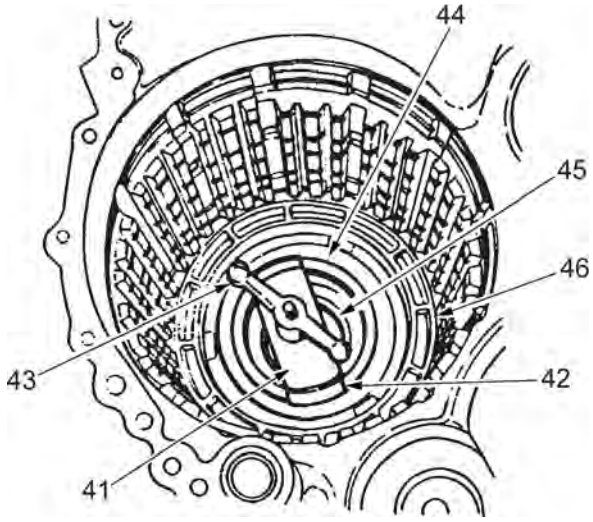


Figure 22. Bar and Stud Assembly and Compressor Installed for Retaining Ring Installation.

CAUTION

When you remove, handle, or install clutch packs, keep all clutch plates and plates in the same order and pointing in the same direction. Under heat and pressure, clutch plates can take on a conical shape, called coning. Each plate will be different in degree of coning. When coned plates are mixed or turned over, they cannot install properly against each other. This can prevent plates from making suff cient surface contact with each other for the clutch pack to operate effectively.

When one clutch plate or plate needs to be replaced, replace the entire clutch pack. Individual clutch plates should not be replaced, because new plates will not have the surface contour of adjacent older plates, decreasing effectiveness of the clutch pack.

14. For f rst clutch pack, install one of f ve reaction plates (Figure 23, Item 52) into range pack bore.
15. Soak four friction plates (Figure 23, Item 53) in lubricating oil for two minutes prior to assembly. Install one of four friction plates (Figure 23, Item 53) onto reaction plate (Figure 23, Item 52).
16. Install internal gear (Figure 23, Item 38), shorter splines upward.
17. Install second of f ve reaction plates (Figure 23, Item 52), then second of four friction plates (Figure 23, Item 53) onto internal gear (Figure 23, Item 38) until all f ve reaction plates (Figure 23, Item 52) and all four friction plates (Figure 23, Item 53) have been installed.

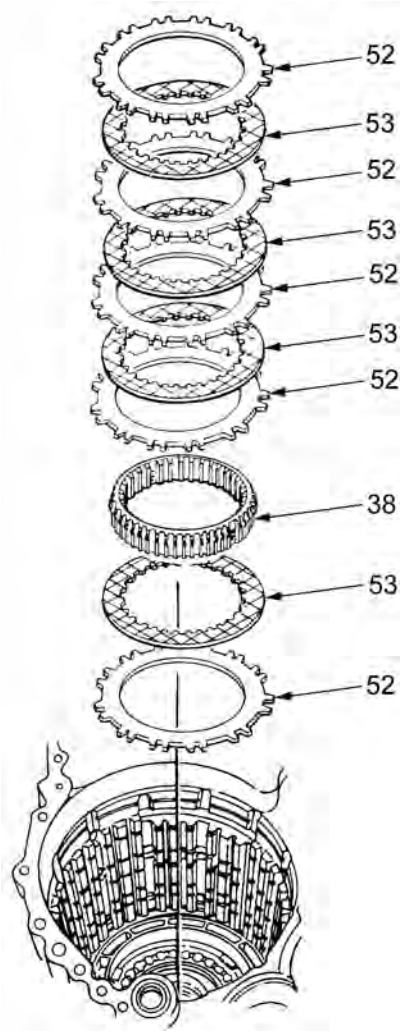


Figure 23. First Clutch Pack Installation.

18. Install clutch plate (backing plate) (Figure 24, Item 38) onto reaction plate (Figure 24, Item 52).
19. Install retaining ring (Figure 24, Item 36) to keep backing plate (Figure 24, Item 38) in position.
20. Install retaining ring (Figure 24, Item 37) into range pack bore.

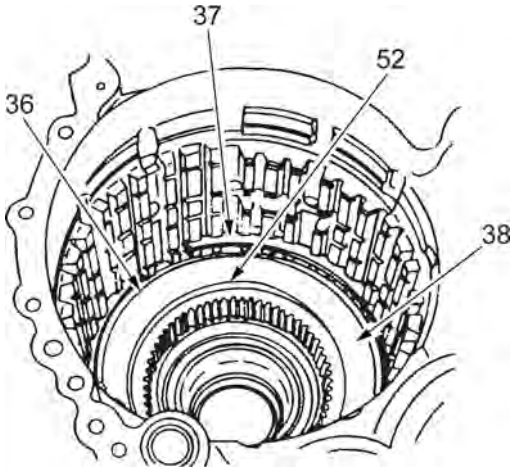


Figure 24. Backing Plate and Retaining Rings Installation.

21. Put lifter (Figure 25, Item 32) over end of shouldered shaft (range input shaft) (Figure 25, Item 35) and put lower end of lifter in groove below area of center sun gear (Figure 25, Item 54) that has splines.
22. Use thumb screw (Figure 25, Item 33) on lifter (Figure 25, Item 32) to tighten bottom of lifting tool (Figure 25, Item 32) in groove.
23. Install hook (Figure 25, Item 31) in top of lifter (Figure 25, Item 32).
24. Use hoist (Figure 25, Item 30), trestle, hook (Figure 25, Item 31), and lifter (Figure 25, Item 32) to lower range input shaft (Figure 25, Item 35) and attached center carrier assembly (Figure 25, Item 27) against retaining ring (Figure 25, Item 37).
25. Remove hook (Figure 25, Item 31) and lifter (Figure 25, Item 32).

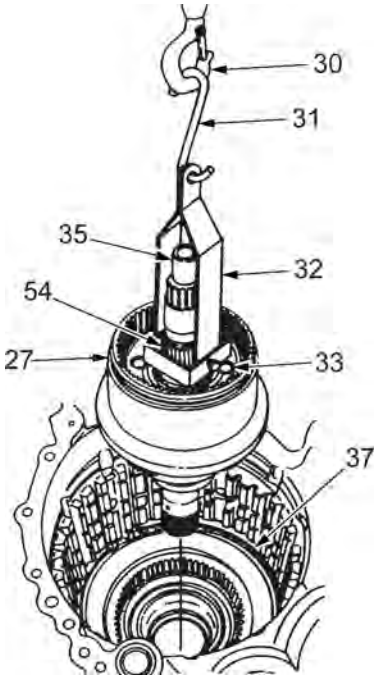


Figure 25. Range Input Shaft and Center Carrier Assembly Installation.

26. Use black tube-type marker to mark edge of second clutch piston housing assembly (Figure 26, Item 29) above bolt hole.
27. Install second clutch piston housing assembly (Figure 26, Item 29), aligning bolt hole in piston housing assembly (Figure 26, Item 29) with bolt hole in center housing.
28. Install washer (Figure 26, Item 18) and bolt (Figure 26, Item 19) through center housing and into piston housing assembly (Figure 26, Item 29) f nger tight.

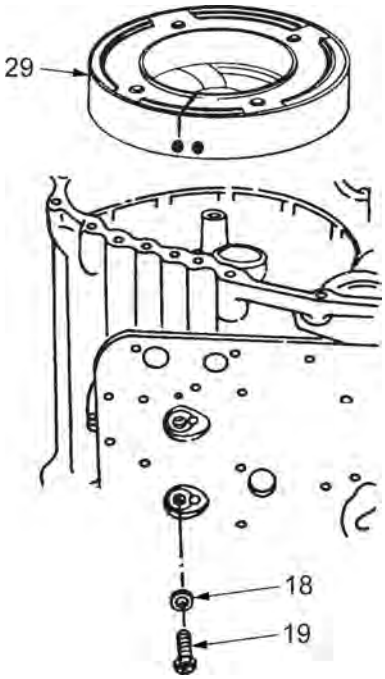


Figure 26. Second Clutch Piston Housing Assembly Installation.

29. Use a thickness gage to measure the space between second clutch piston housing assembly (Figure 27, Item 29) and top of retaining ring groove in range pack bore of center housing. Use Table 1 for the selection of retaining ring (Figure 27, Item 22).

Table 1. Retaining Ring Selection.

For Measured Distance	Select Ring
0.149 to 0.152 in. (3.79 to 3.88 mm)	6884274
0.153 to 0.155 in. (3.89 to 3.96 mm)	6884273
0.156 to 0.158 in. (3.97 to 4.03 mm)	6884275
0.159 to 0.161 in. (4.04 to 4.08 mm)	6884276

30. Install selected retaining ring (Figure 27, Item 22).

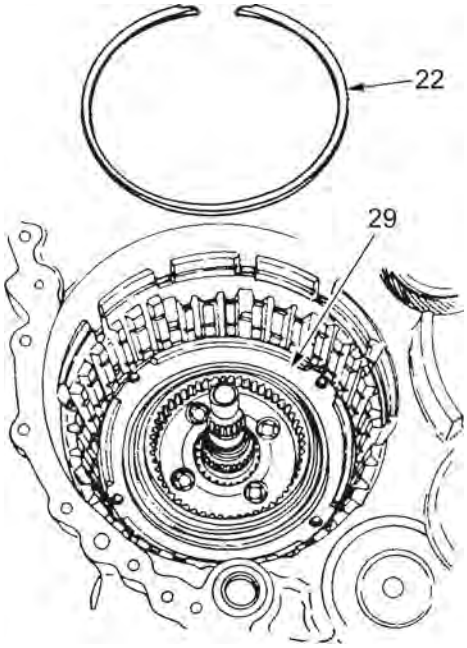


Figure 27. Retaining Ring Selection and Installation.

31. Torque bolt (Figure 28, Item 19) (installed in Step 28) to 36 to 43 lb-ft (49 to 68 N·m).

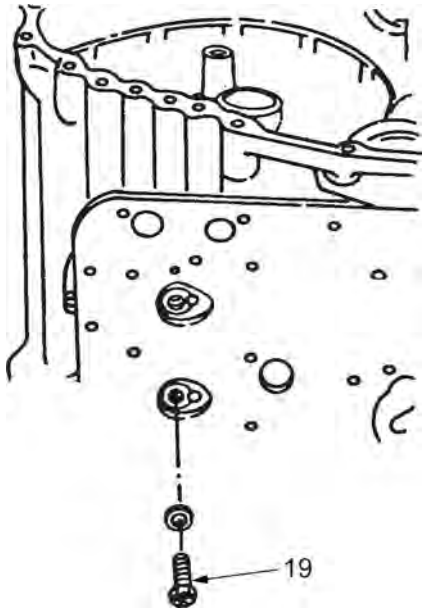


Figure 28. Second Clutch Housing Hardware Installation.

32. Apply petrolatum to thrust washer (Figure 29, Item 25) and install it on the bottom of front carrier assembly (Figure 29, Item 24).
33. Install front carrier assembly (Figure 29, Item 24) into center housing and make sure thrust washer bearing (Figure 29, Item 25) stays in place.
34. Install thrust washer (Figure 29, Item 23) onto front carrier assembly (Figure 29, Item 24).
35. Soak four friction plates (Figure 29, Item 54) in lubricating oil for two minutes prior to assembly. Install one reaction plate (Figure 29, Item 55) and then one friction plate (Figure 29, Item 54).
36. Repeat Step 35 until all five reaction plates (Figure 29, Item 55) and all four friction plates (Figure 29, Item 54) are installed.
37. Install retaining ring (Figure 29, Item 28).

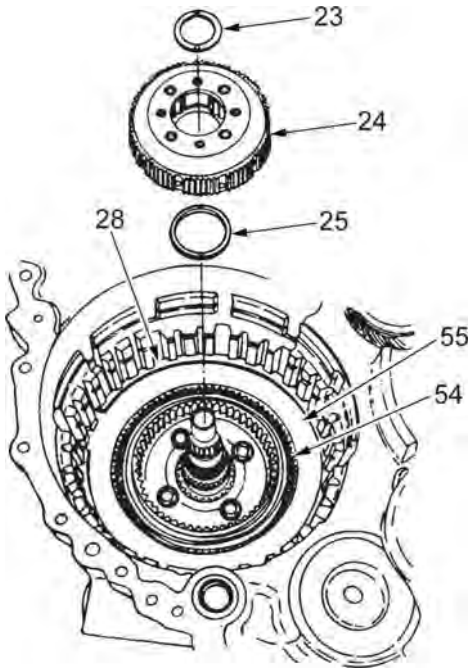


Figure 29. Front Carrier Assembly Installation.

38. Use a black tube-type marker to mark edge of third clutch piston housing assembly (Figure 30, Item 21) above bolt hole.
39. Install third clutch piston housing assembly (Figure 30, Item 21), aligning bolt hole in piston housing assembly (Figure 30, Item 21) with bolt hole in center housing.
40. Install washer (Figure 30, Item 18) and bolt (Figure 30, Item 19) through center housing and into piston housing assembly (Figure 30, Item 21) finger tight.
41. Use thickness gage to measure space between piston housing assembly (Figure 31, Item 21) and top of retaining ring groove in range pack bore of center housing. Use Table 2 for the selection of retaining ring (Figure 31, Item 20).

Table 2. Retaining Ring Selection.

For Measured Distance	Select Ring
0.149 to 0.152 in. (3.79 to 3.88 mm)	6884274
0.153 to 0.155 in. (3.89 to 3.96 mm)	6884273
0.156 to 0.158 in. (3.97 to 4.03 mm)	6884275
0.159 to 0.161 in. (4.04 to 4.08 mm)	6884276

42. Install selected retaining ring (Figure 31, Item 20).
43. Torque bolt (Figure 30, Item 19) (installed in Step 40) to 36 to 43 lb-ft (49 to 68 N·m).

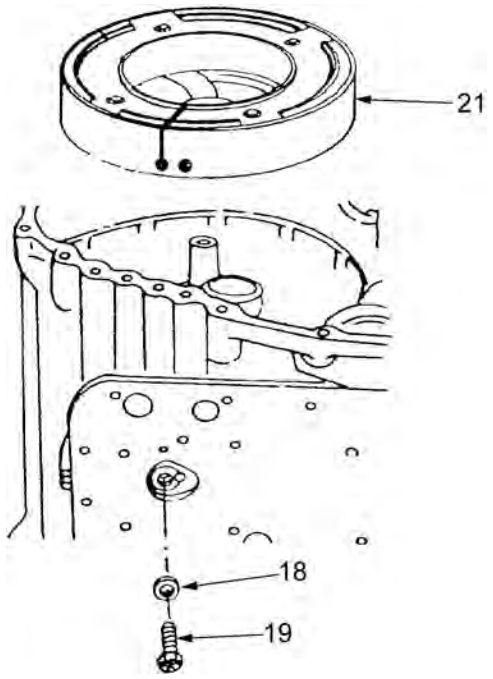


Figure 30. Third Clutch Piston Housing Assembly Hardware Installation.

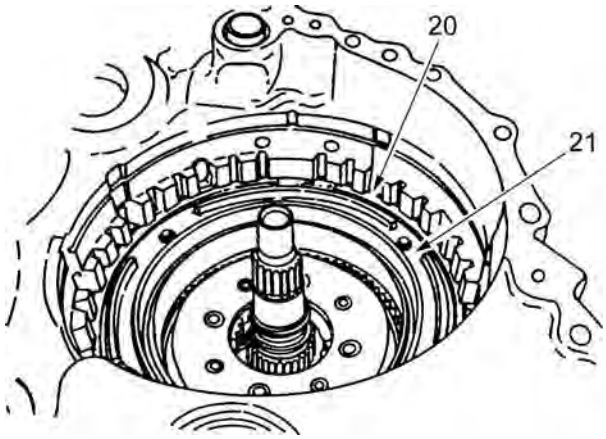


Figure 31. Third Clutch Piston Housing Assembly and Retaining Ring Installation.

44. Soak three friction plates (Figure 32, Item 57) in lubricating oil for two minutes prior to assembly. Install one reaction plate (Figure 32, Item 58), then one friction plate (Figure 32, Item 57).
45. Repeat Step 44 until all four reaction plates (Figure 32, Item 58) and all three friction plates (Figure 32, Item 57) are installed.

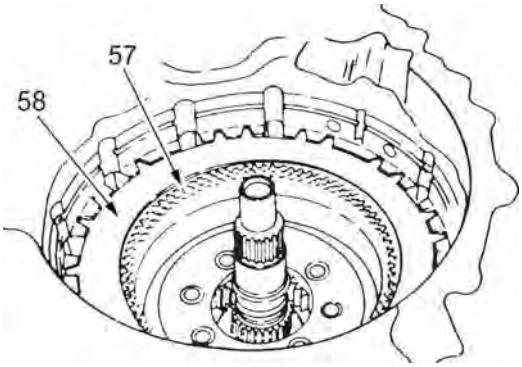


Figure 32. Third Clutch Pack Installation.

46. Apply petrolatum to backing plate pin (Figure 33, Item 14). Install pin backing plate pin (Figure 33, Item 14) into slot in clutch plate (third clutch backing plate) (Figure 33, Item 16).
47. Install clutch backing plate (Figure 33, Item 16). Tap clutch backing plate (Figure 33, Item 16) and pin (Figure 33, Item 14) and make sure pin (Figure 33, Item 14) is installed in slot in range bore of center housing.
48. Install retaining ring (Figure 33, Item 15) that holds clutch backing plate (Figure 33, Item 16).

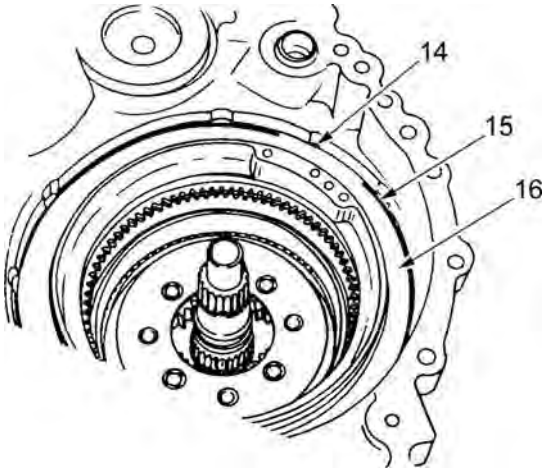


Figure 33. Third Clutch Backing Plate and Pin Installation.

49. Install new O-rings (Figure 34, Item 10) and (Figure 34, Item 12) onto two pitot tubes (Figure 34, Item 13).
50. Apply petrolatum to two O-rings (Figure 34, Item 10) and two O-rings (Figure 34, Item 12).
51. Install two pitot tubes (Figure 34, Item 13), small end first, into bores in center housing (Figure 34, Item 1).

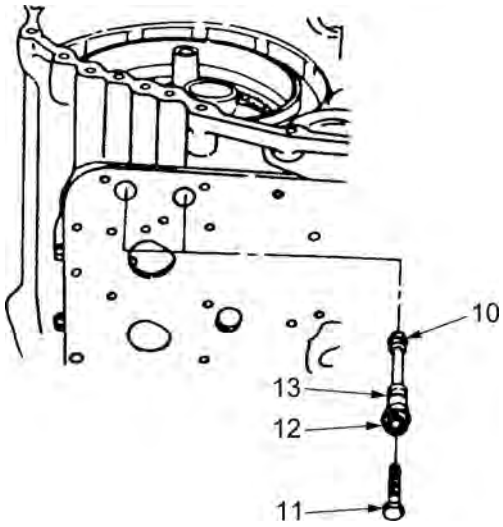


Figure 34. Pitot Tubes Installation.

52. Install fourth and reverse clutch assembly (Figure 35, Item 9).
53. Install thrust washer (Figure 35, Item 8) onto fourth and reverse clutch assembly (Figure 35, Item 9).

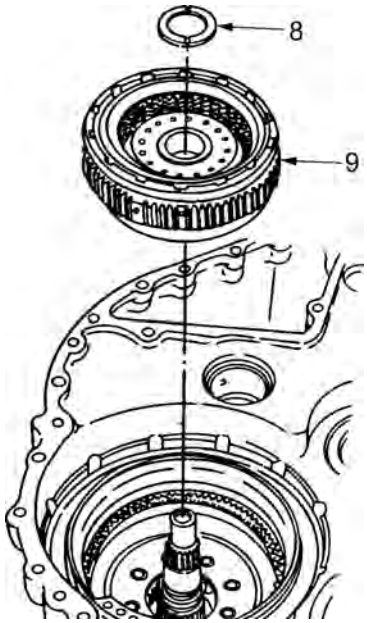


Figure 35. Fourth and Reverse Clutch Assembly Installation.

54. Align clutch plates in fourth and reverse clutch assembly (Figure 35, Item 9). Install forward clutch housing assembly (Figure 36, Item 6) into fourth and reverse clutch assembly (Figure 35, Item 9).

NOTE

If forward clutch does not easily install, position mating output gear on the hub to use as a tool to help move the hub slightly back and forth, and left and right to install. The forward clutch housing is fully installed when it moves evenly in all four directions.

55. Turn forward clutch housing assembly (Figure 36, Item 6) so that one of the slotted openings (Figure 36, Item 3) is positioned over the bolt holes for pitot (Figure 36, Item 5).
56. Install pitot (Figure 36, Item 5). Install two screws (Figure 36, Item 4) to hold pitot (Figure 36, Item 5) in position.
57. Torque two screws (Figure 36, Item 4) to 108 to 132 lb-in. (12 to 15 N·m).
58. Put retaining fixture (Figure 36, Item 2) in position on forward clutch housing (Figure 36, Item 6) and center housing (Figure 36, Item 1).
59. Install 3/8-16 x 3/4 inch bolt (Figure 36, Item 7) to hold retaining fixture (Figure 36, Item 2) in position
60. Turn transmission right end up.

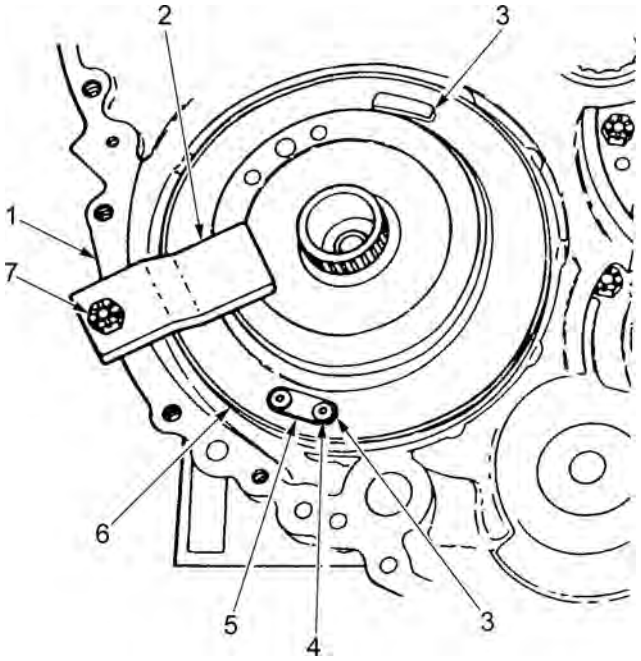


Figure 36. Forward Clutch Housing Assembly Installation.

FOLLOW-ON MAINTENANCE

1. Remove retaining fixture (WP 0055).

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE IDLER GEAR ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0043
WP 0049

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Left cover assembly removed (WP 0033)

REMOVE IDLER GEAR ASSEMBLY

NOTE

Transmission is on maintenance stand, left end up.

1. Remove six bolts (Figure 1, Item 1) and six washers (Figure 1, Item 2) that connect bearing retaining plate (Figure 1, Item 3) to center housing (Figure 1, Item 4).
2. Install two 3/8-16 x 1 inch jack bolts (Figure 2, Item 5) in jack bolt holes (Figure 2, Item 6) in bearing retainer plate (Figure 2, Item 3). Tighten two jack bolts (Figure 2, Item 5) evenly until bearing retainer plate loosens.

NOTE

Outer race of bearing, located on top of hydrostatic pump idler gear, will come off with bearing retainer plate.

3. Remove retaining plate (Figure 2, Item 3).
4. Remove two jack bolts (Figure 2, Item 5).

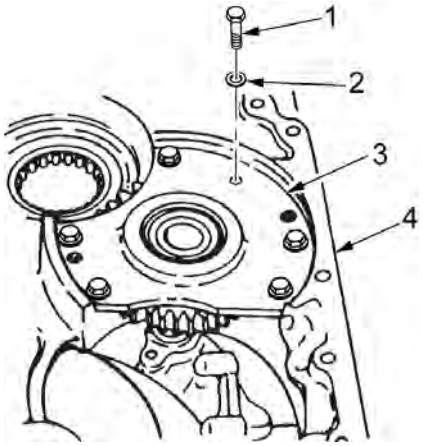


Figure 1. Bearing Retaining Plate Hardware Removal.

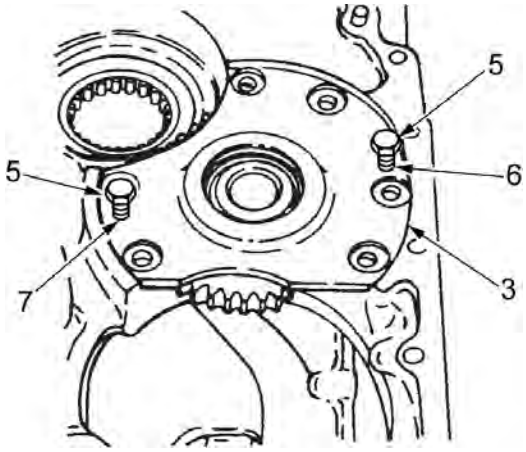


Figure 2. Bearing Retaining Plate Removal.

NOTE

Outer race of bearing, located under hydrostatic pump idler gear, remains in center housing.

5. Remove hydrostatic pump idler gear (Figure 3, Item 7).
6. Refer to WP 0049 for replacement of bearings on hydrostatic pump idler gear (Figure 3, Item 7).
7. Refer to WP 0043 for repair of center housing (Figure 3, Item 4) and replacement of outer races.

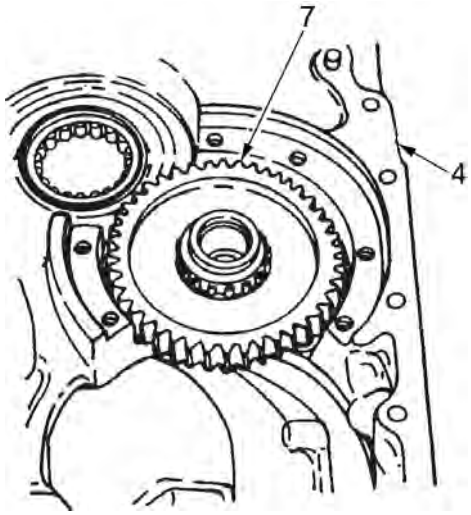


Figure 3. Hydrostatic Pump Idler Gear Removal.

END OF TASK

INSTALL IDLER GEAR ASSEMBLY

NOTE

Transmission is on maintenance stand, left end up.

1. Install hydrostatic pump idler gear (Figure 4, Item 7) into center housing (Figure 4, Item 4).
2. Install bearing retaining plate (Figure 5, Item 3) into center housing (Figure 5, Item 4).
3. Install six washers (Figure 5, Item 2) and bolts (Figure 5, Item 2) to attach bearing retaining plate (Figure 5, Item 3) to center housing (Figure 5, Item 4).
4. Torque six bolts (Figure 5, Item 1) to 36-43 lb-ft (49-68 N·m).

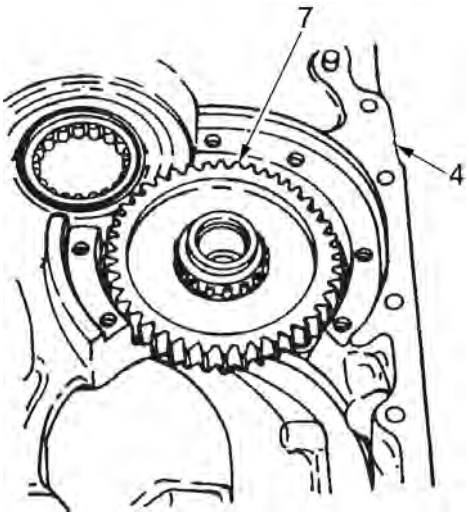


Figure 4. Hydrostatic Pump Idler Gear Installation.

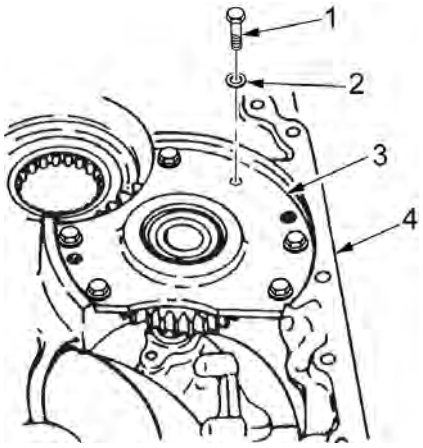


Figure 5. Bearing Retaining Plate Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE BEVEL GEAR ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Sling, Multiple-Leg (3 Legs) (WP 0079, Item 36)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

References
WP 0068

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Reverse equalized components removed (WP 0031)
Left cover assembly removed (WP 0033)
Sump communication tube removed (WP 0044)

REMOVE BEVEL GEAR ASSEMBLY

WARNING

Do a check of slings and trestle for cuts, breaks, or wear before and during lifting transmissions. Slings and trestle can break and cause injury or death.

Bevel gear assembly must be lifted using sling, hoist, and trestle. To avoid injury, keep clear of bevel gear assembly at all times. Do not let bevel gear assembly swing freely during lifting.

1. Attach three 7/16-14 x 1-1/4 inch bolts (Figure 1, Item 1) and three 7/16 inch washers (Figure 1, Item 2) until snug through lugs (Figure 1, Item 6) of multiple-leg sling and into holes (Figure 1, Item 3) in bevel gear assembly (Figure 1, Item 5).
2. Use a multiple-leg sling to lift bevel gear assembly (Figure 1, Item 5) out of transmission center housing assembly (Figure 1, Item 4).

