Service Manual

Fuller Heavy Duty Transmissions TRSM0580

October 2007

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Warnings and Precautions

Before starting a vehicle always be seated in the driver's seat, place the transmission in neutral, set the parking brakes and disengage the clutch.

Before working on a vehicle place the transmission in neutral, set the parking brakes and block the wheels.

Before towing the vehicle place the transmission in neutral, and lift the rear wheels off the ground, remove the axle shafts, or disconnect the driveline to avoid damage to the transmission during towing.

The description and specifications contained in this service publication are current at the time of printing.

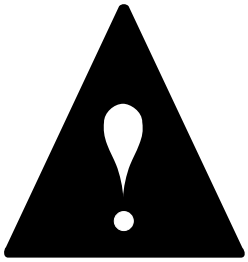
Eaton Corporation reserves the right to discontinue or modify its models and/or procedures and to change specifications at any time without notice.

Any reference to brand name in this publication is made as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents may be used.

Always use genuine Eaton replacement parts.

This symbol is used throughout this manual to call attention to procedures where carelessness or failure to follow specific instructions may result in personal injury and/or component damage.

Departure from the instructions, choice of tools, materials and recommended parts mentioned in this publication may jeopardize the personal safety of the service technician or vehicle operator.



WARNING: Failure to follow indicated procedures creates a high risk of personal injury to the servicing technician.

CAUTION: Failure to follow indicated procedures may cause component damage or malfunction.