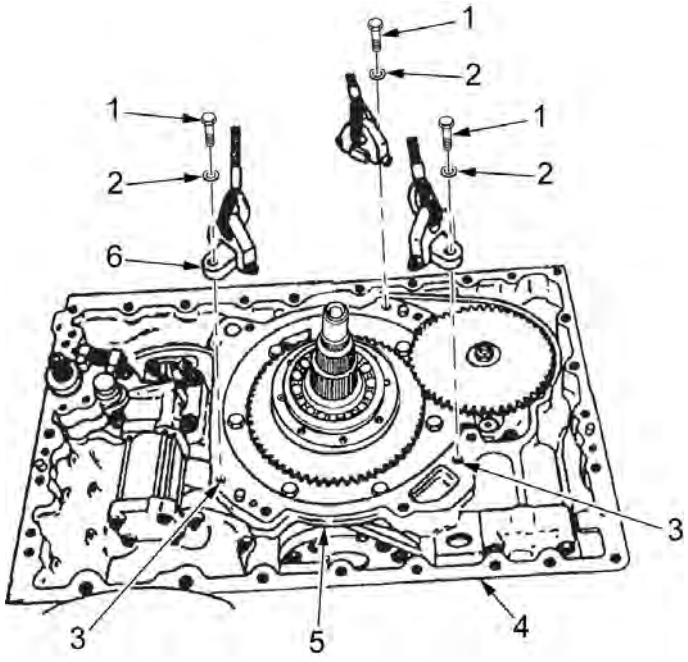


Figure 1. Bevel Gear Assembly Removal.

CAUTION

When lowering bevel gear assembly onto work table, be careful not to bend or break tubes. Bent or broken tubes may cause bevel gear assembly to malfunction and may not align with clearances when bevel gear assembly is installed.

3. Lower bevel gear assembly (Figure 2, Item 5) carefully over work table. While lowering, turn assembly so that it is supported by wooden block.
4. Remove multiple-leg sling from bevel gear assembly (Figure 2, Item 5).

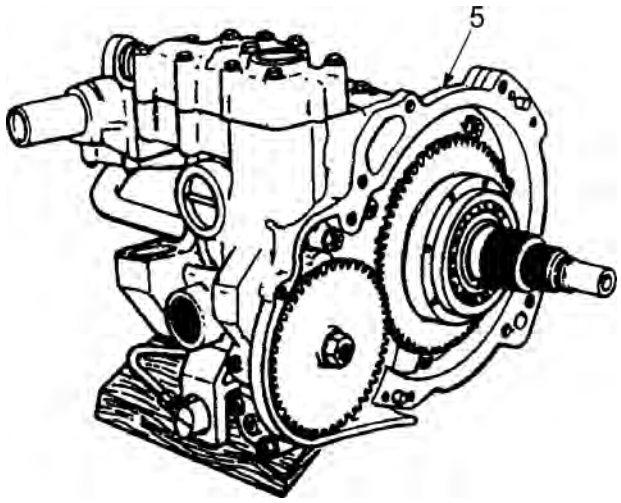


Figure 2. Bevel Gear Assembly on Wooden Supports.

END OF TASK

INSTALL BEVEL GEAR ASSEMBLY

NOTE

The center housing assembly may have been removed from the maintenance stand adapter or may still be attached to the maintenance stand adapter depending upon previous maintenance actions. If center housing assembly has been removed from the maintenance stand adapter, refer to WP 0068 to install the transmission on the maintenance stand adapter.

Transmission center housing assembly is on maintenance stand, with input side turned up.

1. Attach three 7/16-14 x 1-1/4 bolts (Figure 3, Item 1) and three 7/16 inch washers (Figure 3, Item 2) through lugs (Figure 3, Item 6) of multiple-leg sling and into three bolt holes (Figure 3, Item 3) in bevel gear assembly (Figure 3, Item 5).

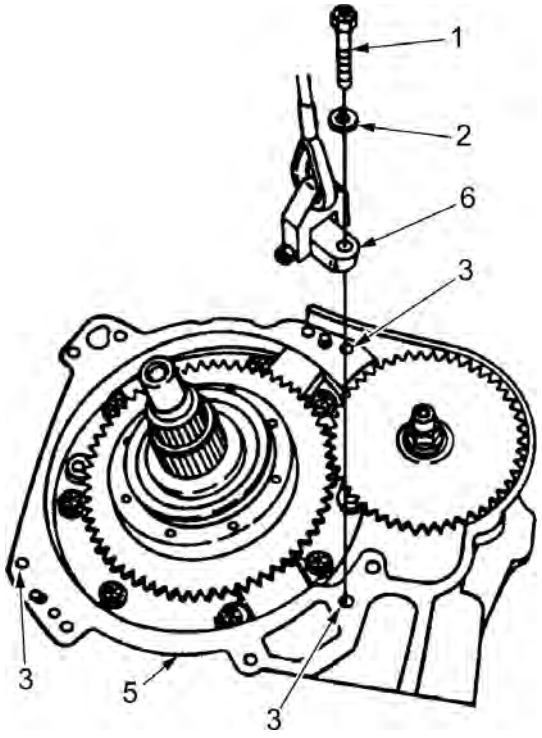


Figure 3. Bevel Gear Assembly with Multiple-Leg Sling Attached.

WARNING

Do a check of slings and trestle for cuts, breaks, or wear before and during lifting transmissions. Slings and trestle can break and cause injury or death.

Bevel gear assembly must be lifted using sling, hoist, and trestle. To avoid injury, keep clear of bevel gear assembly at all times. Do not let bevel gear assembly swing freely during lifting.

CAUTION

Do not cause damage to tubes when you lift bevel gear assembly. Closed tube will cause transmission malfunction.

NOTE

Machined boss (Figure 4, Item 7) on bottom side of bevel gear assembly must be against pedestal (Figure 5, Item 8) on center housing assembly before bevel gear assembly will install all the way into transmission.

2. Lift bevel gear assembly (Figure 6, Item 5) into transmission (Figure 6, Item 9).

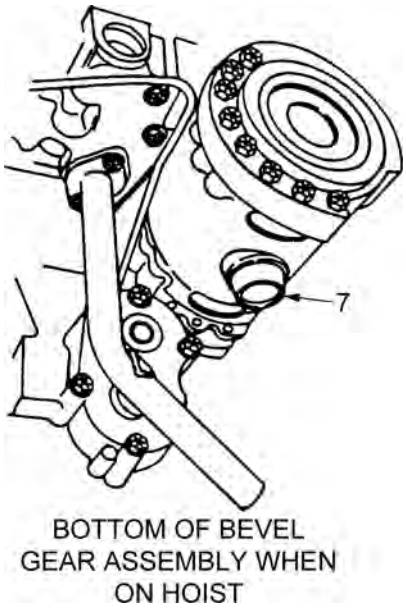


Figure 4. Bevel Gear Machined Boss Must Align with Pedestal on Center Housing.

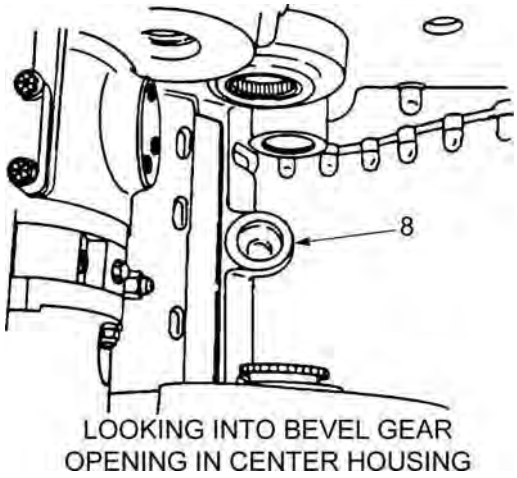


Figure 5. Pedestal on Center Housing Must Align with Machined Boss on Bevel Gear Assembly.

3. Remove three bolts (Figure 6, Item 1) and washers (Figure 6, Item 2) from lugs (Figure 6, Item 6) of multiple-leg sling.
4. Remove multiple-leg sling.

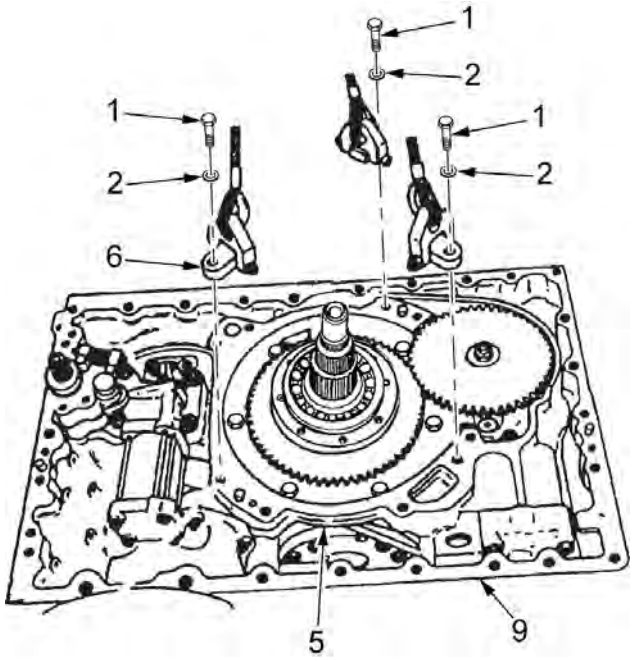


Figure 6. Bevel Gear Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPAIR BEVEL GEAR ASSEMBLY

INITIAL SETUP:

Tools and Special Tools

Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Crowfoot Attachment, Flare Nut, 3/8” Drive, 9/16” (WP 0079, Item 11)
Extension, 3/8” Drive, 6” (WP 0079, Item 16)
Hammer, Hand, Soft-Face, Dead Blow, 52 oz (WP 0079, Item 19)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Press, Arbor, Hand, 25 Ton (WP 0079, Item 28)
Socket Wrench, Universal, 3/8” Drive, 6-Point, 9/16” (WP 0079, Item 39)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)

Materials/Parts

Block, Wood, Lumber, Soft Wood (WP 0078, Item 3) (2 - 16 in. lengths)
Nut, Self-Locking, Hex (WP 0080, Item 24)
O-Ring (WP 0080, Item 42) (2)
Packing, Preformed (WP 0080, Item 40)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Rag, Wiping (WP 0078, Item 13)
Seal Ring, Metal (WP 0080, Item 14) (2)

Personnel Required

Track Vehicle Repairer, 91H10

Equipment Condition

Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Input housing assembly removed (WP 0042)

NOTE

The bevel gear assembly does not have to be removed from the transmission to remove exterior components. However, text and illustrations in this work package are based upon the bevel gear assembly removed from the transmission.

DISASSEMBLE BEVEL GEAR ASSEMBLY, EXTERIOR COMPONENTS

1. Position bevel gear assembly on wooden blocks as shown in Figure 1.
2. Put screwdriver (Figure 1, Item 3) between input oil pump driven gear (Figure 1, Item 1) and input oil pump drive gear (Figure 1, Item 2) to stop gears from turning.
3. Remove nut (Figure 1, Item 4) that keeps input oil pump driven gear (Figure 1, Item 1) in position. Discard nut (Figure 1, Item 4).
4. Remove input oil pump driven gear (Figure 1, Item 1).
5. Remove woodruff key (Figure 2, Item 11) from input oil pump shaft (Figure 2, Item 10).
6. Remove seven bolts (Figure 2, Item 8) and seven washers (Figure 2, Item 9).
7. Remove retaining ring (Figure 2, Item 5).
8. Remove spacer (Figure 2, Item 6).
9. Remove input oil pump drive gear (Figure 2, Item 2) and bearing (Figure 2, Item 7).
10. Remove bearing (Figure 2, Item 7) from input oil pump drive gear (Figure 2, Item 2).

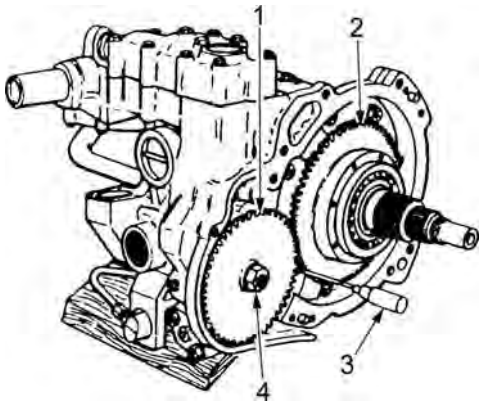


Figure 1. Input Oil Pump Driven Gear Removal.

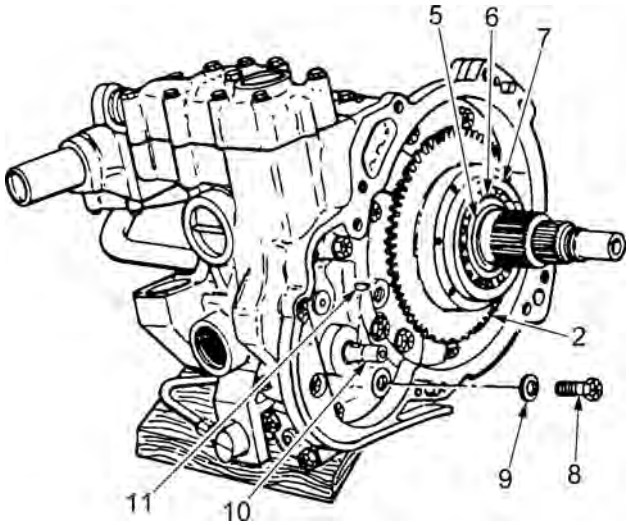


Figure 2. Input Oil Pump Drive Gear and Bearing Removal.

11. Put bevel gear assembly on wooden blocks as shown in Figure 3.
12. Remove two bolts (Figure 3, Item 18) and two washers (Figure 3, Item 19) and one bolt (Figure 3, Item 13) and one washer (Figure 3, Item 14) that keeps scavenge tube assembly (Figure 3, Item 12) in position. Remove the scavenge tube assembly (Figure 3, Item 12).

NOTE

If output oil pump assembly must be sent to Depot Maintenance for overhaul, do Step 13. If not, go to Step 14.

13. Install washer (Figure 3, Item 14) and bolt (Figure 3, Item 13). Torque bolt (Figure 3, Item 13) to 17 to 20 lb-ft (23 to 27 N·m).
14. Remove two bolts (Figure 3, Item 16) and two washers (Figure 3, Item 17) that keep output oil pump assembly (Figure 3, Item 15) in position. Remove the output oil pump assembly (Figure 3, Item 15).

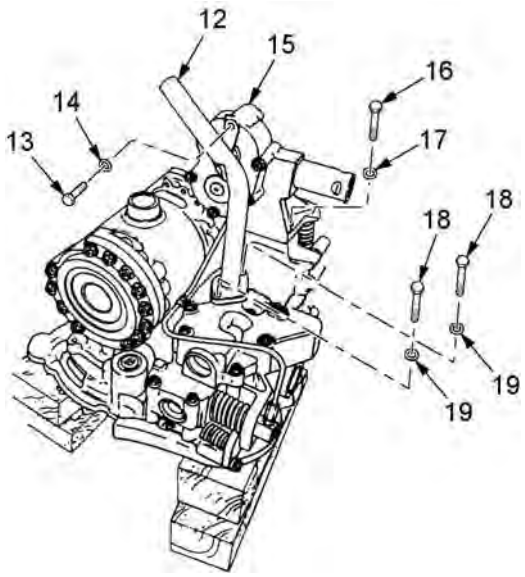


Figure 3. Scavenge Tube Assembly and Output Oil Pump Assembly Removal.

15. Remove spring (Figure 4, Item 20) and valve (Figure 4, Item 21) that were exposed when output oil pump assembly was removed.
16. Remove nine bolts (Figure 4, Item 24) and nine washers (Figure 4, Item 23). Remove check valve (push-start) valve body (Figure 4, Item 22).
17. Remove bolt (Figure 5, Item 25) and washer (Figure 5, Item 26) that attach reverse signal tube (Figure 5, Item 27) to bevel gear carrier assembly.
18. Remove clamp (Figure 5, Item 28) from reverse signal tube (Figure 5, Item 27).

NOTE

If bevel gear assembly must be sent to Depot Maintenance for overhaul, do Step 19. If not, go to Step 20.

19. Install washer (Figure 5, Item 26) and bolt (Figure 5, Item 25). Torque bolt (Figure 5, Item 25) to 36 to 43 lb-ft (49 to 58 N·m).

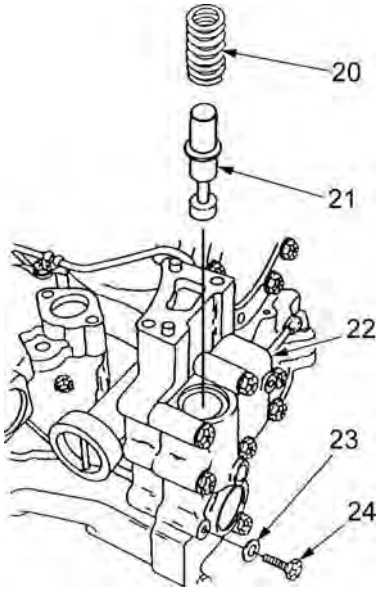


Figure 4. Push-Start Valve Body (Check Valve Body) Removal.

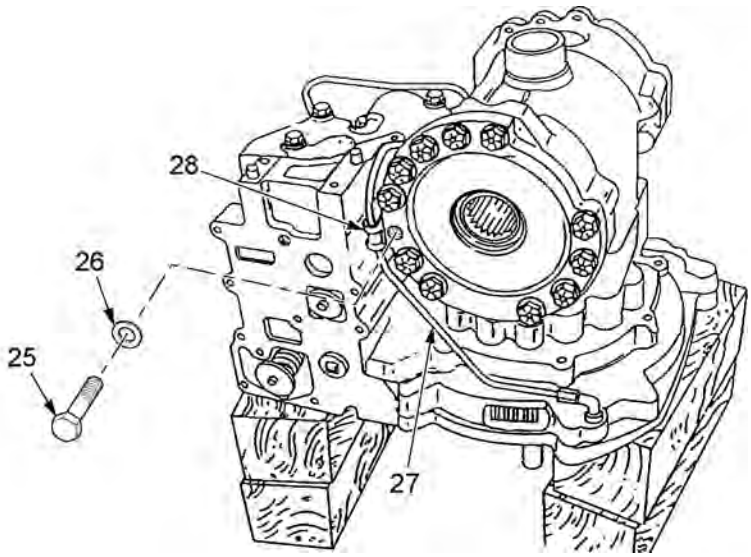


Figure 5. Reverse Signal Tube Clamp Removal.

20. Remove bolt (Figure 6, Item 29) and washer (Figure 6, Item 30) that attach reverse signal tube (Figure 6, Item 27) to input and scavenge pump assembly (Figure 6, Item 31).

NOTE

If input and scavenge pump assembly must be sent to Depot Maintenance for overhaul, do Step 21. If not, go to Step 22.

21. Install bolt (Figure 6, Item 29) and washer (Figure 6, Item 30) in input and scavenge pump assembly (Figure 6, Item 31). Torque bolt (28) to 13 to 16 lb-ft (18 to 22 N·m).
22. Remove reverse signal tube (Figure 6, Item 27) from bevel gear assembly.
23. Remove clamp (Figure 6, Item 28) from reverse signal tube (Figure 6, Item 27).
24. Remove connector (Figure 7, Item 32) and O-ring (Figure 7, Item 33) from input and scavenge pump assembly (Figure 7, Item 31). Remove O-ring (Figure 7, Item 33) from connector (Figure 7, Item 32). Discard O-ring (Figure 7, Item 33).

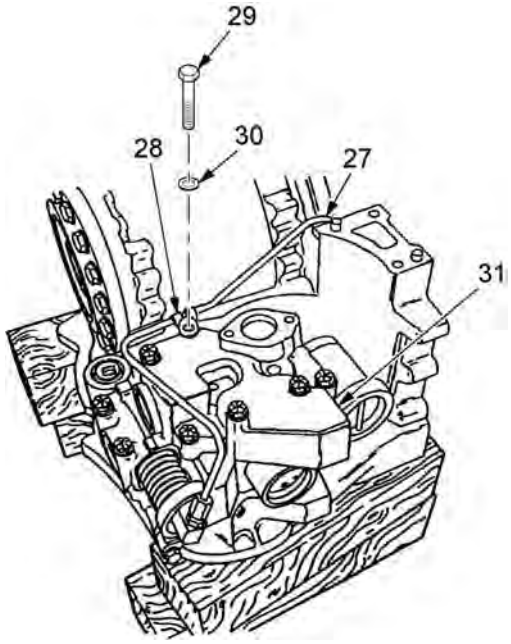


Figure 6. Reverse Signal Tube Removal.

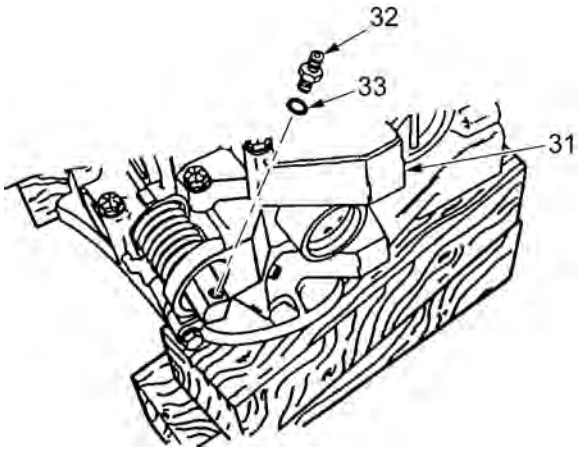


Figure 7. Connector Removal.

25. Remove elbow (Figure 8, Item 34) and O-ring (Figure 8, Item 35) from bevel gear housing. Remove O-ring (Figure 8, Item 35) from elbow (Figure 8, Item 34). Discard O-ring (Figure 8, Item 35).

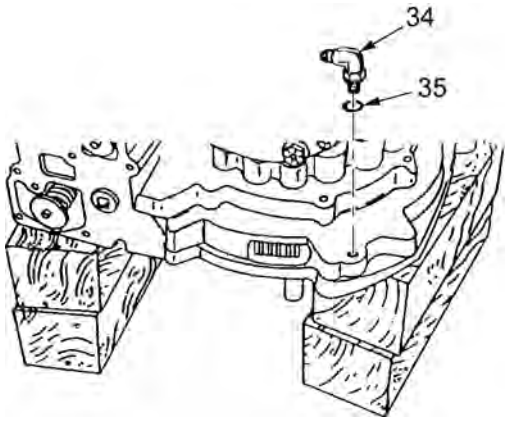


Figure 8. Elbow Removal.

26. Remove two bolts (Figure 9, Item 36) and two washers (Figure 9, Item 37) that keep input and scavenge pump assembly (Figure 9, Item 31) in position. Remove input and scavenge pump assembly (Figure 9, Item 31).

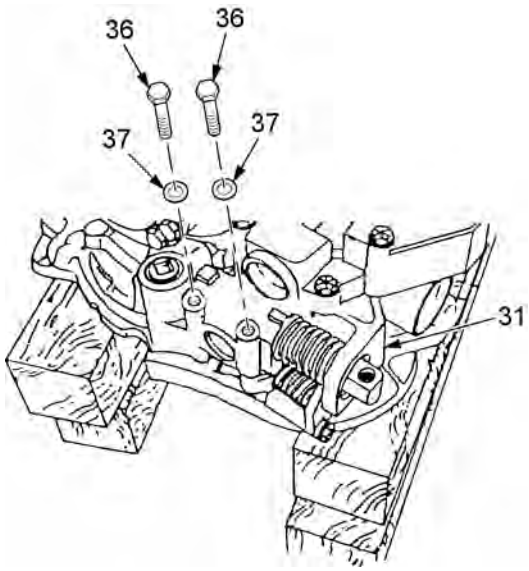


Figure 9. Input and Scavenge Pump Assembly Removal.

27. Position bevel gear assembly on wooden blocks as shown in Figure 10.
28. Remove packing (Figure 10, Item 41) from sleeve of diaphragm assembly (Figure 10, Item 40). Discard packing (Figure 10, Item 41).
29. Remove nine bolts (Figure 10, Item 38) and nine washers (Figure 10, Item 39) that keep diaphragm assembly (Figure 10, Item 40) in position.

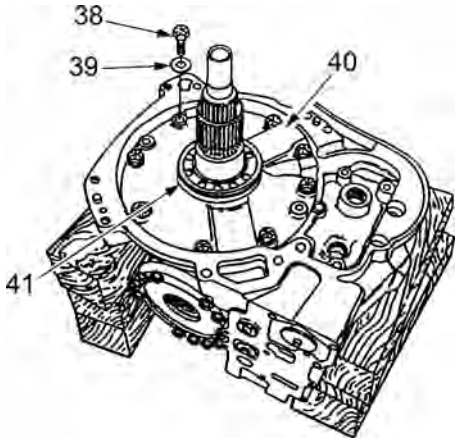


Figure 10. Diaphragm Assembly Hardware Removal.

30. Install two bolts (Figure 11, Item 38) (removed in Step 29) in two jacking bolt holes (Figure 11, Item 42).
31. Tighten one jack bolt (Figure 11, Item 38) and then the other jack bolt (Figure 11, Item 38). Repeat until diaphragm assembly (Figure 11, Item 40) is loose.
32. Remove diaphragm assembly (Figure 11, Item 40).
33. Remove two jack bolts (Figure 11, Item 38).

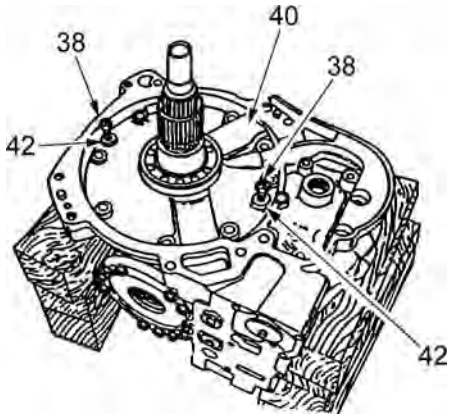


Figure 11. Diaphragm Assembly Removal.

34. Remove two metal seal rings (Figure 12, Item 44) from shaft (Figure 12, Item 43). Discard two seal rings (Figure 12, Item 44).

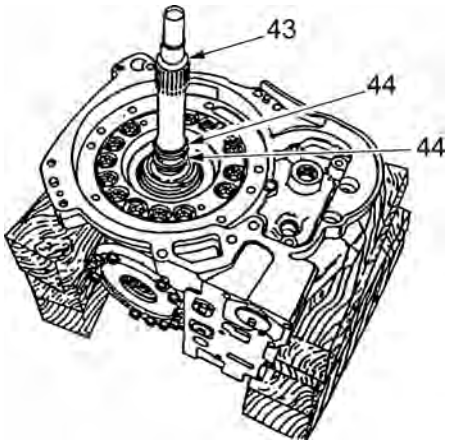


Figure 12. Seal Rings Removal.

END OF TASK

ASSEMBLE BEVEL GEAR ASSEMBLY, EXTERIOR COMPONENTS

1. Put bevel gear assembly, shaft upward, on wooden blocks as shown in Figure 13.
2. Install two new metal seal rings (Figure 13, Item 44) onto shaft (Figure 13, Item 43). Apply petrolatum to seal rings (Figure 13, Item 44).

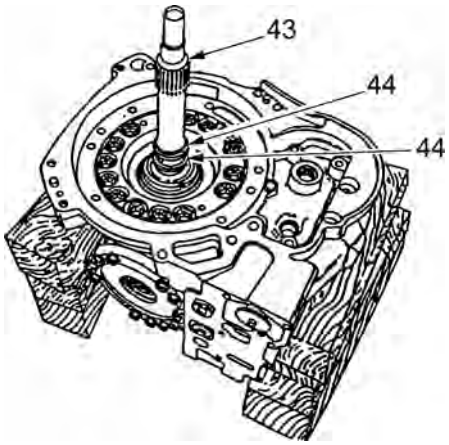


Figure 13. Seal Rings Installation.

3. Install diaphragm assembly (Figure 14, Item 40) onto shaft (Figure 14, Item 42).
4. Install nine bolts (Figure 14, Item 38) and nine washers (Figure 14, Item 39) that keep diaphragm assembly (Figure 14, Item 40) in position.
5. Torque nine bolts (Figure 14, Item 38) to 36 to 43 lb-ft (49 to 58 N·m).
6. Install new packing (Figure 14, Item 41) onto sleeve of diaphragm assembly (Figure 14, Item 40).

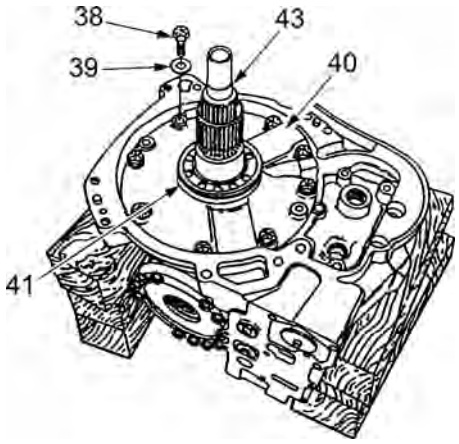


Figure 14. Diaphragm Assembly Installation.

7. Put bevel gear assembly, shaft down, on wooden blocks as shown in Figure 15.
8. Install input and scavenge pump assembly (Figure 15, Item 31). Install two bolts (Figure 15, Item 36) and two washers (Figure 15, Item 37) that keep input and scavenge pump assembly (Figure 15, Item 31) in position.
9. Torque two bolts (Figure 15, Item 36) to 17 to 20 lb-ft (23 to 27 N·m).

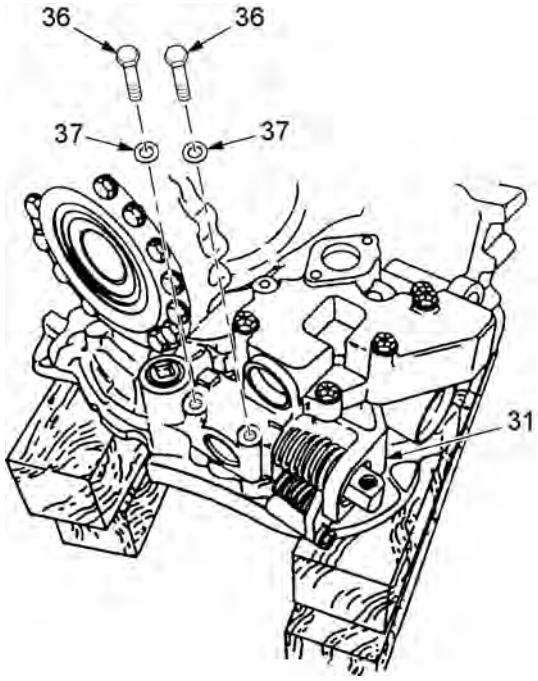


Figure 15. Input and Scavenge Pump Assembly Installation.

10. Install new O-ring (Figure 16, Item 35) onto elbow (Figure 16, Item 34). Install elbow (Figure 16, Item 34) and O-ring (Figure 16, Item 35) into bevel gear housing.

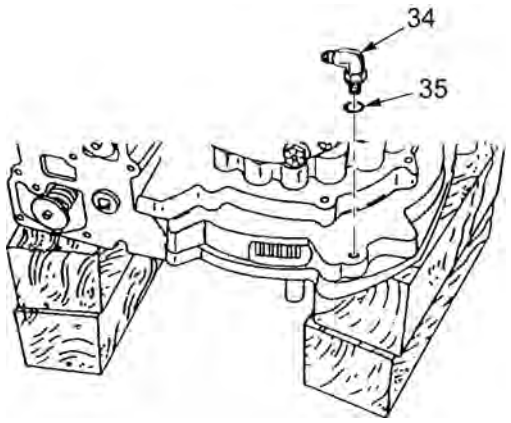


Figure 16. Elbow Installation.

11. Install new O-ring (Figure 17, Item 33) onto connector (Figure 17, Item 32). Install connector (Figure 17, Item 32) and O-ring (Figure 17, Item 33) into input and scavenge pump assembly (Figure 17, Item 31).
12. Torque connector (Figure 17, Item 32) to 5 to 7 lb-ft (7 to 9 N·m).

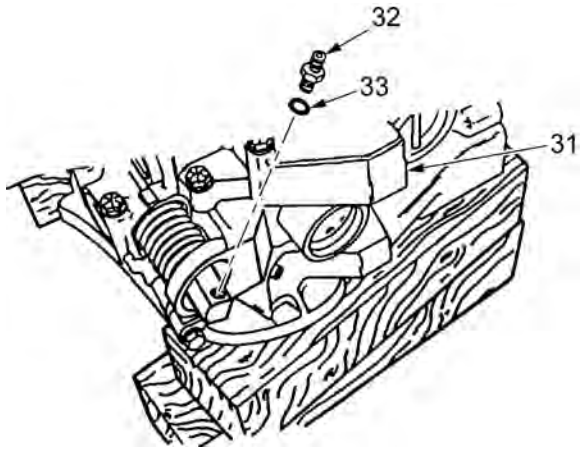


Figure 17. Connector Installation.

13. Install two clamps (Figure 18, Item 28) onto reverse signal tube (Figure 18, Item 27).
14. Remove bolt (Figure 18, Item 25) and washer (Figure 18, Item 26) (if present) from bevel gear carrier.
15. Remove bolt (Figure 19, Item 29) and washer (Figure 19, Item 30) (if present) from input and scavenge pump assembly (Figure 19, Item 31).
16. Install reverse signal tube (Figure 18, Item 27) and (Figure 19, Item 27) onto elbow (Figure 18, Item 34) and connector (Figure 19, Item 32). After ferrule is installed, torque the two nuts on the reverse signal tube (Figure 18, Item 27) and (Figure 19, Item 27) to 10 to 12 lb-ft (1 to 16 N·m).
17. Install washer (Figure 18, Item 26) and bolt (Figure 18, Item 25) that attach reverse signal tube (Figure 18, Item 27) to bevel gear assembly.
18. Torque bolt (Figure 18, Item 25) to 36 to 43 lb-ft (49 to 58 N·m).
19. Install washer (Figure 19, Item 30) and bolt (Figure 19, Item 29) that attach reverse signal tube (Figure 19, Item 27) to input and scavenge pump assembly (Figure 19, Item 31).
20. Torque bolt (Figure 19, Item 29) to 17 to 20 lb-ft (23 to 27 N·m).

21. Torque nut that keeps elbow (Figure 18, Item 34) in place to 5 to 7 lb-ft (18 to 22 N·m).

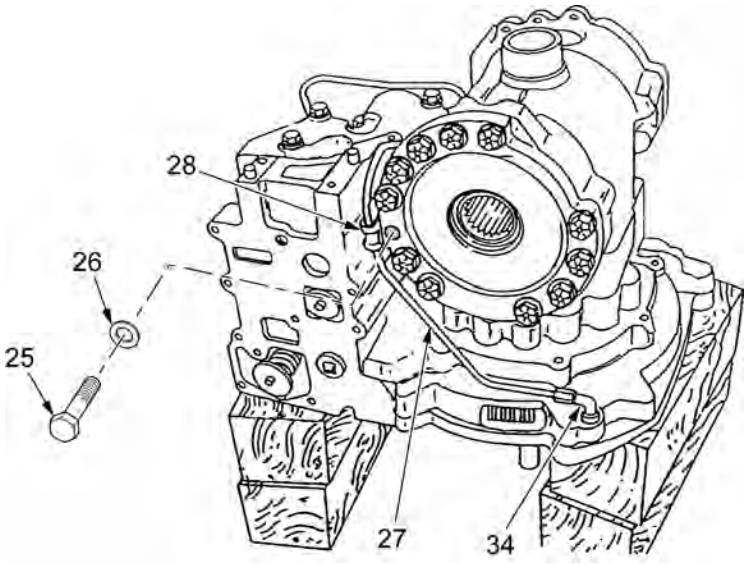


Figure 18. Reverse Signal Tube Clamp Installation.

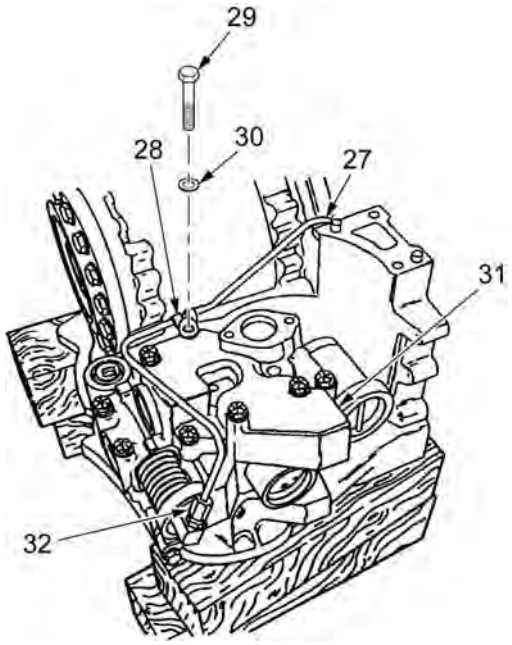


Figure 19. Reverse Signal Tube Installation.

22. Install check valve (push-start) valve body (Figure 20, Item 22) onto bevel gear assembly. Install nine bolts (Figure 20, Item 24) and nine washers (Figure 20, Item 23) that keep check valve (Figure 20, Item 22) in position.
23. Torque bolts (Figure 20, Item 24) to 17 to 20 lb-ft (23 to 27 N·m).
24. Install valve (Figure 20, Item 21), stem down, and spring (Figure 20, Item 20) into check valve (Figure 20, Item 22).
25. Install output oil pump assembly (Figure 21, Item 15) over spring (Figure 21, Item 20) and valve (Figure 20, Item 21) and onto bevel gear assembly.
26. Install two bolts (Figure 21, Item 16) and two washers (Figure 21, Item 17) that keep output oil pump assembly (Figure 21, Item 15) in position.
27. Torque bolts (Figure 21, Item 16) to 36 to 43 lb-ft (49 to 58 N·m).
28. Remove one bolt (Figure 21, Item 13) and one washer (Figure 21, Item 14) (if present) from output oil pump assembly (Figure 21, Item 15).
29. Install scavenge tube assembly (Figure 21, Item 12). Keep scavenge tube assembly (Figure 21, Item 12) in position with one bolt (Figure 21, Item 13) and one washer (Figure 21, Item 14) and two bolts (Figure 21, Item 18) and two washers (Figure 21, Item 19).
30. Torque bolts (Figure 21, Item 13) and (Figure 21, Item 18) to 17 to 20 lb-ft (23 to 27 N·m).

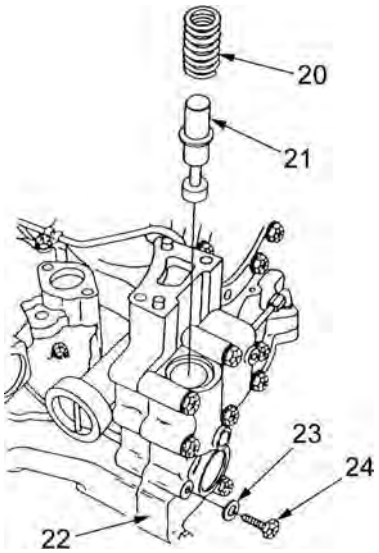


Figure 20. Push-Start Valve Body (Check Valve Body) Installation.

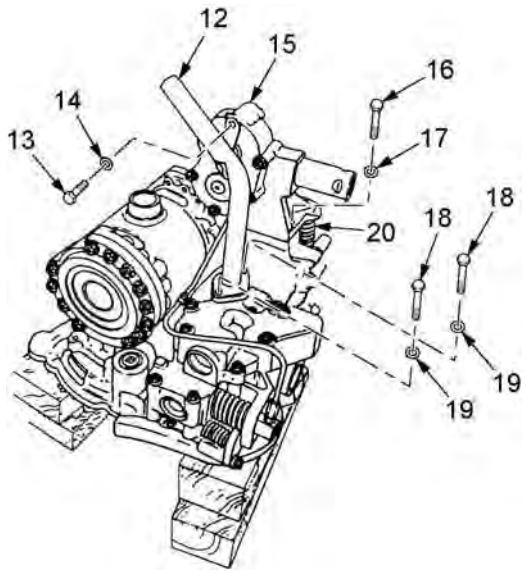


Figure 21. Output Oil Pump Assembly and Scavenge Tube Assembly Installation.

31. Push bearing (Figure 22, Item 7) onto input oil pump drive gear (Figure 22, Item 2). Push to shoulder.
32. Put bevel gear assembly, output oil pump assembly up, as shown in Figure 23.
33. Install input oil pump drive gear (Figure 23, Item 2) and bearing (Figure 23, Item 7) onto shaft (Figure 23, Item 43).
34. Install spacer (Figure 23, Item 6) onto shaft (Figure 23, Item 43).
35. Install retaining ring (Figure 23, Item 5).
36. Install seven bolts (Figure 23, Item 8) and seven washers (Figure 23, Item 9).
37. Torque bolts (Figure 23, Item 8) to 17 to 20 lb-ft (23 to 27 N·m).
38. Install woodruff key (Figure 23, Item 11) into slot in input oil pump shaft (Figure 23, Item 10).

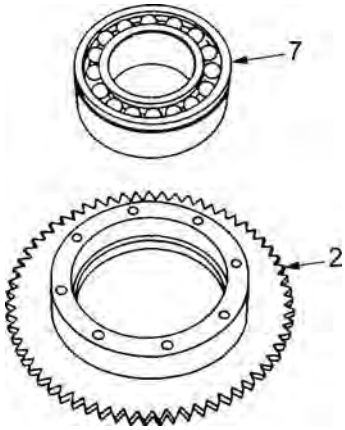


Figure 22. Bearing Installation on Input Oil Pump Drive Gear.

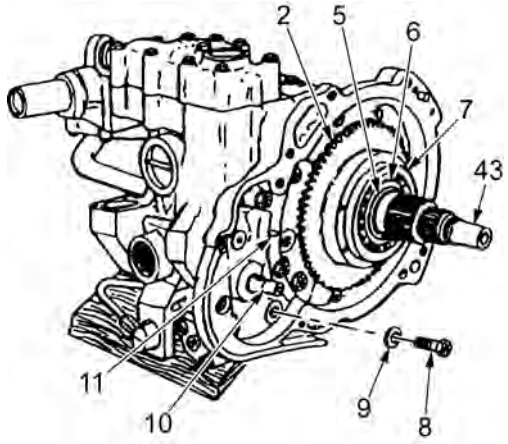


Figure 23. Input Oil Pump Drive Gear Installation.

39. Install input oil pump driven gear (Figure 24, Item 1) over input oil pump shaft (Figure 24, Item 10) and woodruff key (Figure 23, Item 11).
40. Put screwdriver (Figure 24, Item 3) between input oil pump driven gear (Figure 24, Item 1) and input oil pump drive gear (Figure 24, Item 2) to stop gears from turning.
41. Install new nut (Figure 24, Item 4) that keeps input oil pump driven gear (Figure 24, Item 1) in position. Do a check of prevailing torque by measuring the torque required to turn nut (Figure 24, Item 4). Record the prevailing torque.
42. Torque nut (Figure 24, Item 4) to 30 lb-ft (40 N·m) plus prevailing torque.

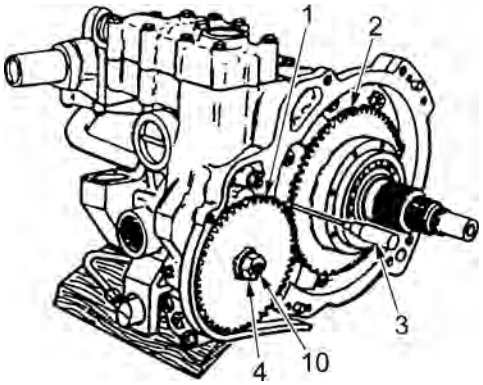


Figure 24. Input Oil Driven Gear Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE HYDROSTATIC PUMP AND MOTOR ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Eyebolt, 7/8-9
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Hook, Chain, S (WP 0079, Item 22)
Pliers Set, Retaining Ring (WP 0079, Item 27)
Sling, Engine and Transmission (WP 0079, Item 35)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Torque, Dial, 3/8” Drive, 300 lb-in. (WP 0079, Item 50)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Steer control assembly removed (WP 0050)

REMOVE HYDROSTATIC PUMP AND MOTOR ASSEMBLY

NOTE

Transmission is right end up.

1. Remove six bolts (Figure 1, Item 3) and six washers (Figure 1, Item 4) holding the hydrostatic pump and motor assembly (Figure 1, Item 6) to transmission (Figure 1, Item 5).
2. Install 7/8-9 eyebolt (Figure 1, Item 2) in threaded hole (Figure 1, Item 1) located in center of shaft on hydrostatic pump and motor assembly (Figure 1, Item 6).

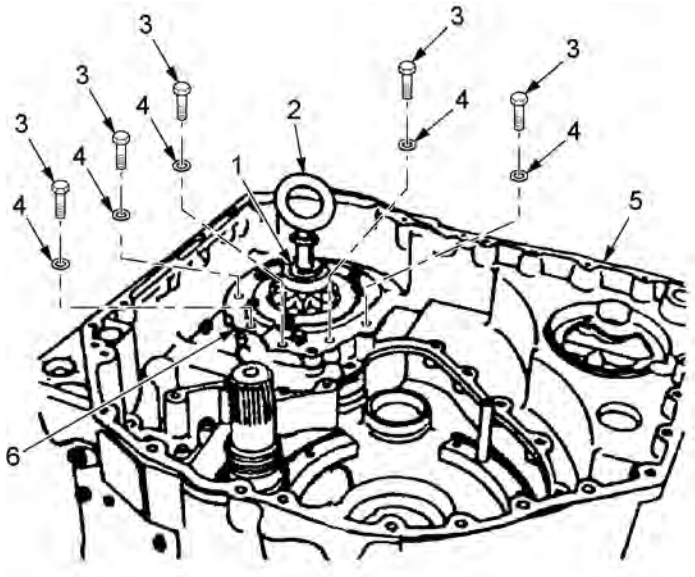


Figure 1. Eyebolt Installation.

3. Install tool S-chain hook (Figure 2, Item 8) in eyebolt (Figure 2, Item 2).
4. Attach tool engine and transmission sling to S-chain hook and raise hydrostatic pump and motor assembly (Figure 2, Item 6) out of transmission (Figure 2, Item 5) using hoist and trestle.
5. Lay hydrostatic pump and motor assembly (Figure 2, Item 6) on table and remove tool engine and transmission sling (Figure 2, Item 6), S-chain hook (Figure 2, Item 8), and eyebolt (Figure 2, Item 2).

NOTE

Gears located on each end of the hydrostatic pump and motor assembly may be removed when hydrostatic pump and motor assembly is in the transmission, or gears may be removed after hydrostatic pump and motor assembly has been removed from transmission.

Hydrostatic drive gear (13-tooth) in Step 7 below is located on the end of the hydrostatic pump and motor assembly where the eyebolt was attached.

6. Using external retaining ring pliers, remove retaining ring (Figure 3, Item 9) that holds the 13-tooth hydrostatic drive gear (Figure 3, Item 10) on the hydrostatic pump and motor assembly (Figure 3, Item 6).
7. Remove the 13-tooth hydrostatic drive gear (Figure 3, Item 10) from hydrostatic pump and motor assembly (Figure 3, Item 6).

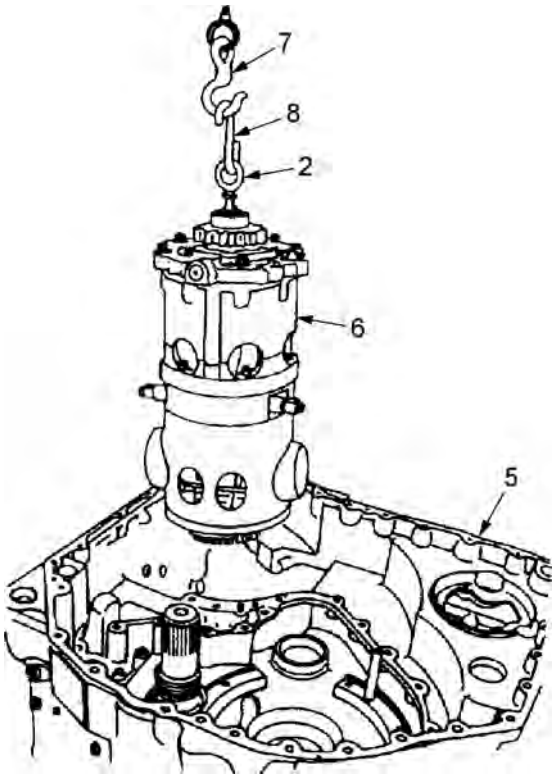


Figure 2. Hydrostat Removal.

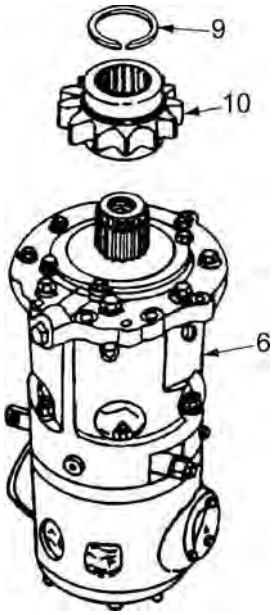


Figure 3. 13-Tooth Hydrostatic Drive Gear Removal.

8. Remove retaining ring (Figure 4, Item 12) that holds 32-tooth hydrostatic gear (Figure 4, Item 11) on hydrostatic pump and motor assembly (Figure 4, Item 6).
9. Remove 32-tooth hydrostatic gear (Figure 4, Item 11) from hydrostatic pump and motor assembly (Figure 4, Item 6).

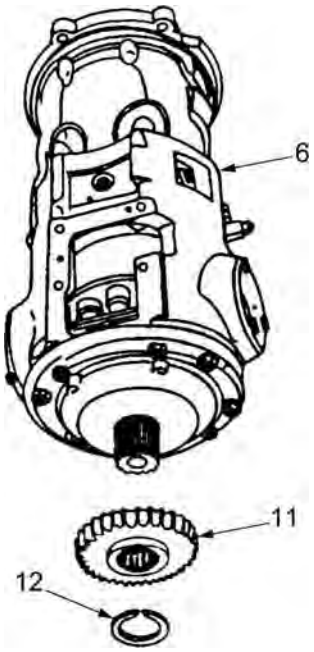


Figure 4. 32-Tooth Hydrostatic Gear Removal.

END OF TASK

INSTALL HYDROSTATIC PUMP AND MOTOR ASSEMBLY

NOTE

Transmission installed on maintenance stand with input housing and right end cover assemblies removed, and right end of transmission turned up.

1. Install 32-tooth hydrostatic gear (Figure 5, Item 11) on end of hydrostat (Figure 5, Item 6) opposite hydrostat mounting end, with larger shoulder of gear out.
2. Install retaining ring (Figure 5, Item 12) to hold gear (Figure 5, Item 11) on hydrostat (Figure 5, Item 6).
3. Install 13-tooth hydrostatic drive gear (Figure 6, Item 10) on hydrostat (Figure 6, Item 6) mounting end, with shoulder of gear out.
4. Install retaining ring (Figure 6, Item 9) to hold gear (Figure 6, Item 10) on hydrostat (Figure 6, Item 6).
5. Install eyebolt (Figure 7, Item 2) in threaded hole (Figure 7, Item 1) located in shaft on mounting end of hydrostat (Figure 7, Item 6).

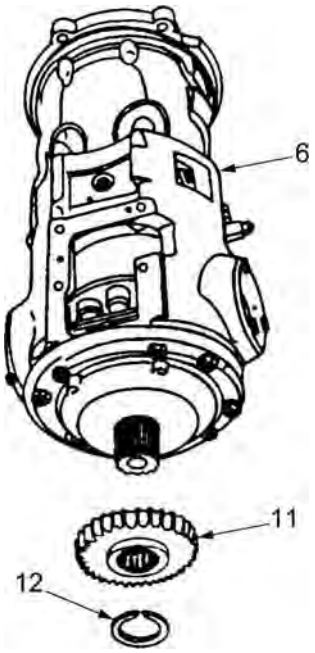


Figure 5. 32-Tooth Hydrostatic Gear Installation.

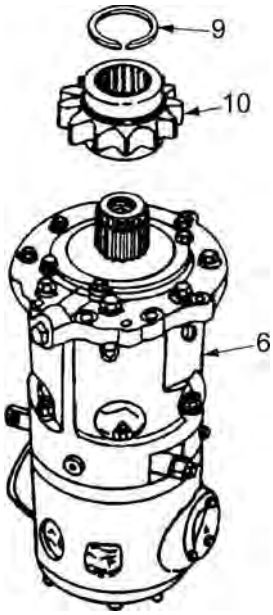


Figure 6. 13-Tooth Hydrostatic Drive Gear Installation.

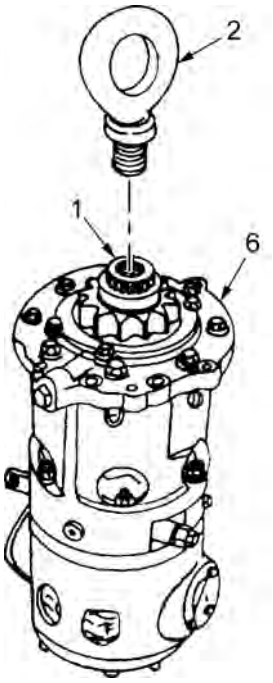


Figure 7. Eyebolt Removal.

6. Install S-chain hook (Figure 8, Item 8) in eyebolt (Figure 8, Item 2) and attach sling (Figure 8, Item 7). Hoist hydrostat (Figure 8, Item 6) over hydrostat bore in center housing (Figure 8, Item 13) using hoist and trestle.

NOTE

Center housing is cut away to receive the raised part of the hydrostat housing where the steer control assembly will be installed.

7. Turn hydrostat (Figure 9, Item 6) so that platform (Figure 9, Item 15) for steer control assembly lines up with recess (Figure 9, Item 14) in center housing (Figure 9, Item 13). Lower hydrostat into transmission, aligning gear at base of hydrostat with gear in center housing.

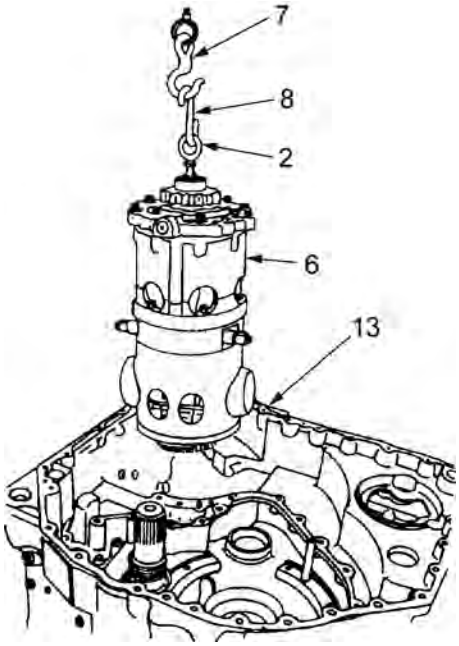


Figure 8. Hoisting Hydrostatic.

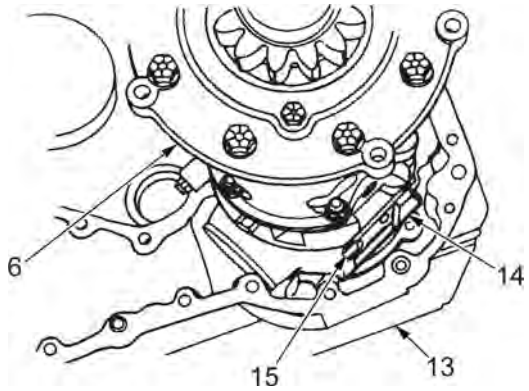


Figure 9. Hydrostat Aligned on Center Housing.

NOTE

Leave sling hooked to hydrostat so that, using hoist and trestle, you can raise and turn hydrostat as necessary to align bolt holes.

8. Install six bolts (Figure 10, Item 3) and six washers (Figure 10, Item 4) in hydrostat (Figure 10, Item 6).
9. Remove hoist, S-chain hook, and eyebolt (Figure 10, Item 2) from hydrostat (Figure 10, Item 6).
10. Torque six bolts (Figure 10, Item 3) to 36 to 43 lb-ft (49 to 68 N·>m).

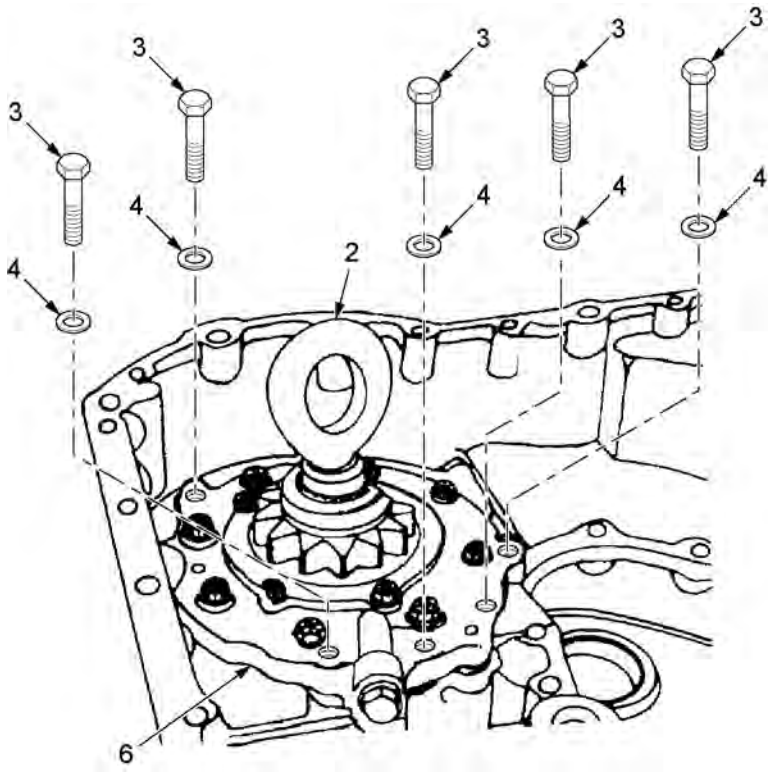


Figure 10. Hydrostat Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE GOVERNOR ASSEMBLY, GOVERNOR BODY ASSEMBLY, AND GOVERNOR DRIVE GEAR

INITIAL SETUP:

Tools and Special Tools
Pliers Set, Retaining Ring (WP 0079, Item 27)
Socket, Socket Wrench, 3/8” Drive, 6-Point, Regular, 1/2” (WP 0079, Item 37)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 29)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Right cover assembly removed (WP 0016)

REMOVE GOVERNOR ASSEMBLY, GOVERNOR BODY ASSEMBLY, AND GOVERNOR DRIVE GEAR

NOTE

Transmission is on maintenance stand, right end up.

1. Remove four bolts (Figure 1, Item 6) and four washers (Figure 1, Item 5) that retain access cover (Figure 1, Item 4) to center housing (Figure 1, Item 1).
2. Remove access cover (Figure 1, Item 4) and gasket (Figure 1, Item 3). Discard gasket (Figure 1, Item 3).
3. Turn governor assembly (Figure 1, Item 2) slightly to the left (counter clockwise) and pull it from center housing (Figure 1, Item 1).

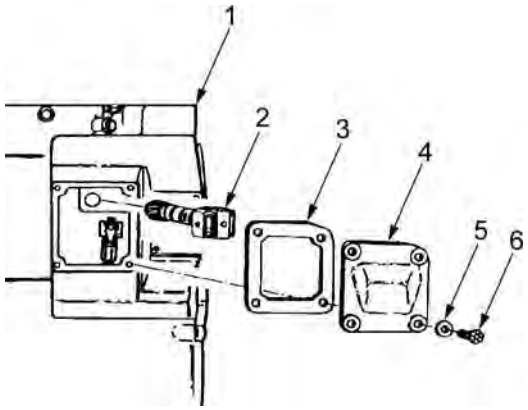


Figure 1. Governor Access Cover and Governor Assembly Removal.

4. Remove three bolts (Figure 2, Item 11) and three washers (Figure 2, Item 10). Remove governor body assembly (Figure 2, Item 9).
5. Remove retaining ring (Figure 2, Item 7).
6. Remove governor drive gear (Figure 2, Item 8).

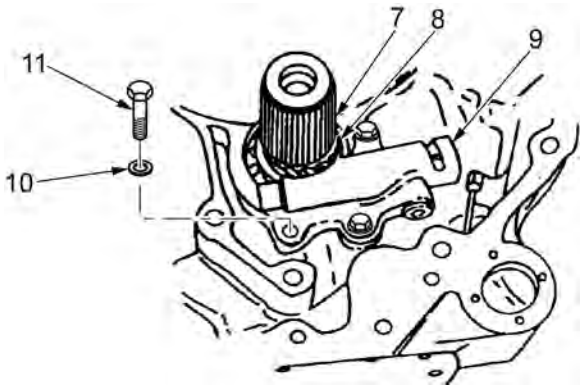


Figure 2. Governor Body Assembly and Governor Drive Gear Removal.

END OF TASK

INSTALL GOVERNOR DRIVE GEAR, GOVERNOR BODY ASSEMBLY, AND GOVERNOR ASSEMBLY

NOTE

Transmission is on maintenance stand, right side up.

1. Install governor drive gear (Figure 3, Item 8) onto range output shaft (Figure 3, Item 12).
2. Install retaining ring (Figure 3, Item 7) into groove of range output shaft (Figure 3, Item 12).
3. Install governor body assembly (Figure 3, Item 9).
4. Install three washers (Figure 3, Item 11) and bolts (Figure 3, Item 10) to retain governor body assembly (Figure 3, Item 9).
5. Torque three bolts (Figure 3, Item 10) to 36 to 43 lb-ft (49 to 68 N·m).

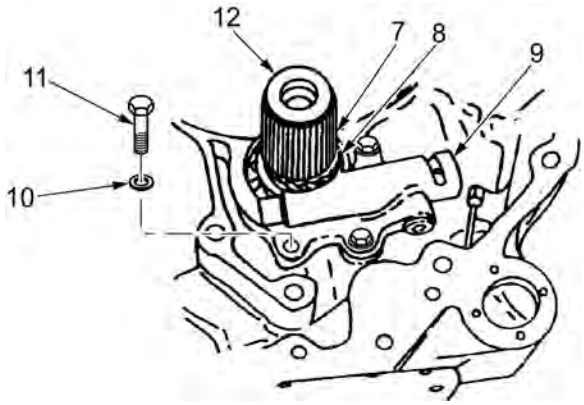


Figure 3. Governor Drive Gear and Governor Body Assembly Installation.

6. Install governor assembly (Figure 4, Item 2), turning it slightly to the left (counterclockwise).
7. Install new gasket (Figure 4, Item 3) and access cover (Figure 4, Item 4).
8. Install four washers (Figure 4, Item 5) and four bolts (Figure 4, Item 6) to retain access cover (Figure 4, Item 4) to center housing (Figure 4, Item 1).
9. Torque four bolts (Figure 4, Item 6) to 17 to 20 lb-ft (23 to 27 N·m).

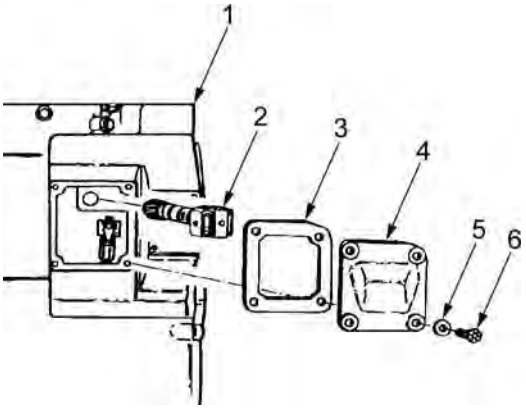


Figure 4. Governor Access Cover and Governor Assembly Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

FINAL ADJUSTMENTS OVERVIEW

INITIAL SETUP:

NOT APPLICABLE

SCOPE

This work package contains a list of applicable work packages to refer to when performing f nal static checks and adjustments required after maintenance actions have been completed and prior to use, shipment, or storage.

Final static checks and adjustments shall be performed after maintenance actions have been completed and prior to use, shipment, or storage.

Functional tests shall be performed with the transmission coupled to the engine and the power pack installed in the vehicle. (Refer to the vehicle manual.) Functional tests must include correct oil and level and a thorough inspection for oil leaks, steering adjustment check, and brake adjustment check. Maintenance records shall be reviewed for complete and correct entries.

Refer to Table 1 for a list of work packages that describe f nal adjustment procedures.

Table 1. Final Adjustment Procedures by Work Package.

Procedure	Work Package
Check Output Shaft Drag, Left and Right	WP 0063
Torque Wrench Check	WP 0064
Adjust Left Brake	WP 0065
Adjust Right Brake	WP 0066

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

CHECK OUTPUT SHAFT DRAG, LEFT AND RIGHT SIDE

INITIAL SETUP:

Tools and Special Tools
Chisel, Cold, 3/8", Flat (WP 0079, Item 7)
Socket, Socket Wrench, 1/2" Drive, 1-1/2" Spline (WP 0079, Item 38)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0065
WP 0066

Equipment Condition
All maintenance actions have been completed

When the left or right cover has been removed and maintenance work has been performed on either cover, or the left or right end of the center housing, the output shaft(s) on the side(s) where the work was performed must be given a drag check. This check will indicate if an assembly error exists such as omission of a spacer or gear or binding of parts.

The output shaft drag check is performed after assembly of the transmission has been completed. The transmission must be on the work table or on the floor in the normal upright operating position.

The output shaft drag check is performed on a dry transmission (i.e., a transmission not filled with oil). Each output shaft in a dry transmission should rotate with the application of 20 lb-ft (27 N·m) of torque. When rotation of the output shaft produces a torque reading higher than 20 lb-ft (27 N·m), the side with the faulty drag must be disassembled and checked for missing parts or parts improperly installed.

NOTE

A high drag check torque reading on a wet transmission should not be interpreted as an indication of a problem. For example, a transmission full of oil may produce a normal drag check reading of 50 lb-ft (68 N·m) or more because of all the oil being moved around. However, an uneven drag check reading, such as 50 lb-ft (68 N·m) on one shaft and 40 lb-ft (54 N·m) on the other shaft, would indicate something binding in the side with the higher reading.

When there is excessive drag on one output shaft, there will probably also be excessive drag on the other output shaft. The output shaft with the higher torque reading represents the side of the transmission which must be disassembled.

CHECK OUTPUT SHAFT DRAG, LEFT AND RIGHT SIDE

1. Straighten bent tab of washer (Figure 1, Item 1) that retains bolt (Figure 1, Item 3) on output f ange (Figure 1, Item 1), if necessary.
2. Turn output f ange (Figure 1, Item 1) to right (clockwise) using torque wrench on bolt (Figure 1, Item 3). Torque while turning should not exceed 20 lb-ft (27 N·m).
3. Punch dimple in washer (Figure 1, Item 4) if dimple is not present. Dimple must go down into dimple hole (Figure 1, Item 2) in left and right output f anges (Figure 1, Item 1).

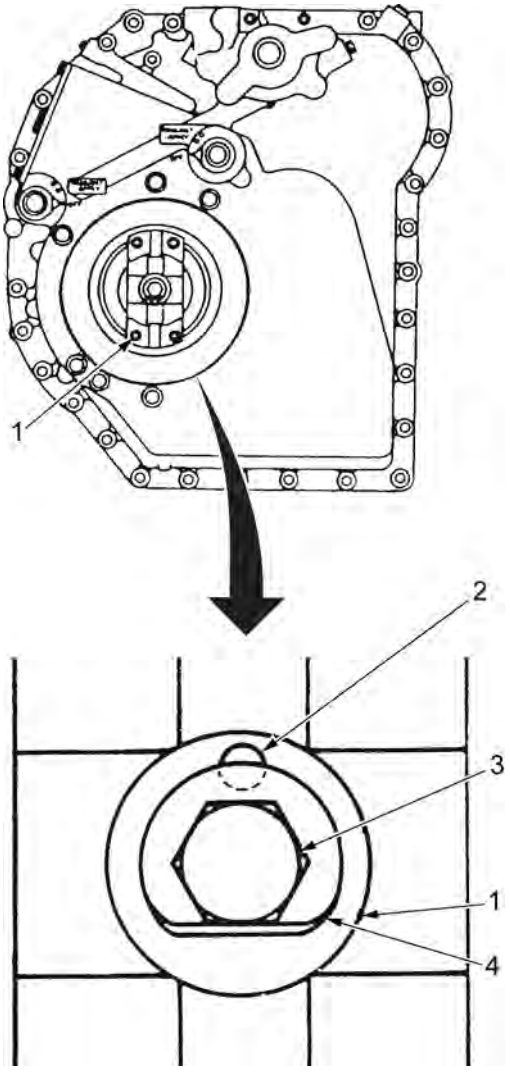


Figure 1. Dimpled Washer on Output Flange.

NOTE

Tab of washer may be on any f at of the bolt head, except tab must be away from dimple hole.

4. Bend tab on washers (Figure 2, Item 4) up against f at of left and right bolt heads (Figure 2, Item 3).

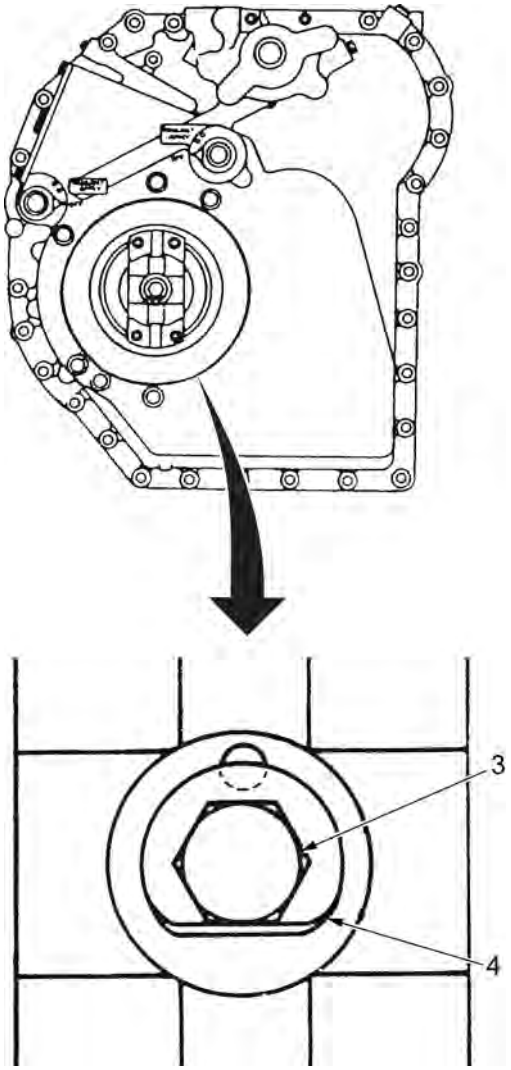


Figure 2. Bent Tab on Output Flange.

FOLLOW-ON MAINTENANCE

1. If torque reading in drag check did not exceed 20 lb-ft (27 N·m), proceed to Left and Right Brake Adjustment work packages (WP 0065 and WP 0066).
2. If torque reading in drag check exceeded 20 lb-ft (27 N·m), return transmission to Depot Maintenance with report on output shaft drag check.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

TORQUE WRENCH CHECK

INITIAL SETUP:

Tools and Special Tools
Socket, Socket Wrench, 1/2” Drive, 1-1/2” Spline (WP 0079, Item 38)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Personnel Required
Track Vehicle Repairer, 91H10

References
WP 0065
WP 0066

Equipment Condition
All maintenance actions have been completed

TORQUE WRENCH CHECK

When the left or right cover has been removed and maintenance work has been performed in either cover of the left or right brakes, a torque wrench check must be performed. This check will indicate if an assembly error exists, such as omission of a spacer or gear, or binding of parts.

The torque wrench check is performed after assembly of the transmission has been completed. The transmission must be on the work table or on the floor in the normal upright operating position. Refer to Figure 1 for an illustration of the process.

This check is performed on a dry transmission (i.e., a transmission not filled with oil).

NOTE

The torque wrench check provides an accurate method to check brakes.

When a brake is adjusted properly, 40 lb-ft (54 N·m) applied to the torque wrench, on the brake apply shaft, should cause the indicator to line up opposite the APPLY mark.

1. Use torque wrench and socket wrench to turn left brake apply shaft counterclockwise until torque wrench reads 40 lb-ft (54 N·m) and hold it there.
2. Check position of indicator in relation to the APPLY mark. Adjust brake if indicator does not line up opposite APPLY mark. (Refer to WP 0065.)
3. Use torque wrench and socket wrench to turn right brake apply shaft clockwise until torque wrench reads 40 lb-ft (54 N·m) and hold it there.

4. Check position of indicator in relation to the APPLY mark. Adjust brake if indicator does not line up opposite APPLY mark. (Refer to WP 0066.)

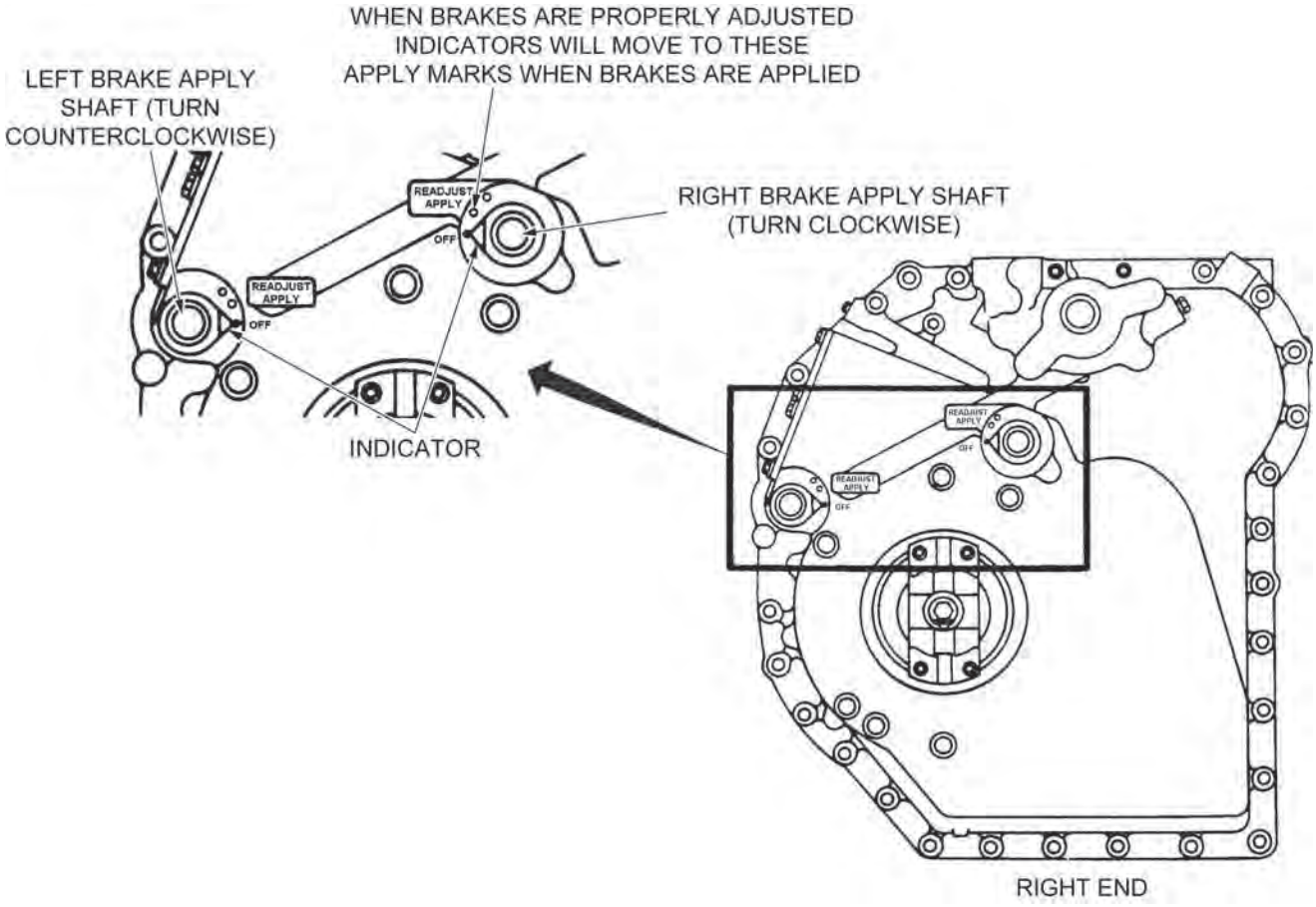


Figure 1. Torque Wrench Check.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

ADJUST LEFT BRAKE

INITIAL SETUP:

Tools and Special Tools
Screwdriver Attachment Hex, 1/2” Drive, 9/16” Hex Bit (WP 0079, Item 33)
Socket, Socket Wrench, 1/2” Drive, 1-1/2” Spline (WP 0079, Item 38)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 29)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
All maintenance actions have been completed

ADJUST LEFT BRAKE

NOTE

Brake needs tightening if indicator passes APPLY mark when 40 lb-ft (54 N·m) is applied with torque wrench.

Brake needs loosening if indicator does not get to APPLY mark when 40 lb-ft (54 N·m) is applied with torque wrench.

Brake adjusting link should be turned only 1/6 turn (60 degrees) at a time until proper brake adjustment is achieved.

1. Remove four bolts (Figure 1, Item 6) and four washers (Figure 1, Item 5) that secure the left brake adjusting cover (Figure 1, Item 4).
2. Remove left brake adjusting cover (Figure 1, Item 4) and gasket (Figure 1, Item 3). Discard gasket (Figure 1, Item 3).
3. Remove governor assembly (Figure 1, Item 2) by turning governor assembly clockwise to disengage gear teeth.

NOTE

Wrench turned to right (counterclockwise rotation of adjusting link) tightens brake.

Wrench turn to left (clockwise rotation of adjusting link) loosens brake.

4. Turn the adjusting link (Figure 1, Item 7) and then apply socket wrench and torque wrench at 40 lb-ft (54 N·m) on left brake apply shaft (Figure 1, Item 1). Repeat until indicator lines up opposite APPLY mark.
5. Install governor assembly (Figure 1, Item 2), engaging gear counterclockwise.
6. Install left brake adjusting cover (Figure 1, Item 4) with new gasket (Figure 1, Item 3).
7. Install four bolts (Figure 1, Item 6) and four washers (Figure 1, Item 5) to attach the left brake adjusting cover (Figure 1, Item 4).
8. Torque four bolts (Figure 1, Item 5) to 17 to 20 lb-ft (23 to 27 N·m).

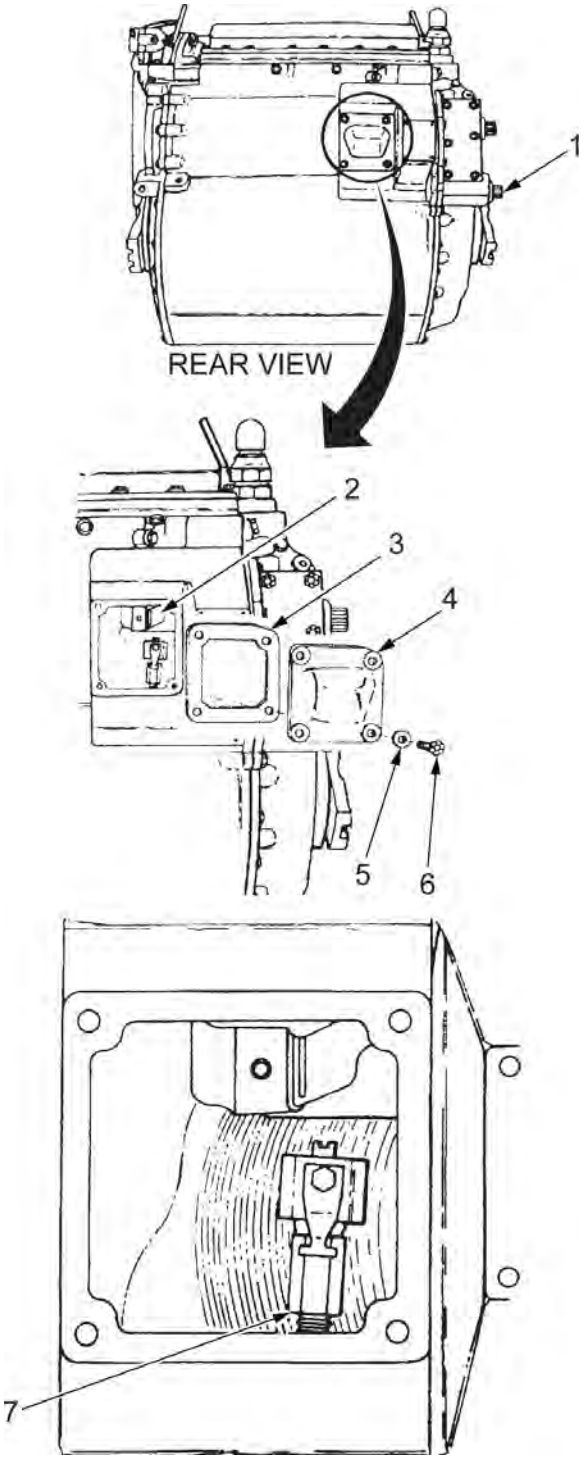


Figure 1. Left Brake Adjusting Link.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

ADJUST RIGHT BRAKE

INITIAL SETUP:

Tools and Special Tools
Socket, Socket Wrench, 1/2” Drive, 1-1/2” Spline (WP 0079, Item 38)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Gasket (WP 0080, Item 30)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
All maintenance actions have been completed

ADJUST RIGHT BRAKE

NOTE

Brake needs tightening if indicator passes APPLY mark when 40 lb-ft (54 N·m) is applied with torque wrench.

Brake needs loosening if indicator does not get to APPLY mark when 40 lb-ft (54 N·m) is applied with torque wrench.

Brake adjusting link should be turned only 1/16 turn (60 degrees) at a time until proper brake adjustment is achieved.

Prior to removal of right brake adjusting cover, note location of chain in relation to bolt.

1. Remove six bolts (Figure 1, Item 1) and six washers (Figure 1, Item 2) that secure the right brake adjusting cover (Figure 1, Item 3).
2. Remove right brake adjusting cover (Figure 1, Item 3) and gasket (Figure 1, Item 4). Discard gasket (Figure 1, Item 4).

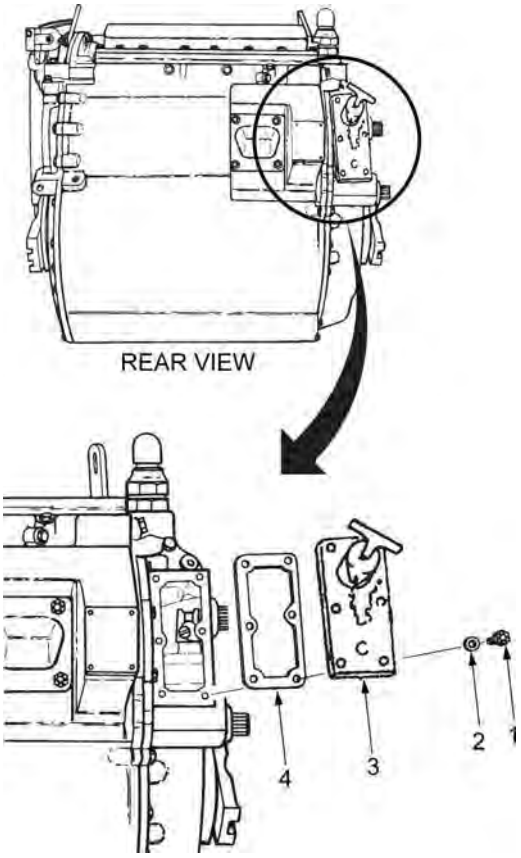


Figure 1. Right Brake Adjusting Cover Removal.

NOTE

Screwdriver turned clockwise in slotted tip of right adjusting link loosens brake.

Screwdriver turned counterclockwise in slotted tip of right adjusting link tightens brake.

3. Turn right adjusting link (Figure 2, Item 5) 1/6 turn (60 degrees) with screwdriver and then apply socket wrench and torque wrench at 40 lb-ft (54 N·m) on right brake shaft (Figure 2, Item 6). Repeat until indicator lines up opposite APPLY mark.

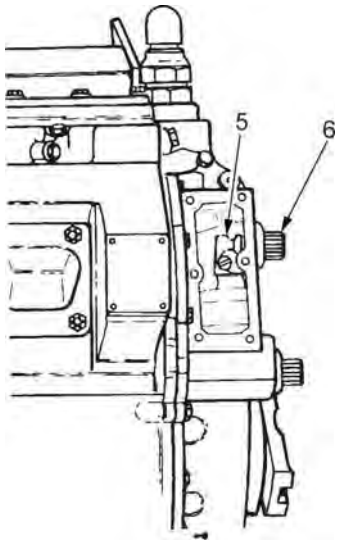


Figure 2. Right Brake Adjusting Link.

4. Install right brake adjusting cover (Figure 3, Item 3) with new gasket (Figure 3, Item 4).
5. Install six bolts (Figure 3, Item 1) and six washers (Figure 3, Item 2) to attach the right brake adjusting cover (Figure 3, Item 3).

NOTE

Oil f ller cap chain is bolted under the top outside bolt and washer of the six bolts and six washers which retain the right brake adjusting cover to the end cover.

6. Torque six bolts (Figure 3, Item 1) to 13 to 15 lb-ft (17 to 20 N·m).

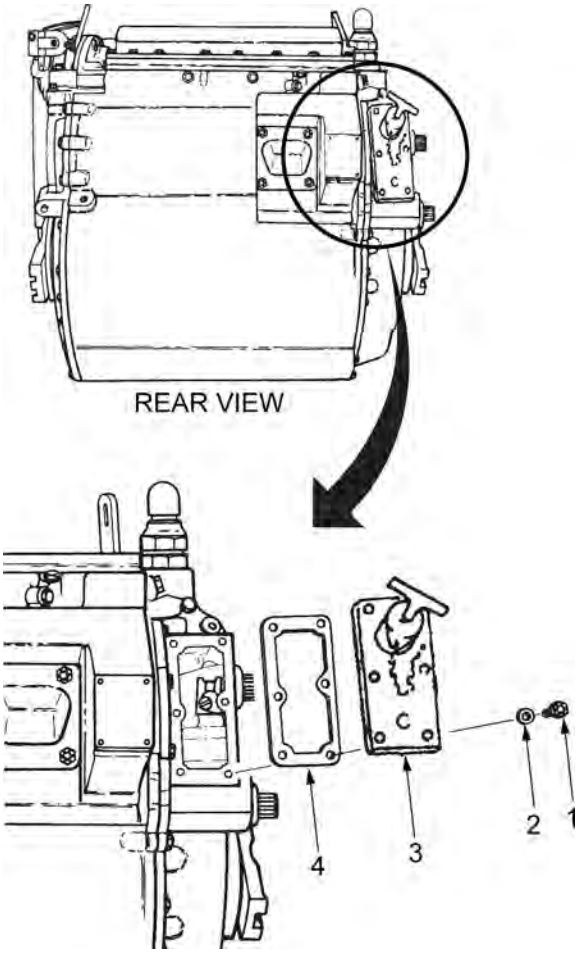


Figure 3. Right Brake Adjusting Cover Insallation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

GENERAL MAINTENANCE INFORMATION

INITIAL SETUP:

Tools and Special Tools
Heater, Gun-Type, Electric (WP 0079, Item 20)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Materials/Parts
Cloth, Abrasive, Crocus (WP 0078, Item 6)
Cloth, Batiste, Lint-Free, White (WP 0078, Item 7)
Gloves, Leather (WP 0078, Item 8)
Grease, High-Temperature (WP 0078, Item 9)
Lubricating Oil, Engine (WP 0078, Item 10)
Petrolatum, Technical (Petroleum Jelly) (WP 0078, Item 12)
Rag, Wiping (WP 0078, Item 13)
Sealing Compound, Gasket (WP 0078, Item 14)
Sodium Phosphate, Tribasic Anhydrous (WP 0078, Item 17)
Solvent, Cleaning (WP 0078, Item 18)

Personnel Required
Track Vehicle Repairer, 91H10

References
DA PAM 738-750
FM 38-700
FM 38-701
LO 9-2350-277-13
TM 9-214
TM 9-243
TM 9-2520-272-40P
WP 0075

SCOPE

This work package provides general maintenance practices that must be followed when working on the transmission. This work package is provided to eliminate the need to repeat common maintenance practices throughout this manual.

OVERVIEW

Follow the maintenance practices in this work package when working on the transmission. The maintenance procedures in this manual cover normal maintenance situations. You may find a situation where the procedure will not work because of contamination, overheating, or excessive wear. For example, a bearing may have to be pressed out instead of lifted out as instructed in the procedure.

When a maintenance practice or procedure does not seem to be working for you, talk to your maintenance officer before trying any other method of doing the task. A bad method could damage good parts or cause unnecessary damage to the transmission.

CARE IN HANDLING

CAUTION

Protective covers on threads, pilot diameters, or splines must be of such conf guration as to prevent further assembly unless the covers are f rst removed. If protective covers are left in the transmission, the transmission may not operate properly.

Protect all threads, splines, and pilot diameters. Parts must be handled carefully to prevent nicking, scratching, or denting. Parts that operate with close tolerance will not function properly, even if slightly damaged. Parts requiring smooth sealing surfaces may leak if scratched. Such parts should be carefully handled and protected. Use suitable containers and parts receptacles for storage.

END OF TASK

CLEANING

WARNING

Some dry cleaning solvents are toxic and f ammable. To avoid injury, wear protective goggles and gloves and use in a well-ventilated area. Avoid contact with skin, eyes, and clothes, and do not breathe vapors. Do not use near open f re or excessive heat. The f ash point for Type I dry cleaning solvent is 100°F (38°C) and for Type II is 138°F (50°C). If you become dizzy while using dry cleaning solvent, get fresh air immediately and get medical aid. If contact with eyes is made, wash your eyes with water and get medical aid immediately. Failure to comply may result in injury or death to personnel.

WARNING

Compressed air used for cleaning purposes must not exceed 30 pounds of pressure per square inch. Use only with effective chip guards and protective personal equipment including goggles or face shield and gloves. Never blow compressed air toward another person. Failure to comply may result in injury to personnel.

WARNING

Hot equipment, hot parts, and steam can burn you. To avoid injury, use with effective personal protective equipment (goggles, face shield, gloves, etc.) Always wear leather gloves when working with steam equipment to protect you from parts that are or might be hot. Never point a steam hose toward another person.

WARNING

Tribasic sodium phosphate can burn eyes and cause skin irritation. Do not get in eyes, on skin, or on clothing. Avoid breathing dust. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling. In case of contact, immediately f ush eyes with plenty of water for at least 15 minutes. Call a physician. Flush skin with water. Wash clothing before reuse.

CAUTION

Rags used for cleaning external surfaces of the transmission must not be used on internal parts and surfaces. Ordinary wiping rags leave lint deposits. Lint or dirt in a transmission can cause the transmission to malfunction. Only clean, lint-free cloths can be used on internal parts and surfaces.

A transmission should not be steam cleaned unless all ports are plugged. Water can be introduced into the transmission through steam cleaning. Water should never be permitted to enter the transmission even when the transmission is to be disassembled. Moisture within the transmission can cause it to fail.

Removing Dirt, Grease, or Oil

All parts must be thoroughly cleaned with dry cleaning solvent and kept clean during all maintenance procedures. Use one of the following methods to remove dirt, grease, or oil from all metal surfaces or parts:

Dip tank: Stir or shake parts fast for one minute in each tank.

Brush or scraper: Clean hard-to-get-at areas with a stiff-bristled brush or scraper.

Wipe with rags dipped in dry cleaning solvent.

Removing Gasket Material

Remove gasket material with a putty knife. Put a lint-free cloth over open cavities to keep out gasket pieces.

Cleaning Bearings

Refer to TM 9-214 for procedures to clean bearings.

Cleaning Oil Passages

Flush with dry cleaning solvent.

Removing Metal Particles

Flush all parts with dry cleaning solvent. Blow parts dry with compressed air. Also blow compressed air into all pockets, cavities, and passages to get rid of trapped metal particles.

Cleaning Transmission Exterior

WARNING

Alkaline solution is used in cleaning operations. Avoid contact of alkaline solution with eyes or skin. Contact with skin can cause rash or blisters. Scrub with soap and water. Contact with eyes can cause blindness. Flush with clean water and get medical attention immediately.

The exterior of the transmission must be thoroughly cleaned before disassembly is started. Use the following methods to remove dirt, oil, grease, or sludge from the exterior surface of the transmission:

To clean a slightly dirty transmission, wash with dry cleaning solvent and blow dry with compressed air.

To clean an excessively dirty transmission, prepare an alkaline steam cleaning solution as follows:

Use 10 lb (4.536 kg) of tribasic sodium phosphate per 50 gal (189 L) of water.

Apply this solution with forced steam pressure at 50 psi (345 kPa).

Degree of Cleanliness

All parts must be clean enough to permit effective inspection. Minute particles left on close tolerance parts, such as valves, can cause transmission failure. Reclean parts as necessary.

END OF TASK

INSPECTION

General Inspection

NOTE

Mandatory Replacement Parts (MRP) need not be inspected.

All non-MRP parts should be inspected when they are removed from the transmission.

Look for metal particle contamination. This may appear as obvious metal particles, or it may appear as dust-like metallic particles, even similar to small deposits of grayish sludge. When this condition is found and it is determined that repair can make the transmission serviceable, the hydrostatic pump and motor assembly, valve bodies, and oil pumps must all be replaced. In addition, all parts must be cleaned and inspected.

Look for unusual wear or damage. The condition of parts removed can identify a problem within the transmission, often before the problem becomes obvious in operation.

Parts that are to go back in the transmission must be thoroughly inspected to determine that they are satisfactory for continued use.

Parts must be clean enough to permit proper inspection.

Castings and Machined Surfaces

1. Look at housings, covers, pistons, and castings for breaks, cracks, deep scoring, or excessive wear that should prevent continued use. Remove nicks, burrs, or scratches with crocus cloth or whetstone.
2. Look at mounting surfaces on housings, valve bodies, and covers for nicks, scratches, or scoring. Remove minor defects with crocus cloth or whetstone.
3. Look at threaded holes for damaged threads. Repair damaged threads with correct side tap or by replacing threaded insert. Screw new inserts into the housing one turn below the surface. Refer to TM 9-243 for use of taps and dies.
4. Look at oil passages for obstructions or dirt. Reclean passages if necessary.

Roller, Ball, and Sleeve Bearings

CAUTION

Any bearing that has been subjected to metal contamination must be closely inspected for metal particles. Metal particles will cause bearing failure.

1. Refer to TM 9-214 for inspection procedures applying to roller and ball bearings.
2. Look at sleeve bearings and bushings for scoring, burrs, sharp edges, or scuff ng. Remove minor scoring, sharp edges, or scuff ng with crocus cloth. Remove burrs with whetstone.

Plain Encased Seals, Step-Type Seal Rings, and Metal Seal Rings

1. Look at plain encased seals for cracks, cuts, or wear. If not like new in appearance, discard seals.
2. Look at composition of seal rings (step-type) for cuts, cracks, or wear. If not like new in appearance, discard seal rings.
3. Look at hook-type metal seal rings for cracks, bends, or broken hooks. If not like new in appearance, discard seal rings.

Gears and Splined Parts

1. Look at gears for burrs, cracks, chipped or broken teeth, or pitting at tooth contact areas. Remove burrs with whetstone. Discard gears that are excessively pitted, cracked, or have chipped or broken teeth.
2. Look at splined parts for twisted or broken splines, burrs, or excessive wear. Remove burrs with whetstone. Discard parts that have twisted or broken splines or excessive wear.

Shafts and Thrust Washers

1. Look at shafts for scoring, burrs, bends, blue discoloring, or clogged oil passages. Remove burrs and minor scoring with crocus cloth or whetstone. Clear oil passages with soft wire or compressed air. Discard shafts that are bent, cracked, or deeply scored.
2. Look at thrust washers for cracks, bends, scoring, discoloring, or burrs. Remove burrs with whetstone. Discard thrust washers that are cracked, bent, scored, or discolored.

Friction Plates and Reaction Plates

1. Look at friction-faced, internal-splined friction plates for cracks, burrs, chipped or broken spline teeth, or severely pitted faces. Remove burrs with whetstone. If any one plate is cracked, severely pitted, or has chipped or broken spline teeth, DISCARD COMPLETE PACK OF CLUTCH PLATES.
2. Look at steel external-tanged reaction plates for cracks, breaks, burrs, galling, embedded metal, scoring, or chipped or broken tangs. Remove minor scoring and burrs with crocus cloth or whetstone. If any one plate is cracked, severely pitted or scored, or has chipped or broken tangs, DISCARD COMPLETE PACK OF CLUTCH PLATES.
3. Assemble clutch plates in the same order and facing the same way as when disassembled. Heat and pressure can cause steel reaction plates or plates to “cone,” or take on a slight conical shape. Fiber-coated friction plates may warp.

Springs

Look at springs for wear or breaks. If bad, discard springs.

Retaining Rings (Snap Rings)

Look at retaining rings for cracks, bends, burrs, or nicks. Remove burrs and nicks with whetstone. If rings are cracked or bent, discard rings. Snap rings must be tight in grooves.

Threaded Parts

1. Inspect all threaded parts for stripped or damaged threads and burrs.
2. Replace all parts that have stripped threads or have damage which cannot be repaired by chasing the threads with a tap or die of the proper size, or by installing threaded inserts.

END OF TASK

LUBRICATION

1. Refer to Vehicle Lubrication Order LO 9-2350-277-13 (M113) for general lubrication information for the transmission.
2. When repairing, assembling, or installing transmission components, make sure all moving parts are well oiled with lubricating oil. This oil will protect parts during the first few moments after engine start-up.
3. Put lubricating oil on all moving parts, such as gears, shafts, and bearings. Also put oil on mating surfaces of valve bodies and housings that mate with moving parts. Put oil or petrolatum on all preformed packings, O-rings, seals, and seal rings as required in the task. Put oil on parts with hand oiler or dip parts in a container of clean oil.
4. Put high-temperature grease on the inside lip of all plain encased seals.
5. Use petrolatum when required to hold gaskets, thrust washers, bushings, or other parts in place during assembly.
6. The combined application of petrolatum and lubrication oil on journals makes bearings or races slide on and off the journals more easily.
7. Immerse all plates in clean lubricating oil one at a time before assembly. Keep all plates in the same order and facing the same way as when disassembled. Soak plates for a minimum of two minutes.
8. Soak each new friction-faced friction plate for a minimum of two minutes in clean lubricating oil.
9. Put lubricating oil on walls and hubs that seal rings will contact.

NOTE

New plugs with pre-coated threads, such as Teflon-coated threads, need no lubrication or sealant before they are installed.

10. Put a small amount of nonhardening sealing compound on the first three threads of all reused or uncoated external pipe plugs and hydraulic fittings.

END OF TASK

TORQUE SPECIFICATIONS AND TIGHTENING SEQUENCE

1. All nuts, bolts, and screws in the transmission are tightened to a torque value in either pound-feet or pound-inches. These torque values are provided in assembly procedures.
2. The first torque value shown for tightening bolts, nuts, screws, plugs, etc., is in terms of pound-feet or pound-inches. Following the torque value for pound-feet or pound-inches is another set of figures in parentheses for Newton meters. Example: Tighten bolt to 12 to 13 lb-ft (16 to 18 N·m).
3. Use the figures in parentheses only when the torque wrench is marked for Newton meters.
4. When bolts, nuts, or screws are in a circular pattern, alternately tighten those located 180 degrees apart to half of minimum torque. Repeat the process, tightening to specific torque.

END OF TASK

REMOVING OR INSTALLING CONNECTORS

1. Look at part or wire to see if it has numbers or letters. Write numbers or letters on tags with pencil. Fasten tags on wires or parts by twisting wire ends of tags. Remove tags after wire or part is installed.
2. If connectors cannot be removed by hand, use conduit-style slip-joint pliers with plastic jaw inserts to loosen them. Finish removal by hand. Straighten any bent contacts with long round-nose pliers. Make sure that contacts and keyways align. Tighten twist-snap-type connectors by hand only until click is heard. Tighten screw-on-type connectors by hand only.
3. Put a protective cap or plug over any electrical connector that is disconnected. Cover connectors on all cables moved to or from the transmission. Take off covers when connectors are installed.
4. Look at connectors for broken, missing, or pushed in contacts before making any connections.
5. Tighten connectors by hand whenever tools are not called out.

END OF TASK

REMOVING OR INSTALLING BEARINGS

The methods and tools used in maintenance procedures for replacing bearings are for normal situations. Unless otherwise specified, bearings are installed with manufacturer's identification (numbered side) out. Bearing identification is legible after bearing is installed.

END OF TASK

MANDATORY REPLACEMENT PARTS

Replace parts that may be deformed during use or damaged during removal. SUCH ITEMS SHOULD BE DISCARDED WHEN THEY ARE REMOVED. Replacement items used in reassembly must be new.

Parts listed in Table 1 will be replaced each time they are removed in transmission disassembly:

Table 1. Mandatory Replacement Parts.

Gaskets	Oil seals
Locknuts	O-rings
Lockstrips	Preformed packings
Lockwashers	Tab washers

Mandatory Replacement Parts in Event of Metal Contamination

In addition to standard replacement parts listed in Table 1, the following MINIMUM repair and replacement must be performed in all cases of metal contamination:

1. Replace the hydrostatic pump and motor.
2. Replace the control valve assemblies.
3. Replace the bevel gear assembly, including oil pumps.
4. CLEAN AND INSPECT ALL PARTS. Replace parts as necessary.

END OF TASK

PARTS REQUIREMENTS FOR EQUIPMENT CONDITIONS

1. The headings of maintenance tasks contain lists of Equipment Conditions. The Equipment Conditions category provides names and locations of other procedures to be completed before you can start work on your assigned task.
2. When Equipment Conditions are needed only to gain access to a work area, examine the items in Materials/Parts category of the initial setup. Select only the supplies and parts needed to complete your work requirement.

END OF TASK

LOCALLY FABRICATED SHOP AIDS

When a maintenance task includes an item to be fabricated, the item is listed under the heading Tools and Special Tools. These fabricated shop aids are listed in Illustrated List of Manufactured Items, WP 0075, including instructions for manufacturing the item.

END OF TASK

REPAIR PARTS

Repair parts are listed and illustrated in TM 9-2520-272-40P, Repair Parts and Special Tools List for Cross-Drive Transmission with Container, Model X200-4A.

END OF TASK

COMMON TOOLS

CAUTION

Use heat guns to heat parts for disassembly or assembly of close f t parts. To prevent damage, do not use open f ame to heat any parts in this transmission.

1. For authorized common tools and equipment, refer to the Modif ed Table of Organization and Equipment (MTOE) for the maintenance activity.
2. All required tools and equipment must be available within the maintenance shop before repair of a transmission is started. The use of improper tools and equipment may damage parts and may result in unsatisfactory performance or failure of the transmission after repairs are completed.

END OF TASK

SPECIAL AND FABRICATED TOOLS

Special tools are listed in WP 0075 of this manual and illustrated in TM 9-2520-272-40P. Fabricated tools are listed and illustrated in WP 0075 of this manual.

END OF TASK

OIL ANALYSIS PROGRAM FOR TRANSMISSION

Refer to the appropriate Lubrication Order LO 9-2350-277-13 (M113) for oil changes and to DA PAM 738-750 (Oil Analysis Program User's Guide) for oil sampling procedures.

END OF TASK

SUPPLEMENTAL MAINTENANCE INSTRUCTIONS

Many maintenance procedures have been standardized and printed in U.S. Army publications. The following publications supplement the maintenance instructions in this manual:

Table 2. Supplemental Maintenance Publication References.

DA PAM 738-750	Functional User's Manual for The Army Maintenance Management System (TAMMS)
FM 38-700	Packaging of Material - Preservation
FM 38-701	Packaging of Material - Packing
TM 9-214	Inspection, Care, and Maintenance of Antifriction Bearings
TM 9-243	Use and Care of Hand Tools and Measuring Tools

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

INSTALL/REMOVE ADAPTER PLATE ON/FROM MAINTENANCE STAND

INITIAL SETUP:

Tools and Special Tools
Adapter Kit, Container (WP 0079, Item 3)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Sling, Engine and Transmission (WP 0079, Item 35)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Torque, Ratcheting, 1/2" Drive, 250 lb-ft (WP 0079, Item 51)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

Equipment Condition
Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)

INSTALL ADAPTER PLATE ON MAINTENANCE STAND

WARNING

Check slings and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

Adapter plate weighs 127 lb (57.6 kg). Lift plate with hoist and trestle to avoid injury.

NOTE

An adapter plate must be mounted on the maintenance turnover stand in order to accept the transmission.

1. Install and securely tighten eyebolt (Figure 1, Item 1) in end of adapter plate (Figure 1, Item 2).
2. Using engine and transmission sling attached to hoist and trestle, position adapter plate (Figure 1, Item 2) so that six holes in adapter plate are aligned with six holes in head of maintenance stand (Figure 1, Item 3).
3. Install two 5/8-11 x 3 inch bolts (Figure 1, Item 5) and two washers (Figure 1, Item 4) through opposite sides of maintenance stand head (Figure 1, Item 3) and into adapter plate (Figure 1, Item 2) to hold alignment.
4. Install the four remaining bolts (Figure 1, Item 5) and four washers (Figure 1, Item 4) holding adapter plate (Figure 1, Item 2) to maintenance stand (Figure 1, Item 3). Tighten all six bolts (Figure 1, Item 5).
5. Torque six bolts (Figure 1, Item 5) to 160 to 175 lb-ft (217 to 237 N·m).
6. Remove engine and transmission sling.

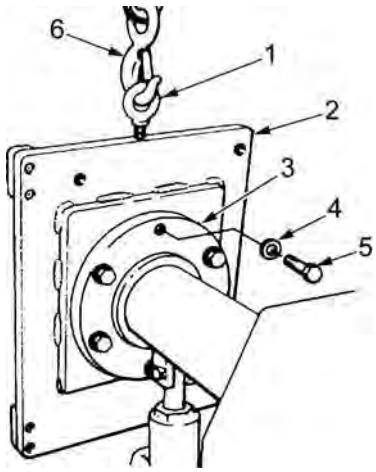


Figure 1. Adapter Plate Installation.

END OF TASK

REMOVE ADAPTER PLATE FROM MAINTENANCE STAND

WARNING

Check slings and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

Adapter plate weighs 127 lb (57.6 kg). Lift plate with hoist and trestle to avoid injury.

1. Install eyebolt (Figure 2, Item 1) in threaded hole at end of adapter plate (Figure 2, Item 2).
2. Attach sling hook of engine and transmission sling in eyebolt (Figure 2, Item 1) and, using hoist and trestle, raise sling until cable is tight.
3. Remove six 5/8-11 x 3 inch bolts (Figure 2, Item 5) and six washers (Figure 2, Item 4) from maintenance stand (Figure 2, Item 3).
4. Remove adapter plate (Figure 2, Item 2).
5. Remove engine and transmission sling.
6. Remove eyebolt (Figure 2, Item 1).

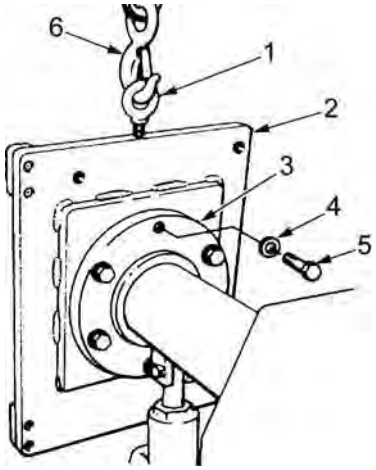


Figure 2. Adapter Plate Removal.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

INSTALL/REMOVE TRANSMISSION ON/FROM ADAPTER PLATE

INITIAL SETUP:

Tools and Special Tools

Adapter, Socket Wrench, 1/2” to 3/8” Square Drive (WP 0079, Item 1)
Adapter Kit, Container (WP 0079, Item 3)
Hoist, Lifting, 2000 lb Capacity (WP 0079, Item 21)
Sling, Engine and Transmission (WP 0079, Item 35)
Sling, Multiple-Leg (3 Legs) (WP 0079, Item 36)
Stand, Maintenance, Automotive (WP 0079, Item 40)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Trestle, Hoist, 2000 lb Capacity (WP 0079, Item 46)
Wrench, Torque, Ratcheting, 1/2” Drive, 250 lb-ft (WP 0079, Item 51)

Personnel Required

Track Vehicle Repairer, 91H10 (2)

Equipment Condition

Transmission removed from vehicle or container (TM 9-2350-277-13&P)
Oil f ll tube assembly removed (WP 0006)
Adapter plate installed on maintenance stand (WP 0068)

INSTALL TRANSMISSION ON ADAPTER PLATE

WARNING

Check slings and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

Transmission will tilt suddenly when weight shifts from one sling to the other. Stay clear of slings and transmission to avoid injury.

Transmission weighs about 975 lb (442 kg). To avoid injury or death, keep out from under and clear of transmission at all times. Do not let transmission swing freely during hoisting.

NOTE

An adapter plate must be mounted on the maintenance turnover stand in order to accept the transmission. The transmission must be mounted on the adapter plate.

If lifting brackets must be reinstalled on transmission, proceed to Step 1.

If lifting brackets have not been removed from transmission, go to Step 2.

1. Install lifting brackets. Refer to TM 9-2350-277-13&P.
2. Make sure right lifting bracket (Figure 1, Item 2) is securely attached to right cover assembly (Figure 1, Item 1) and left lifting bracket (Figure 1, Item 3) is securely attached to left cover assembly (Figure 1, Item 4).

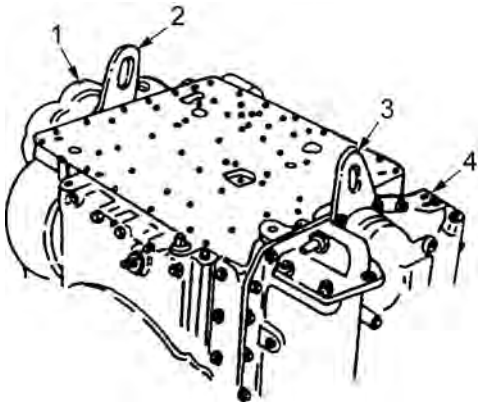


Figure 1. Right and Left Lifting Brackets with Attaching Hardware.

3. Attach hooks of engine and transmission sling into left lifting bracket (Figure 2, Item 3) and right lifting bracket (Figure 2, Item 2).

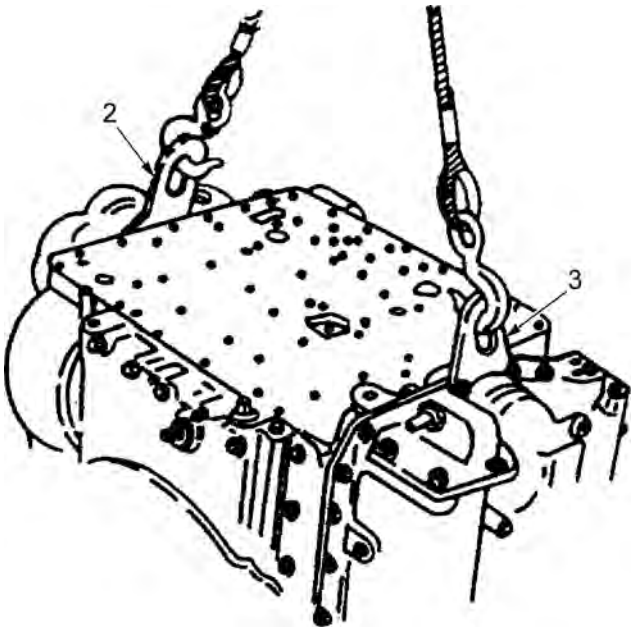


Figure 2. Sling Hooks on Right and Left Lifting Brackets.

4. Remove bolt (Figure 3, Item 7) and washer (Figure 3, Item 6) from input housing (Figure 3, Item 5).

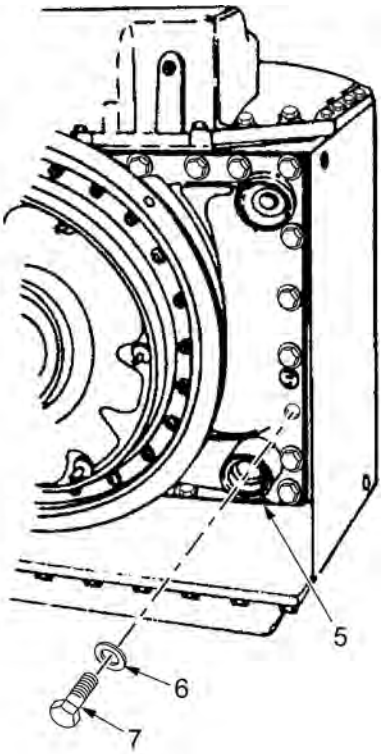


Figure 3. Input Housing Bolt Removal.

5. Remove bolt (Figure 4, Item 8) and washer (Figure 4, Item 9) from left cover assembly (Figure 4, Item 4).

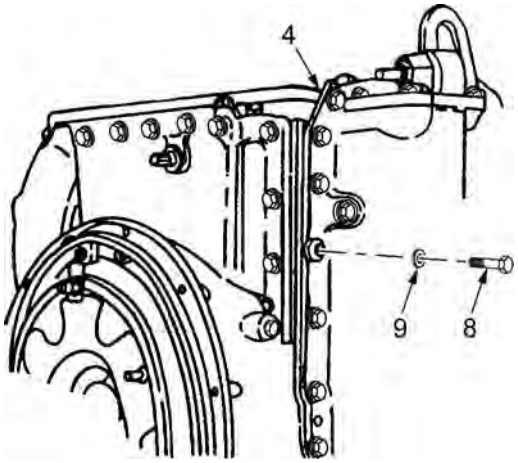


Figure 4. Left Cover Bolt Removal.

6. Remove bolt (Figure 5, Item 11) and washer (Figure 5, Item 10) from right cover assembly (Figure 5, Item 1).

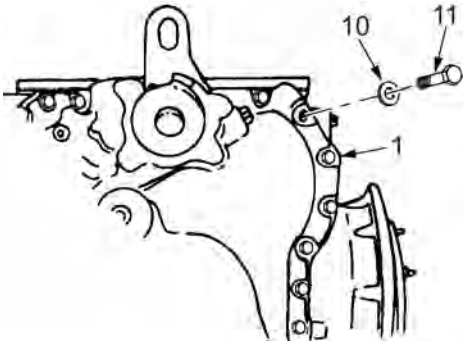


Figure 5. Right Cover Bolt Removal.

7. Attach multiple-leg sling (Figure 6, Item 14) (one leg shown in Figure 6) to transmission where bolts were removed in Steps 4, 5, and 6.
8. Install 3/8-16 x 1-3/4 inch bolt (Figure 6, Item 13) and (Figure 7, Item 13) through each sling lug with one 3/8 inch washer (Figure 6, Item 14) and (Figure 7, Item 14) under each bolt head and one 3/8 inch washer (Figure 6, Item 14) and (Figure 7, Item 14) under each lug. Tighten bolts until snug.

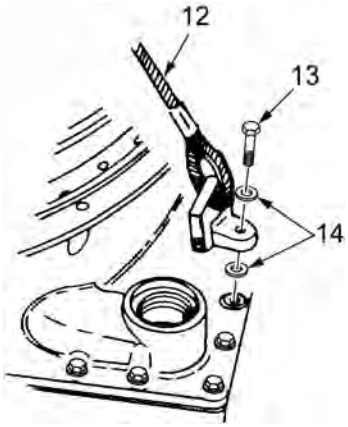


Figure 6. Attachment of Multiple-Leg Sling at Input Housing.

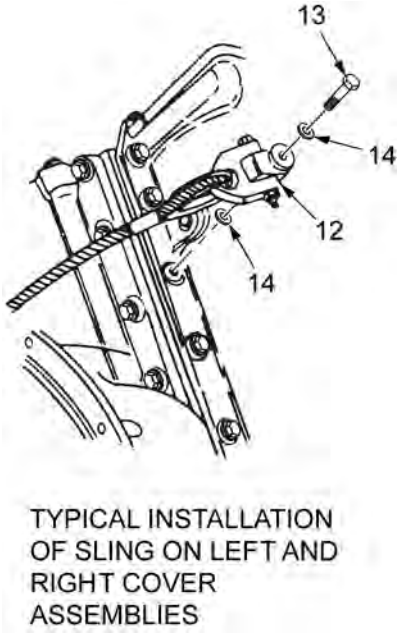


Figure 7. Attachment of Multiple-Leg Sling at Left and Right Covers.

CAUTION

When raising multiple-leg sling, also raise engine and transmission sling as necessary to maintain minimum clearance of 1 ft (0.305 m) between transmission and f oor. Inadequate clearance could cause transmission to be damaged by hitting f oor.

9. Using hoist and trestle, raise engine and transmission sling attached to lifting brackets until bottom of transmission is approximately 1 ft (0.305 m) above f oor. Refer to Figure 8.

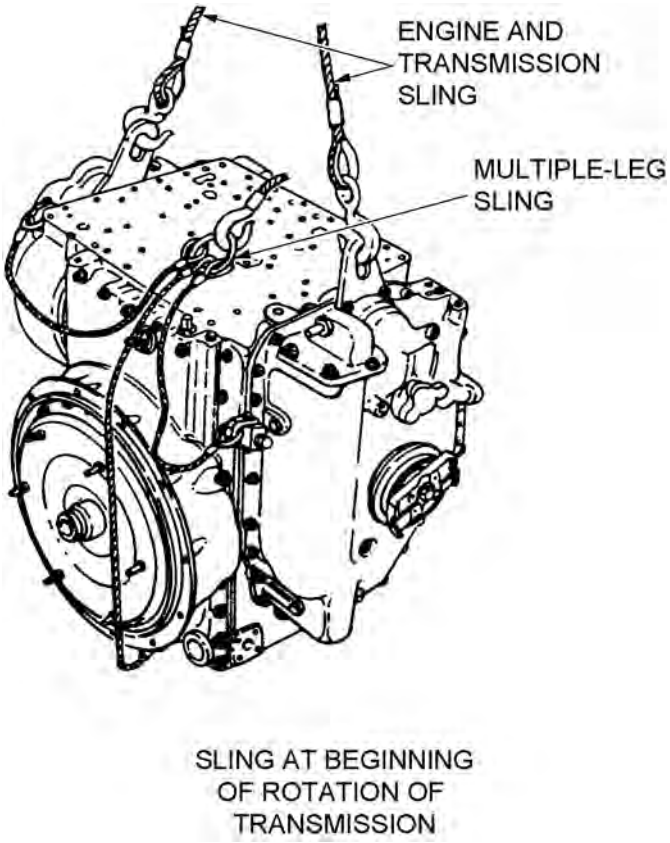


Figure 8. Slings (Beginning Rotation).

WARNING

When rotating transmission vertical to horizontal position, weight of transmission is transferred from one sling to the other. When the center of gravity shifts, transmission may suddenly tilt, thrusting heavy momentary stress on sling, hoist, and trestle. To avoid injury or death, keep out from under and clear of transmission at all times.

10. Using hoist and trestle, raise engine and transmission sling as necessary to maintain proper clearance between transmission and f oor. Refer to Figure 9.
11. Using hoist and trestle, raise multiple-leg sling slowly until weight of transmission is entirely on multiple-leg sling.
12. Remove engine and transmission sling.

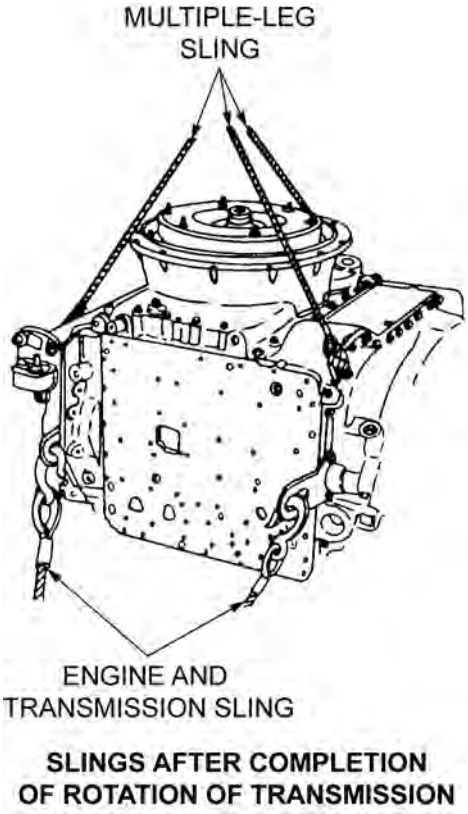


Figure 9. Slings (Rotation Complete).

13. Rotate adapter plate (Figure 10, Item 16) on maintenance stand to match hole pattern in plate with holes on bottom of transmission (Figure 10, Item 15).
14. Align holes in bottom of transmission (Figure 10, Item 15) with holes in adapter plate (Figure 10, Item 16).
15. Install washers (Figure 10, Item 17) (part of container adapter kit) under heads of three 1/2-13 x 2 inch bolts (Figure 10, Item 18) (part of container adapter kit). Install bolts (Figure 10, Item 18) through three holes in adapter plate (Figure 10, Item 16). Screw bolts (Figure 10, Item 18) into holes in bottom of transmission (Figure 10, Item 15).
16. Torque three bolts (Figure 10, Item 18) to 80 to 95 lb-ft (108 to 129 N·m).
17. Remove three 3/8-16 x 1-3/4 inch bolts (Figure 10, Item 13) and six 3/8 inch washers (Figure 10, Item 14) holding multiple-leg sling (Figure 10, Item 12).
18. Remove multiple-leg sling (Figure 10, Item 12).

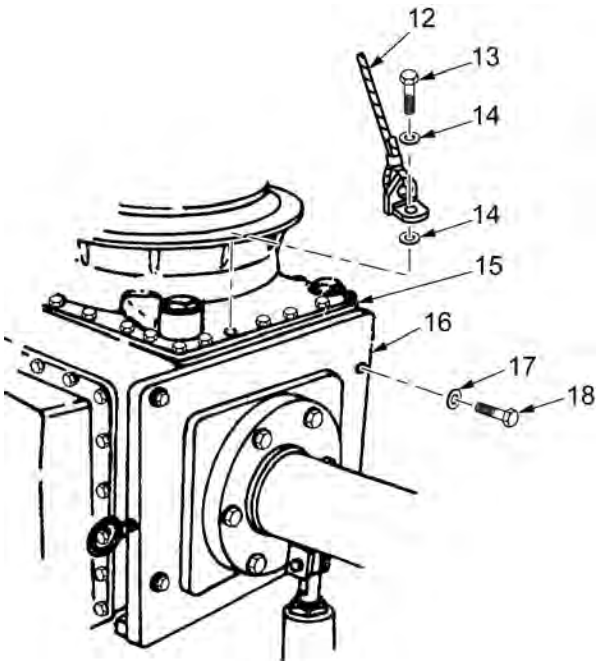


Figure 10. Adapter Attaching Bolts.

NOTE

Bolts were removed in Steps 5 and 6.

19. Install bolt (Figure 11, Item 11) and washer (Figure 11, Item 10) in right cover assembly (Figure 11, Item 1).
20. Install bolt (Figure 12, Item 8) and washer (Figure 12, Item 9) in left cover assembly (Figure 12, Item 4).

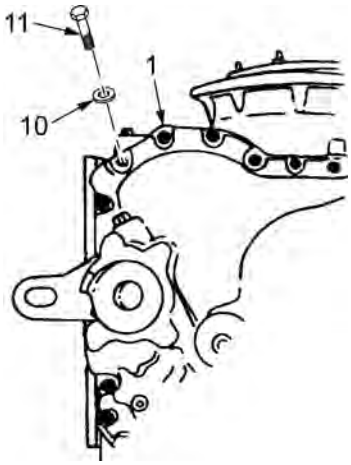


Figure 11. Right Cover Bolt Installation.

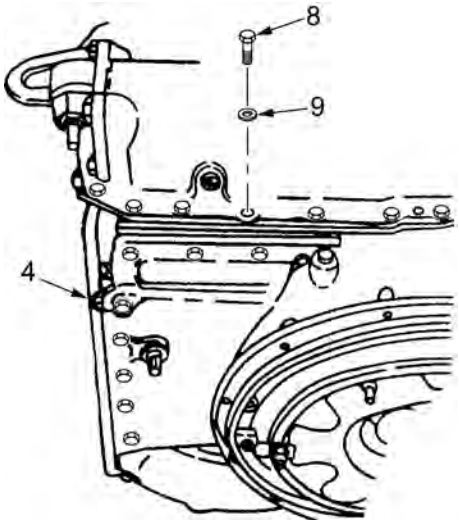


Figure 12. Left Cover Bolt Installation.

NOTE

Bolt was removed in Step 4.

21. Install bolt (Figure 13, Item 7) and washer (Figure 13, Item 6) in input housing (Figure 13, Item 5).

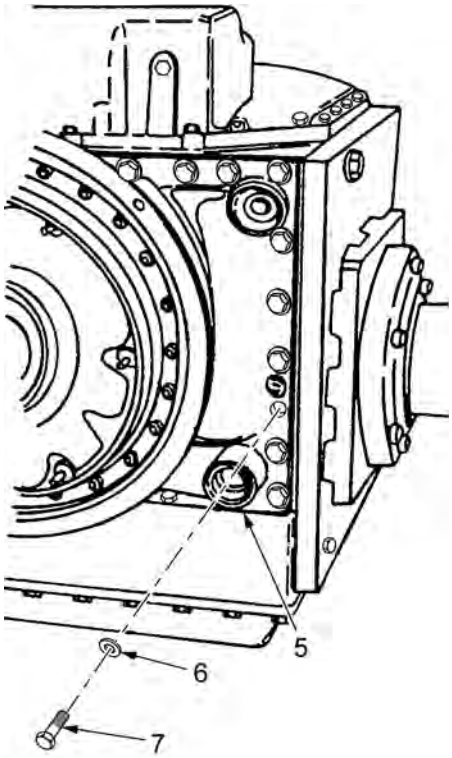


Figure 13. Input Housing Bolt Installation.

END OF TASK

REMOVE TRANSMISSION FROM ADAPTER PLATE

An adapter plate must be mounted on the maintenance turnover stand in order to accept the transmission. The transmission must be mounted on the adapter plate.

WARNING

Check slings and trestle for cuts, breaks, or wear before and during hoisting. Slings and trestle can break and cause injury or death.

Transmission will tilt suddenly when weight shifts from one sling to the other. Stay clear of slings and transmission to avoid injury.

Transmission weighs about 975 lb (442 kg). To avoid injury or death, keep out from under and clear of transmission at all times. Do not let transmission swing freely during hoisting.

NOTE

If lifting brackets must be installed on transmission, go to Step 1.

If lifting brackets have not been removed from transmission, go to Step 3.

1. Install lifting brackets. Refer to TM 9-2350-277-13&P.
2. Make sure right lifting bracket (Figure 14, Item 2) is securely attached to right cover assembly (Figure 14, Item 1), and left lifting bracket (Figure 14, Item 3) is securely attached to left cover assembly (Figure 14, Item 4).

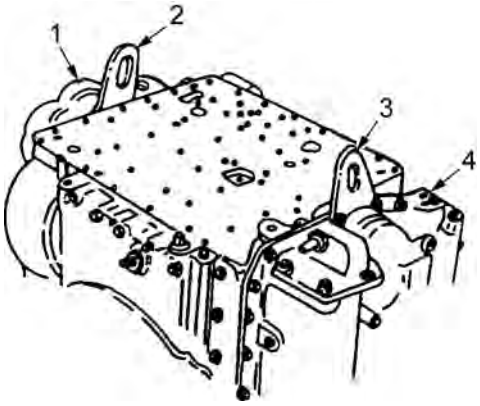


Figure 14. Right and Left Lifting Brackets Mounted on Right and Left Cover Assemblies.

3. Remove bolt (Figure 15, Item 7) and washer (Figure 15, Item 6) from input housing (Figure 15, Item 5). Save bolt and washer.

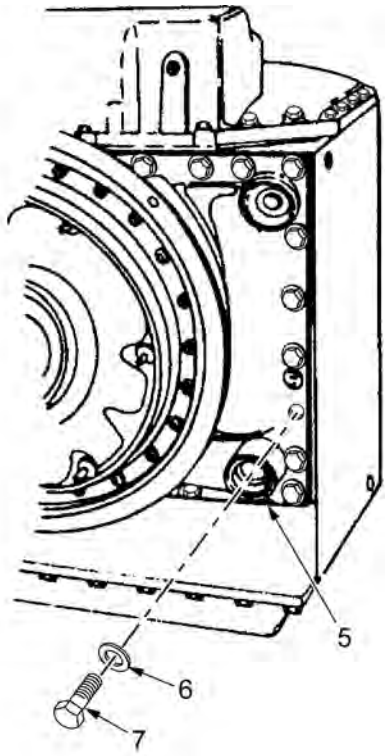


Figure 15. Input Housing Bolt Removal.

4. Remove bolt (Figure 16, Item 8) and washer (Figure 16, Item 9) from left cover assembly (Figure 16, Item 4). Save bolt and washer.

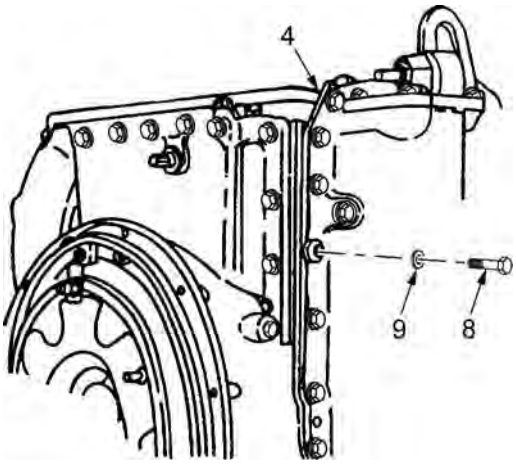


Figure 16. Left Cover Bolt Removal.

5. Remove bolt (Figure 17, Item 11) and washer (Figure 17, Item 10) from right cover assembly (Figure 17, Item 1). Save bolt and washer.

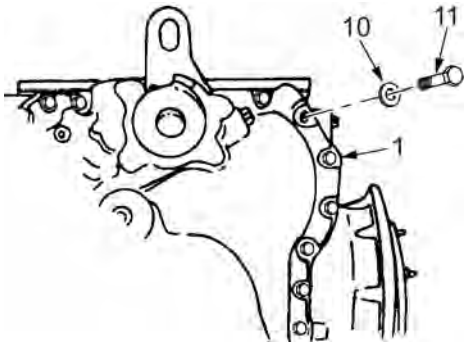


Figure 17. Right Cover Bolt Removal.

6. Install 3/8 inch washer (Figure 18, Item 14) and (Figure 19, Item 14) under head of 3/8-16 x 1-3/4 inch bolt (Figure 18, Item 13) and (Figure 19, Item 13). Put bolt through lug of multiple-leg sling (Figure 18, Item 12) and install another 3/8 inch washer (Figure 18, Item 14) and (Figure 19, Item 14) on bolt (Figure 18, Item 13) and (Figure 19, Item 13).
7. Install bolt (Figure 18, Item 13) attaching the multiple-leg sling (Figure 18, Item 12) to input housing (Figure 18, Item 5). Tighten bolt to snug.
8. Install 3/8 inch washer (Figure 18, Item 14) and (Figure 19, Item 14) under head of 3/8-16 x 1-3/4 inch bolt (Figure 18, Item 13) and (Figure 19, Item 13). Put bolt through lug (Figure 18, Item 19) and (Figure 19, Item 19) of multiple-leg sling (Figure 18, Item 12) and install another 3/8 inch washer (Figure 18, Item 14) and (Figure 19, Item 14) on bolt (Figure 18, Item 13) and (Figure 19, Item 13).
9. Install bolt (Figure 19, Item 13) attaching multiple-leg sling (Figure 18, Item 12) to left cover assembly (Figure 19, Item 4). Tighten bolt to snug.

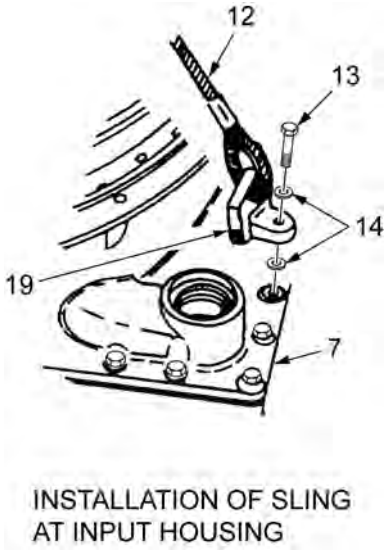


Figure 18. Attachment of Multiple-Leg Sling at Input Housing.

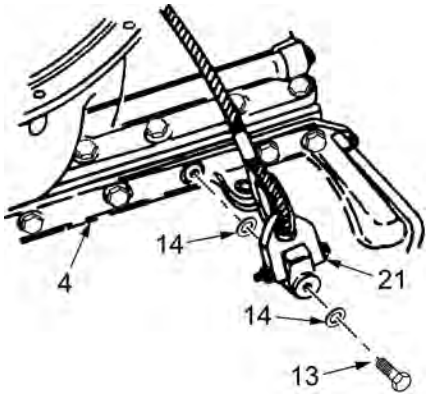


Figure 19. Attachment of Multiple-Leg Sling on Left Cover Assembly.

10. Install 3/8 inch washer (Figure 20, Item 14) under head of 3/8-16 x 1-3/4 inch bolt (Figure 20, Item 13). Put bolt through lug of multiple-leg sling (Figure 20, Item 19) and install another 3/8 inch washer (Figure 20, Item 14) on bolt (Figure 20, Item 13).
11. Install bolt (Figure 20, Item 13) attaching multiple-leg sling (Figure 20, Item 19) to right cover assembly (Figure 20, Item 1). Tighten bolt to snug.

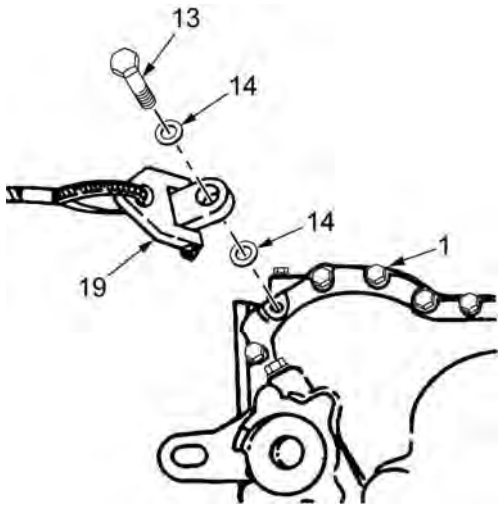


Figure 20. Attachment of Multiple-Leg Sling on Right Cover Assembly.

12. Attach engine and transmission sling (Figure 21, Item 20) hooks to left lifting bracket (Figure 21, Item 3) and right lifting bracket (Figure 21, Item 2).
13. Rotate transmission input housing upward on maintenance stand.
14. (Soldier 1) Use hoist and trestle to raise multiple-leg sling (Figure 21, Item 12) until cables are tight. Maneuver hoist and maintenance stand until all three cables are uniformly tight, ready to receive full weight of transmission (Figure 21, Item 15).

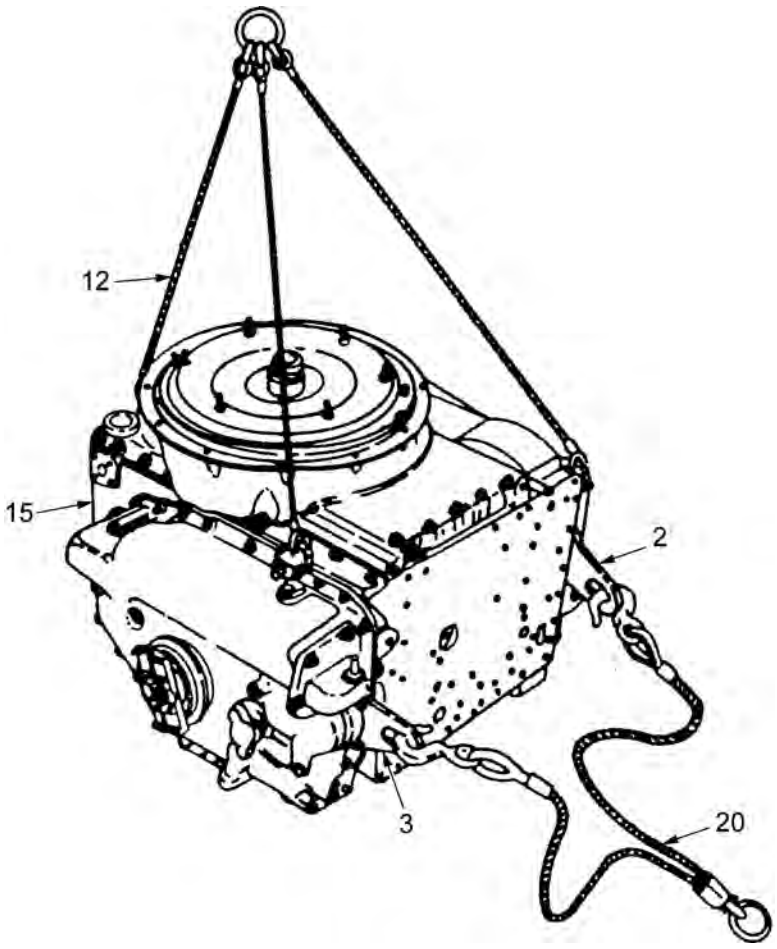


Figure 21. Attachment of Slings.

NOTE

When removing bolts use hoist and trestle as necessary to take tension off bolts.

15. (Soldier 2) Remove three 1/2-13 x 2 inch bolts (Figure 22, Item 18) and washers (Figure 22, Item 17) holding the bottom of the transmission (Figure 22, Item 15) to the adapter plate (Figure 22, Item 21) (part of container adapter kit). The transmission is still being supported at this time by the multiple-leg sling (Figure 22, Item 12).
16. Move transmission (Figure 22, Item 15) away from maintenance stand.

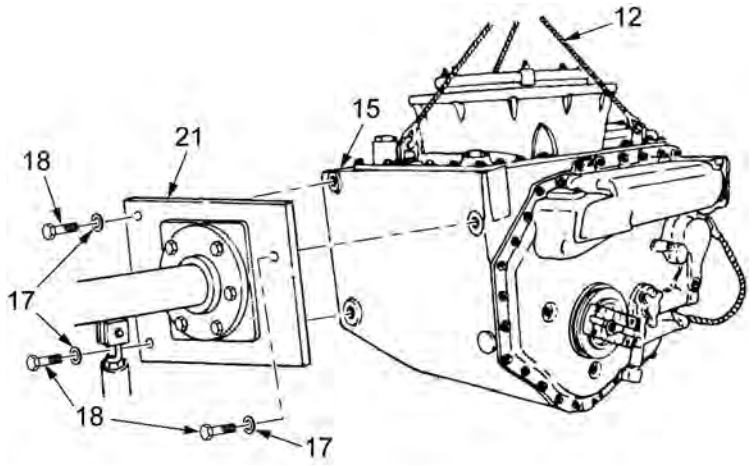


Figure 22. Transmission Removed from Maintenance Stand and Adapter Plate.

WARNING

When rotating transmission from vertical to horizontal position, the weight of transmission is transferred from one sling to the other. When the center of gravity shifts, transmission may suddenly tilt, thrusting heavy momentary stress on sling, hoist, and trestle. To avoid injury or death, keep out from under and clear of transmission at all times.

Check condition of slings; replace as necessary.

Stay clear of slings.

Do not get under transmission.

CAUTION

Either sling, or both slings, should be raised as necessary to maintain at least one foot clearance between transmission and f oor. The transmission will be damaged if it hits the f oor when weight shifts from one sling to the other.

17. (Soldier 1) Using hoist and trestle, slowly raise engine and transmission sling (Figure 23, Item 20).
18. (Soldier 2) Using hoist and trestle, raise multiple-leg sling (Figure 23, Item 12) as necessary to maintain proper clearance between transmission (Figure 23, Item 15) and f oor.
19. Using hoist and trestle, raise engine and transmission sling (Figure 23, Item 20) slowly until entire weight of transmission (Figure 23, Item 15) is on engine and transmission sling.
20. Remove multiple-leg sling (Figure 23, Item 12) from transmission (Figure 23, Item 15).
21. Lower transmission (Figure 23, Item 15) slowly to work table or f oor. Remove hooks of engine and transmission sling (Figure 23, Item 20) from transmission.

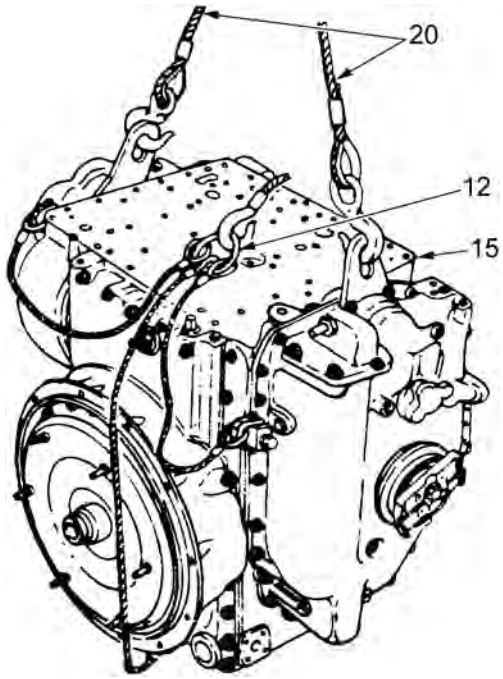


Figure 23. Slings.

22. Install bolt (Figure 24, Item 11) and washer (Figure 24, Item 10) in right cover assembly (Figure 24, Item 1).

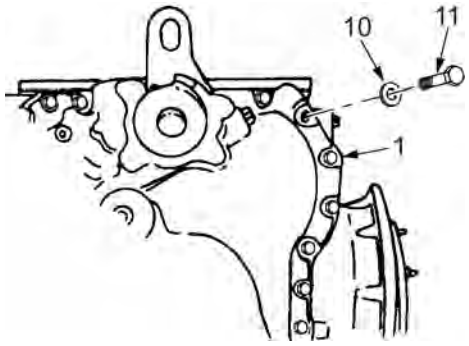


Figure 24. Right Cover Bolt Installation.

23. Install bolt (Figure 25, Item 8) and washer (Figure 25, Item 9) in left cover assembly (Figure 25, Item 4).

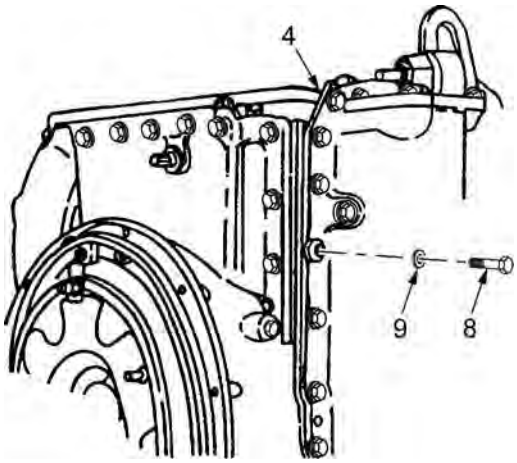


Figure 25. Left Cover Bolt Installation.

24. Install bolt (Figure 26, Item 7) and washer (Figure 26, Item 6) in input housing (Figure 26, Item 5).
25. Torque three bolts (Figure 26, Item 7) and (Figure 25, Item 8) and (Figure 24, Item 11) to 27 to 32 lb-ft (37 to 43 N·m).

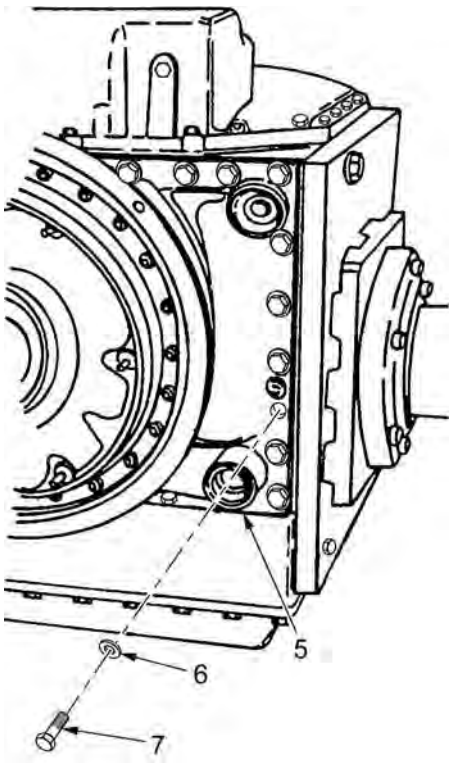


Figure 26. Input Housing Bolt Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE SOLENOIDS AND TERMINALS

INITIAL SETUP:

Tools and Special Tools
Adapter, Socket Wrench Drive, 3/8” Male x 1/2” Female (WP 0079, Item 2)
Extension, 3/8” Drive, 6” (WP 0079, Item 16)
Stripper-Crimper, Wire, Hand (WP 0079, Item 41)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Dial, 3/8” Drive, 300 lb-in. (WP 0079, Item 50)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Main control valve body assembly is removed (WP 0008)
Lockup valve body assembly is removed (WP 0010)

REMOVE SOLENOIDS

CAUTION

Do not remove solenoids from valve assemblies while valve assemblies are installed on the transmission. Bolts can drop through oil return holes into the transmission, damaging the transmission. Bolt must be retrieved, even if transmission has to be disassembled.

NOTE

Do not remove solenoids unless replacement is necessary.

For solenoid A, one bolt is 1/4 inch longer than the other bolts. This is to allow for the thickness of spring retainer.

1. Remove two bolts (Figure 1, Item 6) and (Figure 2, Item 6) from any of four solenoids (Figure 1, Item 1) on main valve body assembly (Figure 1, Item 5), or remove two bolts (Figure 1, Item 6) and (Figure 2, Item 6) from solenoid A (Figure 1, Item 2) on the main valve body assembly (Figure 1, Item 5).
2. Remove two bolts (Figure 1, Item 6) and (Figure 2, Item 6) from any of two solenoids (Figure 2, Item 1) on lockup valve body assembly (Figure 2, Item 7).
3. For solenoid A (Figure 1, Item 2), remove spring retainer (Figure 1, Item 3).
4. Remove any of the seven solenoids (Figure 1, Item 1), if necessary.

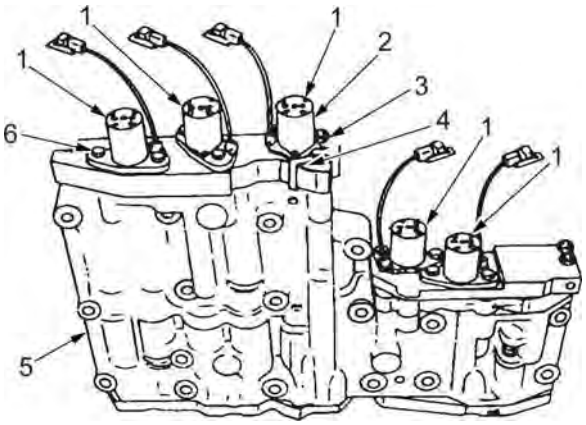


Figure 1. Solenoids on Main Valve Body Assembly.

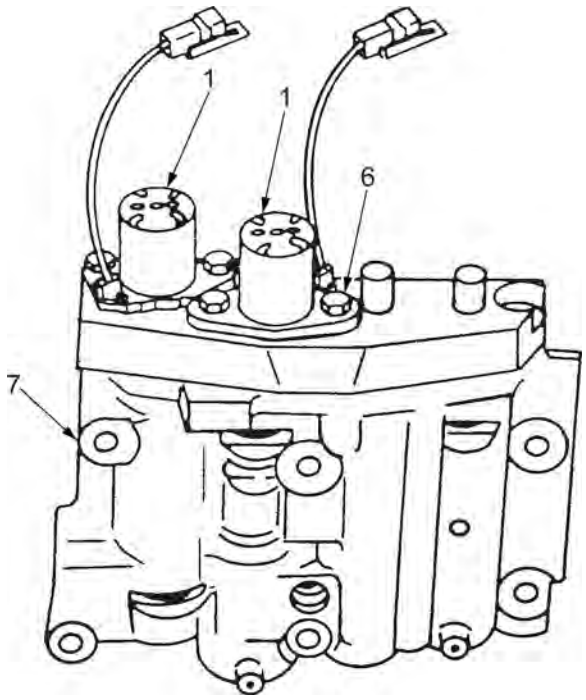


Figure 2. Solenoids on Lockup Valve Body Assembly.

END OF TASK

REMOVE TERMINAL FROM INSULATOR

1. Insert two small screwdrivers between insulator (Figure 3, Item 8) and terminal (Figure 3, Item 9).
2. Press down on screwdrivers to release insulator (Figure 3, Item 8) from terminal (Figure 3, Item 9). Pull terminal (Figure 3, Item 9) from insulator (Figure 3, Item 8).

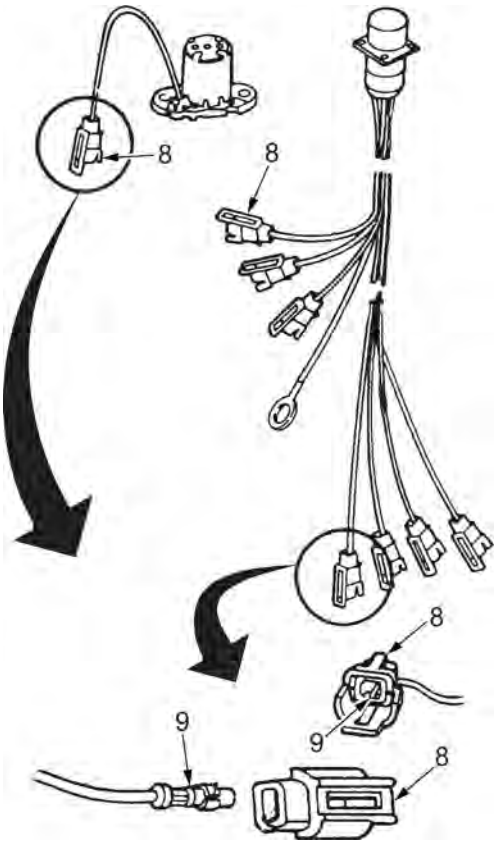


Figure 3. Terminal Removed from Insulator.

END OF TASK

REMOVE TERMINAL

1. Cut quick disconnect terminal (Figure 4, Item 9) or straight ring (ground) terminal (Figure 4, Item 10) off lead (Figure 4, Item 8) as close to terminal (Figure 4, Item 9) and (Figure 4, Item 11) as possible.

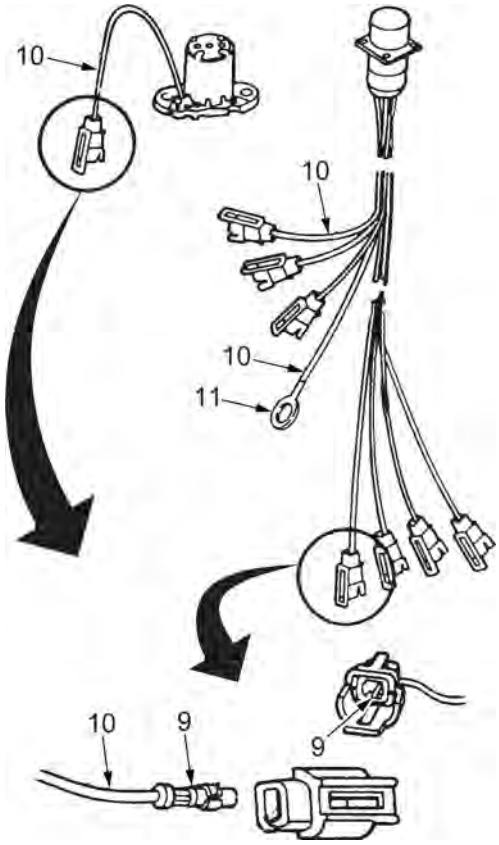


Figure 4. Cut Terminal Off Lead.

2. Strip 1/4 in. (6 mm) of insulation from end of lead (Figure 5, Item 10).
3. Put new terminal (Figure 5, Item 8) and (Figure 5, Item 11) on stripped end of lead (Figure 5, Item 10) and (Figure 6, Item 10). Bend tabs (Figure 6, Item 14) of terminal (Figure 5, Item 8) and (Figure 5, Item 11) around insulation and bend tabs (Figure 6, Item 15) around wire of lead (Figure 6, Item 10). Bend tangs (Figure 6, Item 16) slightly away from terminal (Figure 5, Item 9).

END OF TASK

INSTALL TERMINAL

1. Line up slot (Figure 5, Item 12) on terminal (Figure 5, Item 8) with key (Figure 5, Item 13) in new insulator (Figure 5, Item 8). Push insulator (Figure 5, Item 8) onto terminal (Figure 5, Item 9) until tangs lock into place.

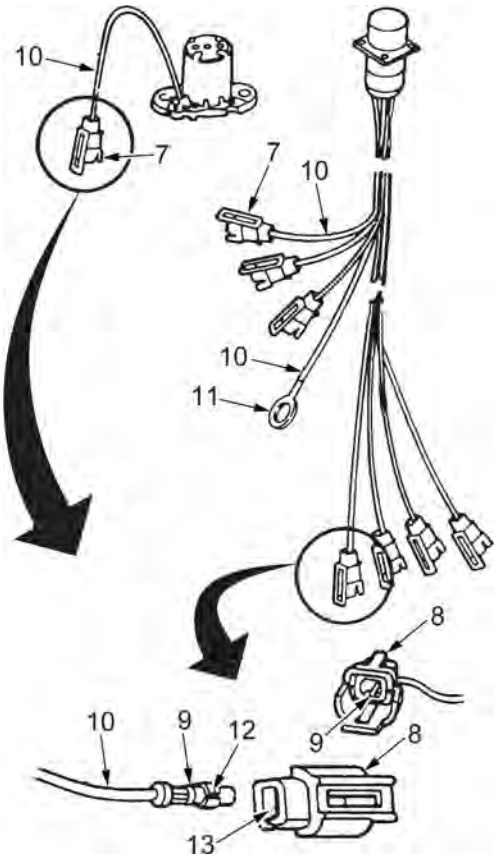


Figure 5. Terminal and Insulator.

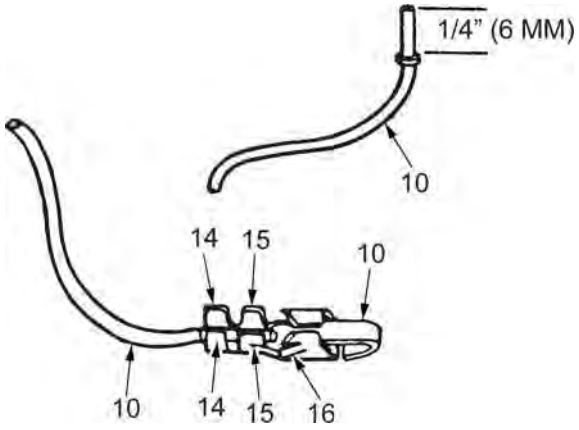


Figure 6. Install New Terminal on Lead.

END OF TASK

INSTALL SOLENOIDS

1. For any solenoids (Figure 7, Item 1) being replaced, be sure there is a preformed packing (Figure 7, Item 14) in place on the underside of each new solenoid (Figure 7, Item 1).
2. Install new solenoids (Figure 7, Item 1) in positions shown on main control valve body assembly (Figure 7, Item 5) and on lockup valve body assembly (Figure 7, Item 7).
3. For solenoid A (Figure 7, Item 2), install spring retainer (Figure 7, Item 4) in position shown to cover exhaust port.
4. Install two bolts (Figure 7, Item 6) into each of four solenoids (Figure 7, Item 1) on main valve body assembly (Figure 7, Item 5), or install one bolt (Figure 7, Item 3) and one bolt (Figure 7, Item 4) into solenoid A (Figure 7, Item 2) on the main valve body assembly (Figure 7, Item 5).
5. Install two bolts (Figure 7, Item 6) into each of two solenoids (Figure 7, Item 1) on lockup valve body assembly (Figure 7, Item 7).
6. Torque all replaced bolts (Figure 7, Item 3) and (Figure 7, Item 4) to 108 to 132 lb-in. (12 to 15 N·m).

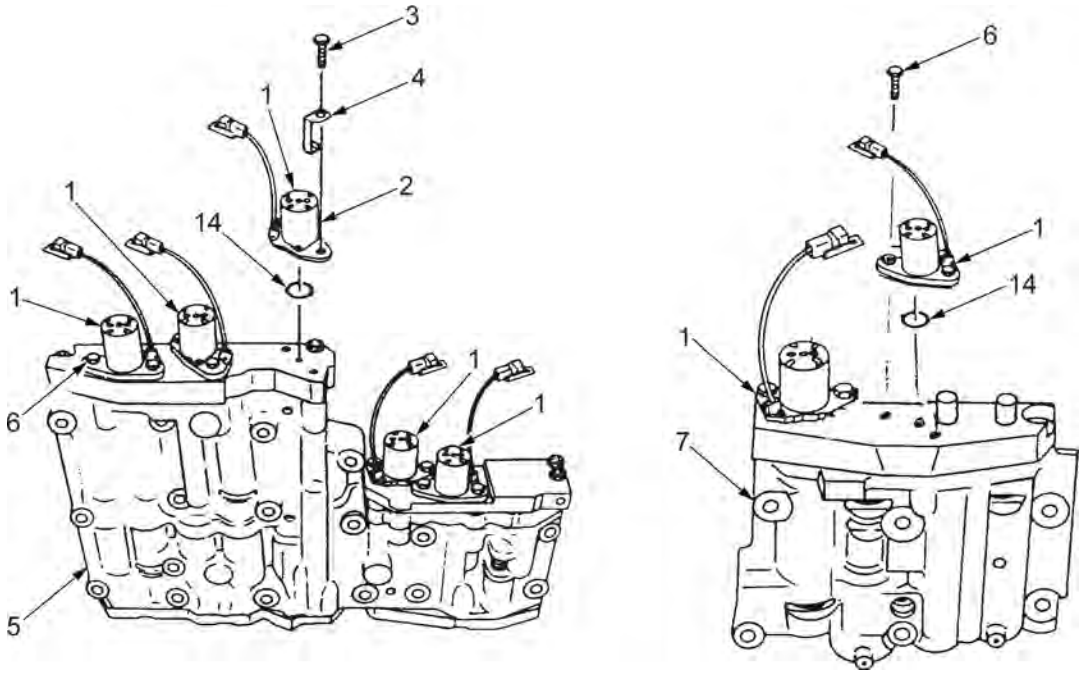


Figure 7. Solenoids Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE PACKING ASSEMBLY

INITIAL SETUP:

Tools and Special Tools
Socket, Socket Wrench, 3/8” Drive, 6-Point, Regular, 1/2” (WP 0079, Item 37)
Tool Kit, General Mechanic’s (GMTK) (WP 0079, Item 45)
Wrench, Torque, Dial, 3/8” Drive, 300 lb-in. (WP 0079, Item 50)

Materials/Parts
Seal, Plain Encased (WP 0080, Item 7)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Main control valve body assembly is removed (WP 0008)
Lockup valve body assembly is removed (WP 0010)

REPLACE PACKING ASSEMBLY

NOTE

Shipping plug may or may not be installed, dependent upon origin of transmission. This opening is used for the throttle modulator, a vehicle part which is installed when the vehicle power pack is installed.

1. Remove bolt (Figure 1, Item 3) and bracket (Figure 1, Item 4). If present, remove metal shipping plug (Figure 1, Item 2).
2. Drive packing assembly (seal) (Figure 1, Item 1) from inside of top cover. Discard packing assembly (seal) (Figure 1, Item 1).
3. Using a 1/2 inch drive, 13/16 inch socket as a driver, drive against the identif cation numbers on new seal (Figure 1, Item 1).
4. Install new seal (Figure 1, Item 1) to a f rm seat against the shoulder in the bore.
5. Install shipping plug if present.
6. Install bolt (Figure 1, Item 3) and bracket (Figure 1, Item 4) over shipping plug (Figure 1, Item 2), if shipping plug is present.
7. Torque bolt (Figure 1, Item 3) to 156 to 180 lb-in. (18 to 20 N·m).

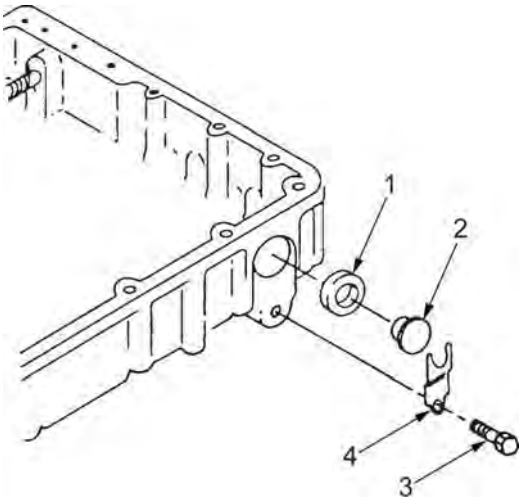


Figure 1. Packing Assembly (Seal).

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE PUSH ROD COMPONENTS

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Seal, Plain Encased (WP 0080, Item 41)

Personnel Required
Track Vehicle Repairer, 91H10 (2)

Equipment Condition
Main control valve body assembly removed (WP 0008)
Lockup valve body assembly removed (WP 0010)

REMOVE PUSH ROD COMPONENTS

WARNING

Spring-loaded parts can f y and injure you. Push rod components are spring loaded and must be restrained when spring pins are removed and installed.

CAUTION

When removing spring pins, be careful not to cut spring pins.

1. Tap two pins (Figure 1, Item 2) f ush with push rod (Figure 1, Item 3).
2. Remove two pins (Figure 1, Item 2).
3. Pull linear actuator cap (Figure 1, Item 1) from headless straight pin (push rod) (Figure 1, Item 3).
4. Push from inside of top cover to remove push rod (Figure 1, Item 3) and extension (Figure 1, Item 5) through cover.
5. Remove extension (Figure 1, Item 5) from push rod (Figure 1, Item 3).
6. Remove spring (Figure 1, Item 4).

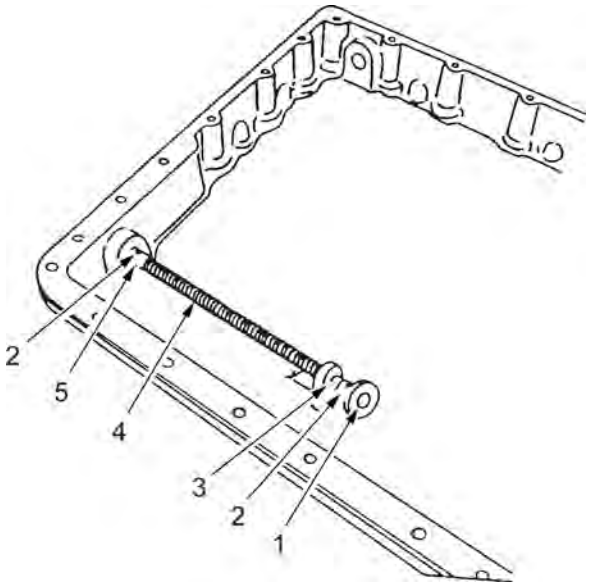


Figure 1. Push Rod Components Removal.

7. Pry plain encased seal (Figure 2, Item 6) from inside of cover. Discard seal (Figure 2, Item 6).

END OF TASK

INSTALL PUSH ROD COMPONENTS

1. Using a 1/2 inch drive, 13/16 inch socket as a driver, drive against the identification numbers on new plain encased seal (Figure 2, Item 6).
2. Install new plain encased seal (Figure 2, Item 6) to a firm seat against the shoulder in the bore.

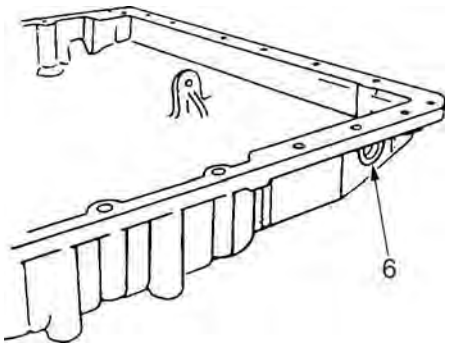


Figure 2. Seal.

3. Insert rod (Figure 3, Item 3) through bracket (Figure 3, Item 7).
4. Install extension (Figure 3, Item 5), beveled end first, into bore.
5. Tap extension into seal (Figure 3, Item 6) so that pin hole is about 3/8 inch from inside of cover.
6. (Soldier 1) Hold the extension firmly in place by hand. Be sure to keep holding extension until pin (Figure 4, Item 2) is installed.

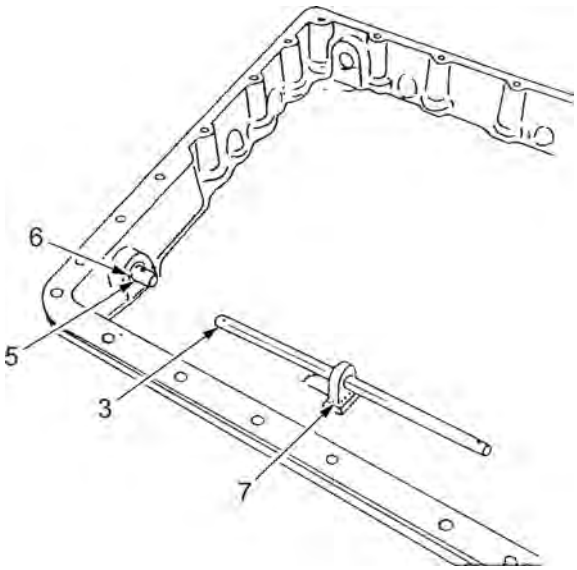


Figure 3. Push Rod Installation.

WARNING

Spring-loaded parts can f y and injure you. Push rod components are spring loaded and must be restrained when spring pins are removed and installed.

7. (Soldier 2) Install spring (Figure 4, Item 4) onto rod (Figure 4, Item 3) inside cover.
8. Install rod (Figure 4, Item 3) into extension (Figure 4, Item 5) and install pin (Figure 4, Item 2).
9. Tap pin (Figure 4, Item 2) until it is of equal height on both sides of extension (Figure 4, Item 5).

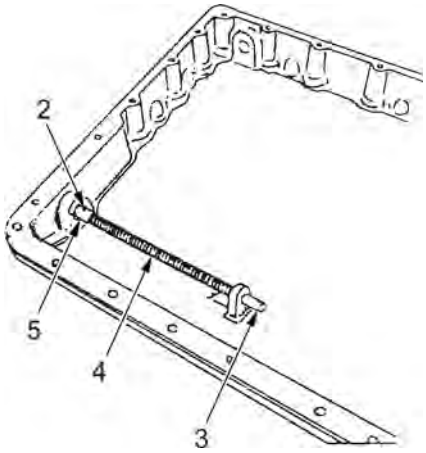


Figure 4. Spring Installation.

10. Place cap (Figure 5, Item 1) onto rod (Figure 5, Item 3).
11. Install other pin (Figure 5, Item 2) to hold cap (Figure 5, Item 1) on rod (Figure 5, Item 3).
12. Tap pin (Figure 5, Item 2) until it is of equal height on both sides of rod (Figure 5, Item 3).

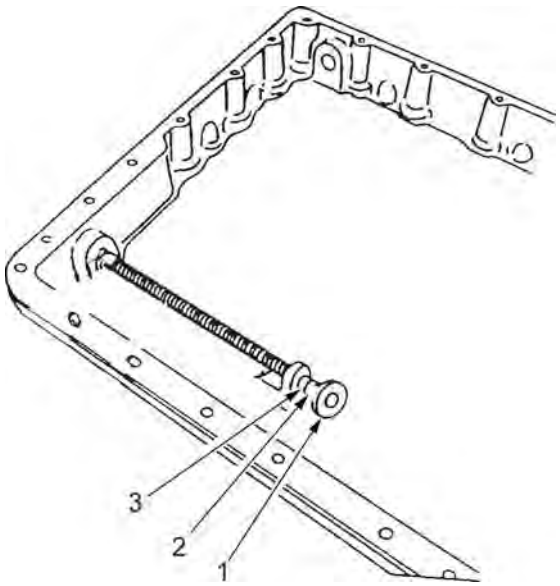


Figure 5. Actuator Cap Installation.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

REPLACE OIL TRANSFER PLATE PLUGS

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)
Wrench, Torque, Dial, 3/8" Drive, 300 lb-in. (WP 0079, Item 50)

Personnel Required
Track Vehicle Repairer, 91H10

Equipment Condition
Main control valve body assembly removed (WP 0008)
Lockup valve body assembly removed (WP 0010)
Oil transfer plate removed (WP 0015)

REPLACE OIL TRANSFER PLATE PLUGS

NOTE

Do not remove plugs unless replacement is necessary.

1. Remove any of four plugs (Figure 1, Item 1).
2. Install any of four new plugs (Figure 1, Item 1).
3. Torque any replaced plugs (Figure 1, Item 1) to 50 to 60 lb-in. (6 to 7 N·m).

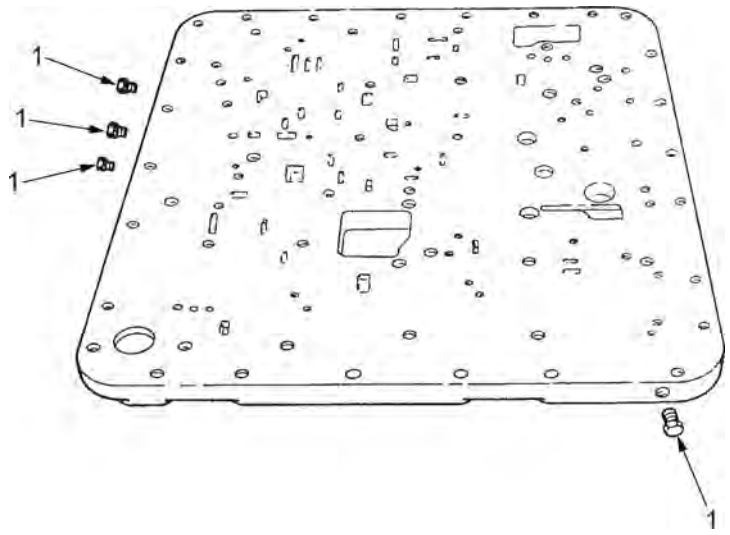


Figure 1. Oil Transfer Plate Plugs Replacement.

END OF TASK

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

ILLUSTRATED LIST OF MANUFACTURED ITEMS
INTRODUCTION

INTRODUCTION

Scope

This work package includes complete instructions for making items authorized to be manufactured or fabricated at the sustainment maintenance level.

How to Use the Index of Manufactured Items

A part number index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the information which covers fabrication criteria.

Explanation of the Illustrations of Manufactured Items

All instructions needed by maintenance personnel to manufacture the item are included on the illustrations. Refer to parts information in TM 9-2520-272-40P. All bulk materials needed for manufacture of an item are listed by part number or specif cation number in a tabular list on the illustration.

Table 1. Illustrated List of Manufactured Items Index

Drawing/Part No.	Nomenclature	Figure No.
Item 1	Retaining Fixture	Figure 1, Retaining Fixture Manufacturing Dimensions.
Item 2	Guide Pin	Figure 2, Guide Pin.
Item 3	Guide Pin	Figure 3, Guide Pin.
Item 4	Guide Pin	Figure 4, Guide Pin.
Item 5	Shim	Figure 5, Shim
Item 6	Insert Installer, Remover	Figure 6, Insert Installer, Remover Manufacturing.

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

ILLUSTRATED LIST OF MANUFACTURED ITEMS

INITIAL SETUP:

Tools and Special Tools
Tool Kit, General Mechanic's (GMTK) (WP 0079, Item 45)

Materials/Parts
Bolt, 3/8-16 x 4 in.
Bolt, 5/16-18 x 3 in.
Bolt, 5/16-24 x 3 in.
Steel Bar Stock, 1/4 x 1 in.
Steel Plate, 3/8 in.

Item 1. Retaining Fixture

Use the retaining fixture to remove the left cover assembly.

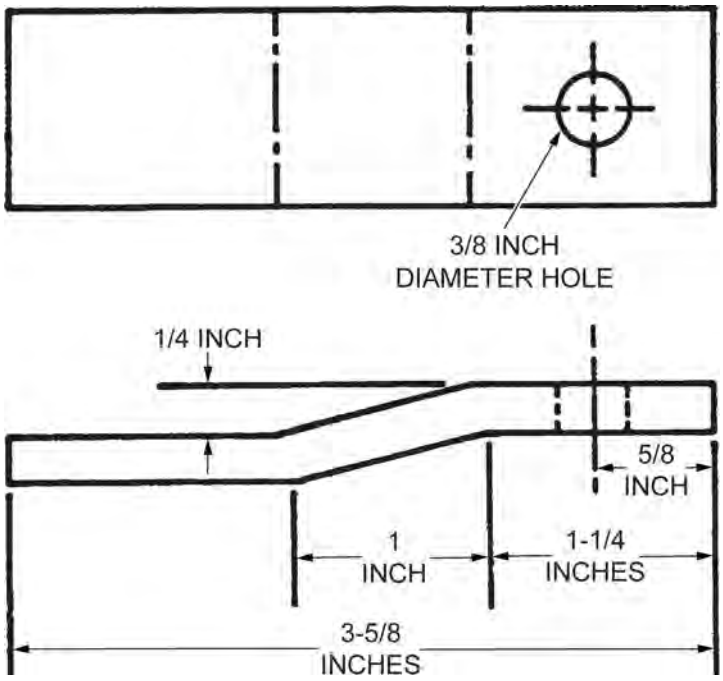


Figure 1. Retaining Fixture Manufacturing Dimensions.

1. Make the retaining fixture from 1/4 x 1 in. steel bar stock.
2. Use a metal file or metal grinder to grind off burrs and sharp corners.

Material: Steel

Item 2. Guide Pin

Use the guide pin to install the converter element components.

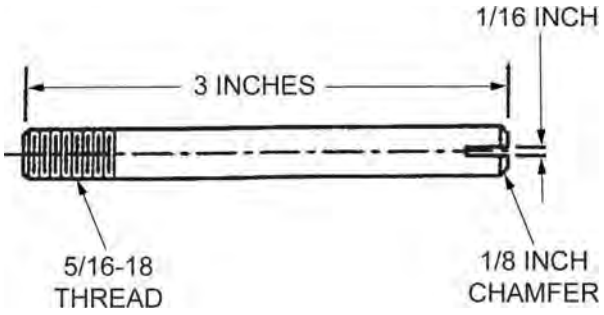


Figure 2. Guide Pin.

1. Make the guide pin by cutting the head off a 5/16-18 x 3 in. bolt.
2. Cut a 1/16 in. slot for screwdriver.
3. Use a metal file or metal grinder to grind off all burrs.

Material: Steel

Item 3. Guide Pin.

Use the guide pin to install the left cover assembly.

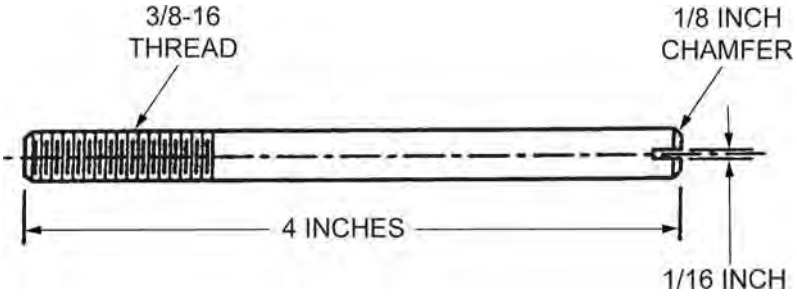


Figure 3. Guide Pin.

1. Make the guide pin by cutting the head off a 3/8-16 x 4 in. bolt.
2. Cut a 1/16 in. slot for screwdriver.
3. Use a metal file or metal grinder to grind off all burrs.

Material: Steel

Item 4. Guide Pin

Use the guide pin to install the transmission top components.

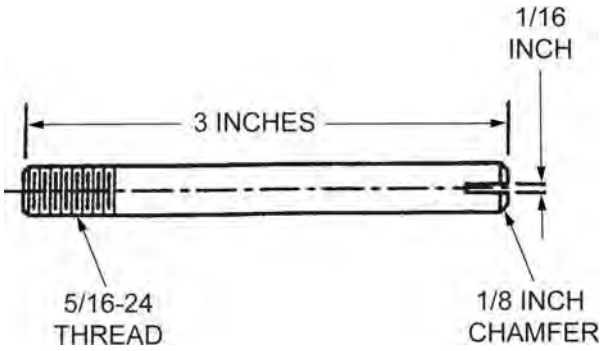


Figure 4. Guide Pin.

1. Make the guide pin by cutting the head off a 5/16-24 x 3 inch bolt.
2. Cut a 1/16 in. slot for screwdriver.
3. Use a metal file or metal grinder to grind off all burrs.

Material: Steel

Item 5. Shim.

Use the shim to repair the center housing, install the 1st clutch piston.

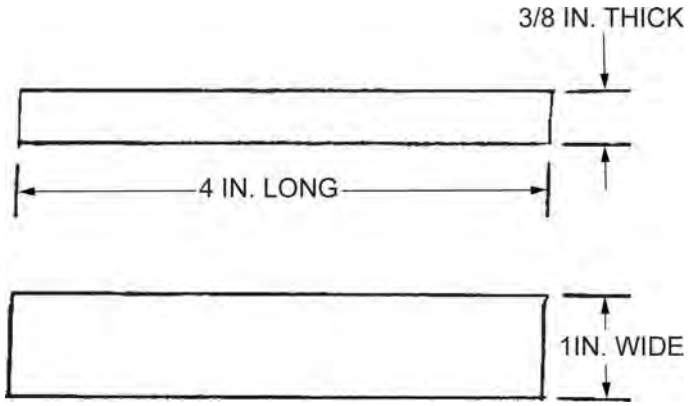


Figure 5. Shim

1. Make the shim from a 3/8 in. steel plate.

Material: Steel

Item 6. Insert Installer, Remover

Use the insert installer, remover to repair the center housing components.

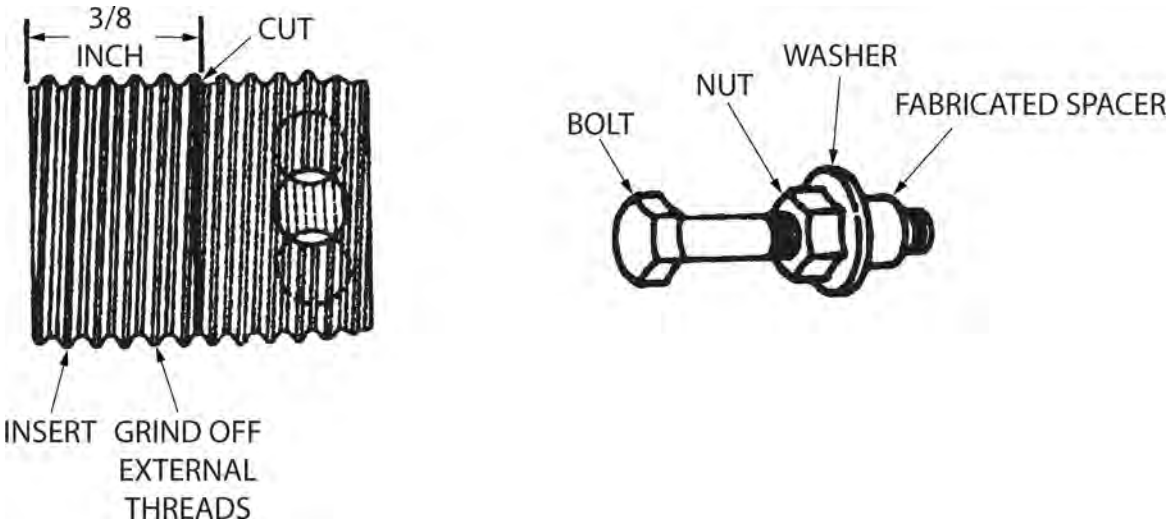


Figure 6. Insert Installer, Remover Manufacturing.

1. Make the spacer from the same part number insert as the one to be removed.
   a. Cut a 3/8 in. (10 mm) long section from the undrilled end of the insert.
   b. Screw the cut-off section onto a bolt and grind off the external threads of insert.

Material: Steel

Table 1. Material List for Insert Installer, Remover.

P/N	Insert	Bolt	Nut	Washer
452692	3/8-16 thread	5305-01-387-0114	5310-00-680-7270	5310-01-389-7014
23018271	1/2-13 thread	5305-00-071-2079	5310-00-808-8019	5310-00-614-3506
23049118	5/16-18 thread	5306-01-210-0767	5310-01-064-3422	5310-00-880-5977
23049119	3/8-16 thread	5305-01-387-0114	5310-00-680-7270	5310-01-389-7014

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

TORQUE LIMITS

SCOPE

The purpose of this work package is to provide a reference of standard torque specif cations used in maintenance and repair of the X200-4A Transmission and its metal storage and shipping container.

HOW TO USE TORQUE TABLES

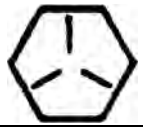
NOTE

Manufacturer's marks may vary. Grades and manufacturer's marks appear on the screw/bolt head.

1. Identify the grade of bolt by looking at the markings on the top of the bolt head.
2. Measure the diameter of the screw/bolt you are installing.
3. Count the number of threads per inch or use a pitch gage.
4. Find the diameter of the screw/bolt you are installing under the heading SIZE.
5. Find the number of threads per inch that matches the number of threads that you counted in Step 3 under the heading THREADS.
6. Find the torque value for the screw/bolt that you are installing under the heading TORQUE.
7. Refer to Table 3 for nuts installed on bolts.

STANDARD TORQUE SPECIFICATIONS

Table 1. Torque Values in Pound Feet/Newton Meters Standard Heat-Treated (Grade 5) Screws and Bolts.



Size	Threads	Torque
1/4	20	9-11 (12-15)
	28	10-12 (14-16)
5/16	18	13-16 (18-22)
	24	14-18 (19-24)
3/8	16	26-32 (35-43)
	24	33-40 (45-54)
7/16	14	42-50 (57-68)
	20	50-60 (68-81)
1/2	13	67-80 (91-108)
	20	83-100 (112-136)
5/8	11	117-140 (159-190)
	18	134-182 (182-217)
3/4	16	215-250 (291-339)

Table 2. Torque Values in Pound Feet/Newton Meters
Special Heat-Treated (Grade 8) Self-Locking Screws, Bolts, and Allen Head Screws.

Size	Threads	Torque
1/4	20	9-11 (12-15)
	28	10-12 (14-16)
5/16	18	17-20 (23-27)
	24	19-23 (26-31)
3/8	16	36-43 (49-58)
	24	41-49 (56-66)
7/16	14	54-65 (73-88)
	20	64-77 (87-105)
1/2	13	81-97 (110-131)
	20	96-115 (130-156)
5/8	11	164-192 (222-260)
	18	193-225 (262-305)
3/4	16	337-385 (457-522)

Table 3. Torque Values in Pound Feet/Newton Meters
Nuts on Bolts.

Size	Threads	Torque
5/16	24	14-18 (19-24)
5/8	18	134-160 (182-217)
3/4	16	215-250 (291-339)

END OF WORK PACKAGE

CHAPTER 4

SUPPORTING INFORMATION

FOR

CROSS-DRIVE TRANSMISSION WITH CONTAINER, MODEL X200-4A

SUSTAINMENT MAINTENANCE

REFERENCES

Scope

This work package lists all f eld manuals, forms, technical manuals, and miscellaneous publications referenced in this manual.

COMMON TABLES OF ALLOWANCE

CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 50-909	Field Garrison Furnishings and Equipment
CTA 50-970	Expendable/Durable Items (Except: Medical Class V, Repair Parts, and Heraldic Items)

FIELD MANUALS

FM 4-25.11	First Aid
FM 38-700	Packaging of Material - Preservation
FM 38-701	Packaging of Material - Packing

FORMS

DA Form 2028	Department of the Army Recommended Changes to Publications and Blank Forms
SF 368	Product Quality Def ciency Report (PQDR)

LUBRICATION ORDERS

LO 9-2350-277-13	Lubrication Order

PAMPHLETS

DA PAM 738-750	Functional User's Manual for The Army Maintenance Management System (TAMMS)
DA PAM 750-8	The Army Maintenance Management System (TAMMS) Users Manual

TECHNICAL BULLETINS

TB 9-289	Reconditioning of Type I and Type II Reusable Metal Containers
TB 43-0211	Oil Analysis Program User's Guide

TECHNICAL MANUALS

TM 750-244-6	Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use
TM 9-214	Inspection, Care, and Maintenance of Antifriction Bearings
TM 9-243	Use and Care of Hand Tools and Measuring Tools
TM 9-2350-247- Series	(M548A3) Carrier, Cargo, Full Tracked
TM 9-2350-277- Series	(M58) Carrier, Personnel, Full Tracked
TM 9-2350-277- Series	(M113A3) Carrier, Personnel, Full Tracked
TM 9-2350-277- Series	(M577A3) Carrier, Command Post, Light Tracked
TM 9-2350-277- Series	(M1064A3) Carrier, Mortar, 120 MM, Self-Propelled
TM 9-2350-277- Series	(M1068A3) Carrier, Standardized Integrated Command Post System
TM 9-2350-366- Series	(BMP-2 OSV) Carrier, Personnel, Full Tracked
TM 9-2520-272-40P	Sustainment Maintenance Repair Parts and Special Tools List (RPSTL) for Cross-Drive Transmission with Container, Model X200-4A

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

EXPENDABLE AND DURABLE ITEMS LIST

INTRODUCTION

Scope

This work package lists expendable and durable items that you will need to operate and maintain the Cross Drive Transmission, Model X200-4A. This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment, or CTA 8-100, Army Medical Department Expendable/Durable Items.

Explanation of Columns in the Expendable/Durable Items List

Column (1) – Item No. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., Use brake fluid (WP 0098, Item 5)).

Column (2) – Level. This column identifies the lowest level of maintenance that requires the listed item (include as applicable: C = Crew, O = AMC, F = Maintainer or ASB, H = BelowDepot or TASMG, D = Depot).

Column (3) – National Stock Number (NSN). This is the NSN assigned to the item which you can use to requisition it.

Column (4) – Item Name, Description, Part Number/(CAGEC). This column provides the other information you need to identify the item. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (5) – U/I. Unit of Issue (U/I) code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Table 1. EXPENDABLE AND DURABLE ITEMS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/I
1	H	8040-00-118-2695	Adhesive, Sealant, Silicone, RTV, Non-Corrosive, Type 1, 1/2 oz Primer and 2.8 oz Adhesive in a 3 oz Tube. (81349) MIL-A-46146	KT
2	F	7510-00-205-1438	Bands, Rubber No. 19 (58536) A-A-131	BX
3	F	5510-00-220-6194	Block, Wood, Lumber, Soft Wood 2x4 in x 8 ft (81348) MML751	BF
	F	5510-00-274-5300	2x4 in x 14 ft	
4	H	6830-00-247-0619	Carbon Dioxide, Technical (Dry Ice) (81343) G-6.2	LB
5	C	7930-01-328-2030	Cleaning Compound, Solvent, Detergent (66724) PF05	
6	F	5350-00-221-0872	Cloth, Abrasive, Crocus (80204) ANSI B74.18	PK
7	C	8305-01-152-3587	Cloth, Batiste, Lint-Free, White (58536) A-A-50185	YD
8	C	8415-00-268-7859	Gloves, Leather (58536) A-A-50022	PR
9	F	9150-00-944-8953	Grease, High-Temperature (83149) MIL-PRF-81322	CN
10	C	9150-01-421-1427	Lubricating Oil, Engine, Grade 15W-40 (81349) MIL-PRF-2104	GL
11	F	7520-00-973-1059	Marker, Tube Type, Black (95070) MARKSALOTBLACK	DZ
12	F	9150-00-250-0926	Petrolatum, Technical (Petroleum Jelly) (81348) VV-P-236	CN
13	F	7920-00-205-1711	Rag, Wiping, 50 lb Bale (80244) 7920-00-205-1711	BE
14	F	8030-00-849-0071	Sealing Compound, Gasket (81349) MIL-S-45180	TB
15	F	8030-00-111-2762	Sealant, Lubricating, Thread-Locking (81349) ASTM D5363	BT
16	F	9515-01-380-9063	Shim Stock, 1/32 in. Thick (81348) SAE AMS-DTL-22499	SH
17	F	6810-00-141-6078	Sodium Phosphate, Tribasic Anhydrous (81348) O-S-642	LB
18	C	6850-01-277-0595	Solvent, Cleaning (59557) 134-HI-SOLV	GL
19	F	7510-00-473-9513	Tape, Masking (81349) SAE AMS-T-23397	RL
20	F	4020-00-291-5901	Twine, Cotton, 16-Ply (58536) A-A-1451	LB

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

TOOL IDENTIFICATION LIST

INTRODUCTION

Scope

This work package lists all common tools and supplements and special tools/f xtures needed to maintain the Cross-Drive Transmission, Model X200-4A.

Explanation of Columns in the Tool Identif cation List

Column (1) – Item No. This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., Extractor (WP 0090, Item 32)).

Column (2) – Item Name. This column lists the item by noun nomenclature and other descriptive features (e.g., Gage, belt tension).

Column (3) – National Stock Number (NSN). This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.

Column (4) – Part Number/(CAGEC). Indicates the primary number used by the manufacturer (individual, company, f rm, corporation, or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specif cations, standards, and inspection requirements to identify an item or range of items. The manufacturer's Commercial and Government Entity Code (CAGEC) is also included.

Column (5) – Reference. This column identif es the authorizing supply catalog or RPSTL for items listed in this work package.

TOOL IDENTIFICATION LIST

Table 1. Tool Identif cation List

(1) Item No.	(2) Item Name	(3) National Stock Number(NSN)	(4) Part Number/ (CAGEC)	(5) Reference
1	ADAPTER, Socket Wrench, 1/2" to 3/8" Square Drive	—	KTC S0658 (00NS2)	CL 4910-95-A81
2	ADAPTER, Socket Wrench Drive, 3/8" Male x 1/2" Female	—	KTC S0659 (00NS2)	CL 4910-95-A81
3	ADAPTER KIT, Container (Adapter Plate)	5342-01-242-6798	11650180 (19207)	TM 9-2520-272-40P
4	BAR and STUD ASSEMBLY	5120-01-048-2158	J24204-2 (33287)	TM 9-2520-272-40P
5	BAR, Pry, Wrecking, 30"	—	KTC S0129 (00NS2)	CL 4910-95-A81
6	CAPS, Vise Jaw	—	KTC S0153 (00NS2)	CL 4910-95-A81
7	CHISEL, Cold, 3/8", Flat	—	KTC S6386 (00NS2)	CL 4910-95-A81
8	COMPRESSOR, Clutch Spring	5120-01-054-7221	J24452 (33287)	TM 9-2520-272-40P
9	COMPRESSOR, Clutch Spring	5120-01-176-3890	J23616 (33287)	TM 9-2520-272-40P
10	CROWFOOT, Open-End, 1/2" Drive, 1-7/8"	—	SCO60 (55719)	CL 4940-95-B36

(1) Item No.	(2) Item Name	(3) National Stock Number(NSN)	(4) Part Number/ (CAGEC)	(5) Reference
11	CROWFOOT ATTACHMENT, Flare Nut, 3/8” Drive, 9/16”	—	KTC S0165 (00NS2)	CL 4910-95-A81
12	DIE and TAP SET, Rethreading	—	KTC S0185 (00NS2)	CL 4910-95-A81
13	DRILL, Electric, Portable, 3/8” Chuck	—	KTC S0191 (00NS2)	CL 4910-95-A81
14	DRILL BIT, Twist, 1/4”	—	KTC S6245 (00NS2)	CL 4910-95-A81
15	DRILL BIT, Twist, 3/8” Shank, 3/4” Drill	—	DW1625 (1U3E8)	TM 9-2520-272-40P
16	EXTENSION, 3/8” Drive, 6”	—	KTC S0496 (00NS2)	CL 4910-95-A81
17	FIXTURE ASSEMBLY, Leak Test	2520-01-242-6797	11650178 (19207)	TM 9-2520-272-40P
18	GAGE, Vernier Caliper, 0-6”	—	KTC S0999 (00NS2)	CL 4910-95-A81
19	HAMMER, Hand, Soft-Face, Dead Blow, 52 oz	—	KTC S0221 (00NS2)	CL 4910-95-A81
20	HEATER, Gun-Type, Electric	4940-01-028-7493	HG-501A (53284)	TM 9-2350-277-13&P
21	HOIST, Lifting, 2000 lb Capacity	3950-01-170-6276	00104 (08722)	
22	HOOK, Chain, S	4030-01-178-7310	11650102 (19207)	TM 9-2520-272-40P
23	INSERTER, Seal	5120-01-242-6796	11650176 (19207)	TM 9-2520-272-40P
24	INSERTER and REMOVER, Seal	5120-01-096-3493	12268021 (19207)	TM 9-2520-272-40P
25	INSTALLER, Lock Ring	5120-01-054-4050	J24453 (33287)	TM 9-2520-272-40P
26	LIFTER, Pump Support	5120-01-054-4056	J24473 (33287)	TM 9-2520-272-40P
27	PLIERS SET, Retaining Ring	—	KTC S0260 (00NS2)	CL 4910-95-A81
28	PRESS, Arbor, Hand, 25 Ton	3444-01-572-9227	SPM 2514 (45225)	—
29	PROTECTOR, Inner Seal	4910-01-178-6551	J21362 (25341)	TM 9-2520-272-40P
30	PULLER SET, Mechanical, Gear and Bearing, 3-Jaw	—	KTC S0269 (00NS2)	CL 4910-95-A81
31	SANDER/GRINDER, 4-1/2”	—	KTC S0275 (00NS2)	CL 4910-95-A81
32	SCREWDRIVER ATTACHMENT HEX, 3/8” Drive, 1/8” Hex Bit	—	KTC S0301 (00NS2)	CL 4910-95-A81
33	SCREWDRIVER ATTACHMENT HEX, 1/2” Drive, 9/16” Hex Bit	—	KTC S0298 (00NS2)	CL 4910-95-A81
34	SLIDE HAMMER PULLER	—	KTC S6357 (00NS2)	CL 4910-95-A81
35	SLING, Engine and Transmission	4910-01-086-1681	12268037 (19207)	TM 9-2520-272-40P

(1) Item No.	(2) Item Name	(3) National Stock Number(NSN)	(4) Part Number/ (CAGEC)	(5) Reference
36	SLING, Multiple-Leg (3 Legs)	3940-01-087-0155	12268036 (19207)	TM 9-2520-272-40P
37	SOCKET, Socket Wrench, 3/8" Drive, 6-Point, 1/2"	—	KTC S0503 (00NS2)	CL 4910-95-A81
38	SOCKET, Socket Wrench, 1/2" Drive, 1-1/2" Spline	5120-00-906-1051	8355955 (19207)	TM 9-2350-277-13&P
39	SOCKET, Socket Wrench, Universal, 3/8" Drive, 6-Point, 9/16"	—	KTC S0369 (00NS2)	CL 4910-95-A81
40	STAND, Maintenance, Automotive	4910-01-117-4344	1750A (45225)	—
41	STRIPPER-CRIMPER, Wire, Hand	—	PWC28A (55719)	CL 4940-95-B36
42	TAP, 3/8 X 16 NC Rethread	—	KTC S6052 (00NS2)	CL 4910-95-A81
43	TAP, 1/2 X 13 NC Rethread	—	KTC S6054 (00NS2)	CL 4910-95-A81
44	TAP WRENCH, Adjustable, 0-1/2"	—	KTC S6228 (00NS2)	CL 4910-95-A81
45	TOOL KIT, General Mechanic's (GMTK)	5180-01-548-7634	PD484 (19200)	CL 5180-95-B48
46	TRESTLE, Hoist, 2000 lb Capacity	—	—	—
47	VISE, Machinist's, 4" Jaw	—	KTC S0725 (00NS2)	CL 4910-95-A81
48	WRENCH, Adjustable, 18"	—	KTC S0977 (00NS2)	CL 4910-95-A81
49	WRENCH, Torque, Dial, 1/4" Drive, 30 lb-in.	—	KTC S0986 (00NS2)	CL 4910-95-A81
50	WRENCH, Torque, Dial, 3/8" Drive, 300 lb-in.	—	KTC S0987 (00NS2)	CL 4910-95-A81
51	WRENCH, Torque, Ratcheting, 1/2" Drive, 250 lb-ft	—	KTC S0991 (00NS2)	CL 4910-95-A81

END OF WORK PACKAGE

SUSTAINMENT MAINTENANCE

MANDATORY REPLACEMENT PARTS LIST

This work package includes a list of all mandatory replacement parts referenced in the work package initial setups and procedures. These are items that must be replaced during the maintenance or repair whether they have failed or not.

Table 1. MANDATORY REPLACEMENT PARTS

ITEM NO.	PART NUMBER/ CAGEC	NSN	NOMENCLATURE	QTY
1	ERNB260 (73342)	5325-00-720-8064	Ring, Retaining	6
2	MS21044N5 (80205)	5310-00-088-0553	Nut, Self-Locking, Hex	24
3	MS28778-20 (81343)	5331-00-816-3546	O-Ring	1
4	M83248/1-217 (81349)	5331-00-165-1943	O-Ring	1
5	443318 (24617)	5310-01-112-7932	Nut, Self-Locking, Hex	1
6	445675 (24617)	5315-01-215-7510	Pin, Spring	1
7	544306 (80201)	5330-01-216-5698	Seal, Plain Encased	1
8	870115 (0E9N0)	5330-00-003-0887	Seal, Lip	1
9	3909063 (73342)	5310-01-143-0542	Push-On Nut	8
10	6758036 (73342)	2520-00-679-6974	Seal Ring, Transmission	1
11	6770820 (73342)	5331-00-821-4490	O-Ring	1
12	6832550 (73342)	5330-01-218-7143	Gasket	1
13	6836113 (73342)	5330-01-218-1565	Seal Ring, Metal	2
14	6836115 (73342)	5330-01-216-6765	Seal Ring, Metal	2
15	6836127 (73342)	5325-01-215-9687	Ring Retaining (Seal Ring, Metal)	2
16	6836128 (73342)	5330-01-215-9503	Seal Ring, Metal	2
17	6836129 (73342)	5331-01-216-5704	O-Ring	2
18	6836130 (73342)	5331-01-216-5705	O-Ring	2
19	6836264 (73342)	5330-01-214-1479	Seal Ring, Metal	2
20	6883031 (73342)	5330-01-083-3065	Seal, Plain	1
21	6883033 (73342)	2520-01-079-6700	Seal, Transmission	1

ITEM NO.	PART NUMBER/ CAGEC	NSN	NOMENCLATURE	QTY
22	6836799 (73342)	5330-01-145-0697	Seal, Plain (3rd Clutch Piston Only)	1
23	9421023 (24617)	5315-01-215-7511	Pin, Spring	1
24	11649930 (19207)	5310-00-402-5220	Nut, Self-Locking, Hex	1
25	23011456 (73342)	5330-01-280-5809	Seal, Plain (2nd Clutch Piston Only)	1
26	23011475 (73342)	2520-01-185-0146	Seal, Air, Gas, Turbine	2
27	23016014 (73342)	5331-01-291-5078	O-Ring	2
28	23016564 (73342)	5330-00-631-8125	Gasket	2
29	23017880 (73342)	5330-01-216-4012	Gasket	2
30	23017882 (73342)	5330-01-216-6654	Gasket	2
31	23018072 (73342)	5330-01-216-4015	Gasket	1
32	23018073 (73342)	5330-01-217-7013	Gasket	1
33	23018076 NON-ASBESTOS (73342)	5330-01-406-7801	Gasket	1
34	23018080 (73342)	5330-01-216-7424	Seal, Brake Coolant	2
35	23018187 (73342)	5330-01-217-2201	Gasket	1
36	23018191 NON-ASBESTOS (73342)	5330-01-553-0432	Gasket	1
37	23018194 (73342)	5340-01-217-2305	Locking Plate, Nut and Bolt	4
38	23018233 (73342)	5330-01-221-9177	Seal, Nonmetallic Round Section	2
39	23018234 (73342)	5330-01-216-5711	Retainer, Packing	3
40	23018235 (73342)	5330-01-238-4613	Packing, Preformed	1
41	23018241 (73342)	5330-01-216-4005	Seal, Plain Encased	1
42	23018247 (73342)	5331-01-216-5703	O-Ring	2
43	23018753 (73342)	5331-01-219-2548	O-Ring	1
44	23040579 (73342)	5331-01-219-2546	O-Ring	2
45	23040580 (73342)	5331-01-219-2547	O-Ring	2
46	23040581 (73342)	5331-00-167-5110	O-Ring	4

ITEM NO.	PART NUMBER/ CAGEC	NSN	NOMENCLATURE	QTY
47	23040582 (73342)	5331-01-219-2545	O-Ring	2
48	23045129 (73342)	5330-01-217-4041	Gasket	1
49	23045477 (73342)	5331-01-216-2815	O-Ring	1
50	23046647 (73342)	5330-01-238-5879	Gasket (Seal)	2
51	23046648 (73342)	5331-01-237-2967	O-Ring (Seal)	2
52	23047805 (73342)	5330-01-251-1931	Gasket	1
53	23048171 (73342)	5330-01-266-3312	Retainer, Packing	2
54	23048292 (73342)	5330-01-287-5798	Packing, Preformed	1
55	23049059 (73342)	5330-01-286-5468	Retainer, Packing (Seal Ring, Hook)	2
56	29520291 (73342)	5330-01-509-4404	Seal, Plain (Inner)	2
57	29520292 (73342)	5330-01-509-0298	Seal, Plain (Outer)	2

END OF WORK PACKAGE

GLOSSARY

GLOSSARY

B	
Burr	Local rise of material forming a protruding sharp point or high spot.
C	
Chipping	Loss of material over a larger area than that of nicks.
Control Valve Body	This unit contains most of the hydraulic controlling devices such as the steering valves, range selection valve, main pressure regulator, converter pressure regulator, and lubricating pressure regulator.
Component	Any part or group of parts that, when together, form a subassembly or assembly.
Corrosion	Chemical reaction between surfaces of material and environment to which it is subjected. Generally appears as rust on steel or as a light- colored, powdery coating on aluminum or magnesium. Advanced forms of corrosion will result in pitting.
Crack	Surface or material break caused by stress which results in partial or complete separation of material.
D	
Defect	Any nonconformance of a characteristic with specif ed requirements.
Diagnostic	Pertaining to the act of examining, observing, and analyzing systems to determine the condition of that being inspected.
Distortion	Loss of original shape, either local or over an area. Includes bends, twists, warps, bulges, dents, kinks, f attening, or crushing.
DMWR	Depot Maintenance Work Requirement.
E	
End Cover	Right and Left Assemblies. Each unit contains an output planetary, a brake, a steering pinion, gears, and an output f ange or coupling.
Excessive Wear	Obvious wear beyond expectations. Determined by inspector's experience. Term is applicable to parts visually inspected.
F	
Fit	The term "f t" as used in this manual refers to the mating of associated parts and/or components. a. A loose f t is the condition where suff cient tolerance is provided between the associated parts to allow free movement. b. A tight, interference, or press f t is when one part with a given outer diameter is pressed into a part with an equal or smaller inner diameter to prevent associated parts from moving in relation to each other. c. A shrink f t is provided when one part with a given outer diameter is chilled and the other part with a given outer diameter is heated to permit mating. A shrink f t is accomplished when the associated parts return to normal, ambient temperature.
Front Housing	This unit consists of a large aluminum casting containing the main input oil pump, output oil pump, and oil f lter. It is assembled with the rear housing as a matched set and is identif ed by serial number near the top split line.
G	
Gall	A scratch or groove caused by rubbing.
Gouge	A groove in or breakdown of metal surfaces from foreign contact under heavy pressure. Usually, loss of material rather than displacement.
Groove	A long, narrow channel or depression.
I	
Inspection	The examination and testing of supplies and services to determine whether they conform to specif ed requirements.
L	
Leakage	Evidence of a f uid beyond its container.

GLOSSARY – (Continued)

M	
Malfunction	Failure to function properly as designed.
Measuring and Test Equipment	All devices used to measure, gage, test, inspect, diagnose, or otherwise examine materials, supplies, and equipment to determine compliance with technical requirements.
N	
Newton	Metric term for force.
Newton-Meter	Metric term for torque.
Nick	A small groove or notch. Usually, displacement of material rather than loss.
O	
Overhaul	That maintenance effort/service/action necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards in appropriate technical publications.
Overheating	A condition indicated by discoloration of parts which usually results in a loss of hardness. Usually caused by lack of lubrication, malfunction of parts, or excessive wear.
P	
Physical	Method of inspecting parts requiring action.
Pitting	A material surface cavity, usually with def ned rough edges. Usually caused by rust and corrosion.
Pound-Foot	Unit of energy equal to the amount of energy required to raise a weight of one pound to a height of one foot.
Pound-Inch	Unit of energy equal to the amount of energy required to raise a weight of one pound to a height of one inch.
Q	
Quality	The composite of all attributes or characteristics, including the performance, of an item or product.
Quality Assurance	A planned and systematic pattern of all actions necessary to provide adequate conf dence that the item or product conforms to established technical requirements.
R	
Range Pack	The area of the transmission consisting of the planetary gearing and clutches. It basically consists of the parts and assemblies which function individually or collectively to vary speed and power output or to change forward-reverse direction.
Rear Housing	This unit consists of a large aluminum casting containing the low range servo, reverse range servo, band adjusting screws, and the band apply arms and linkages. It is assembled with the front housing as a matched set and is identif ed by serial number near the top split line.
Repair	A process of f xing something that is damaged, worn, or does not operate or function properly.
Rub	Evidence of friction caused by contact of two items.
S	
Scoring	Deep tears or brakes in material surfaces from foreign contact under pressure. May show temperature effect from high friction.
Scratch	A slight tear or break in material surface from momentary foreign contact.
Specif cation	A document intended primarily for use in procurement, which clearly and accurately describes the essentials and technical requirements for items, materials, or services, including the procedures by which it will be determined that the requirements have been met. They may also contain preservation, packaging, and marking requirements.
Spline	A keyway between two mating parts. Usually used with multiple keyways.
Surface Abrasions	A surface condition where surface material is displaced or removed.

GLOSSARY – (Continued)

T	
Testing	An element of inspection; generally denotes the determination by technical means of the properties or elements of supplies, or components thereof, including functional operation, and involves the established scientif c principles and procedures.
Tolerance	Permissible deviation or variation from exact dimensions or standards.
Torque	A force or combination of forces that produces or tends to produce a twisting or rotating motion. The amount of force applies to fasteners as prescribed by tightening instructions.
Torque Converter	The torque converter (also called converter) consists mainly of a turbine, a pump, and a stator. The converter transmits power from the engine to the transmission gearing. The torque converter serves as both a torque multiplier and a f uid coupling.
U	
Unserviceable	Parts, components, assemblies, etc., that are worn, damaged, mutilated, etc., to the extent that they cannot be used for their intended purposes.
V	
Visual	Method of inspecting parts using unaided human eye.
W	
Wear	A loss of material from contacting surfaces. Normal wear is the slow loss of material from contacting surfaces. Wear has a polished f nish and leaves a pronounced pattern.
±	Plus or minus.
°	Degree.
%	Percent.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA.	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE *Date you filled out this form.*
TO *(Forward to proponent of publication or form) (Include ZIP Code)* U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000	**FROM** *(Activity and location) (Include ZIP Code)* *Your mailing address*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM Number	*Date of the TM*	*Title of the TM*

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)
	0007-3					*Figure 2, Item 9 should show a lockwasher. Currently shows a flat washer.*
	0018-2					*Cleaning and inspection, Step 6, reference to governor support pin (14) is wrong reference. Reference should be change to (12).*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your Name	*Your Phone Number*	*Your Signature*

TO *(Forward direct to addressee listed in publication)*	**FROM** *(Activity and location) (Include ZIP Code)*	**DATE**
U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000	*Your Address*	*Date you filled out this form*

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM Number	*Date of the TM*	*Title of the TM*

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remarks, or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your Name	*Your Phone Number*	*Your Signature*

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	**DATE**
TO *(Forward to proponent of publication or form) (Include ZIP Code)* U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000	**FROM** *(Activity and location) (Include ZIP Code)*	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-2520-272-40	13 February 2012	Sustainment Maintenance Manual for Cross Drive Transmission w/Container Transmission Model X200-4A

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO *(Forward direct to addressee listed in publication)*	**FROM** *(Activity and location) (Include ZIP Code)*	**DATE**
U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000		

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-2520-272-40	13 February 2012	Sustainment Maintenance Manual for Cross Drive Transmission w/Container Transmission Model X200-4A

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remarks, or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 25-30; the proponent agency is OAASA

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE

TO *(Forward to proponent of publication or form) (Include ZIP Code)*

U.S. Army TACOM Life Cycle Management Command
ATTN: AMSTA-LCL-MPP/TECH PUBS
6501 E. 11 Mile Road, Warren, MI 48397-5000

FROM *(Activity and location) (Include ZIP Code)*

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-2520-272-40	13 February 2012	Sustainment Maintenance Manual for Cross Drive Transmission w/Container Transmission Model X200-4A

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO *(Forward direct to addressee listed in publication)*	**FROM** *(Activity and location) (Include ZIP Code)*	**DATE**
U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LCL-MPP/TECH PUBS 6501 E. 11 Mile Road, Warren, MI 48397-5000		

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 9-2520-272-40	13 February 2012	Sustainment Maintenance Manual for Cross Drive Transmission w/Container Transmission Model X200-4A

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remark, or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	**TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION**	**SIGNATURE**

By Order of the Secretary of the Army:

RAYMOND T. ODIERNO
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army

1200603

Distribution:

To be distributed in accordance with the initial distribution number (IDN) 372631 requirements for TM 9-2520-272-40.

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 Kilometers	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 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

Linear Measure

1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

Weights

1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 Lb.
1 Metric Ton = 1000 Kilograms = I Megagram = I . I Short Tons

Square Measure

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer 1,000,000 Sq. Meters = 0.386 Sq. Miles

Liquid Measure

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

Cubic Measure

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = I ,000,000 Cu. Centimeters = 35.31 Cu. Feet

Temperature

5/9 (°F - 32) = °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 °C + 32 = °F

PIN: 086365-000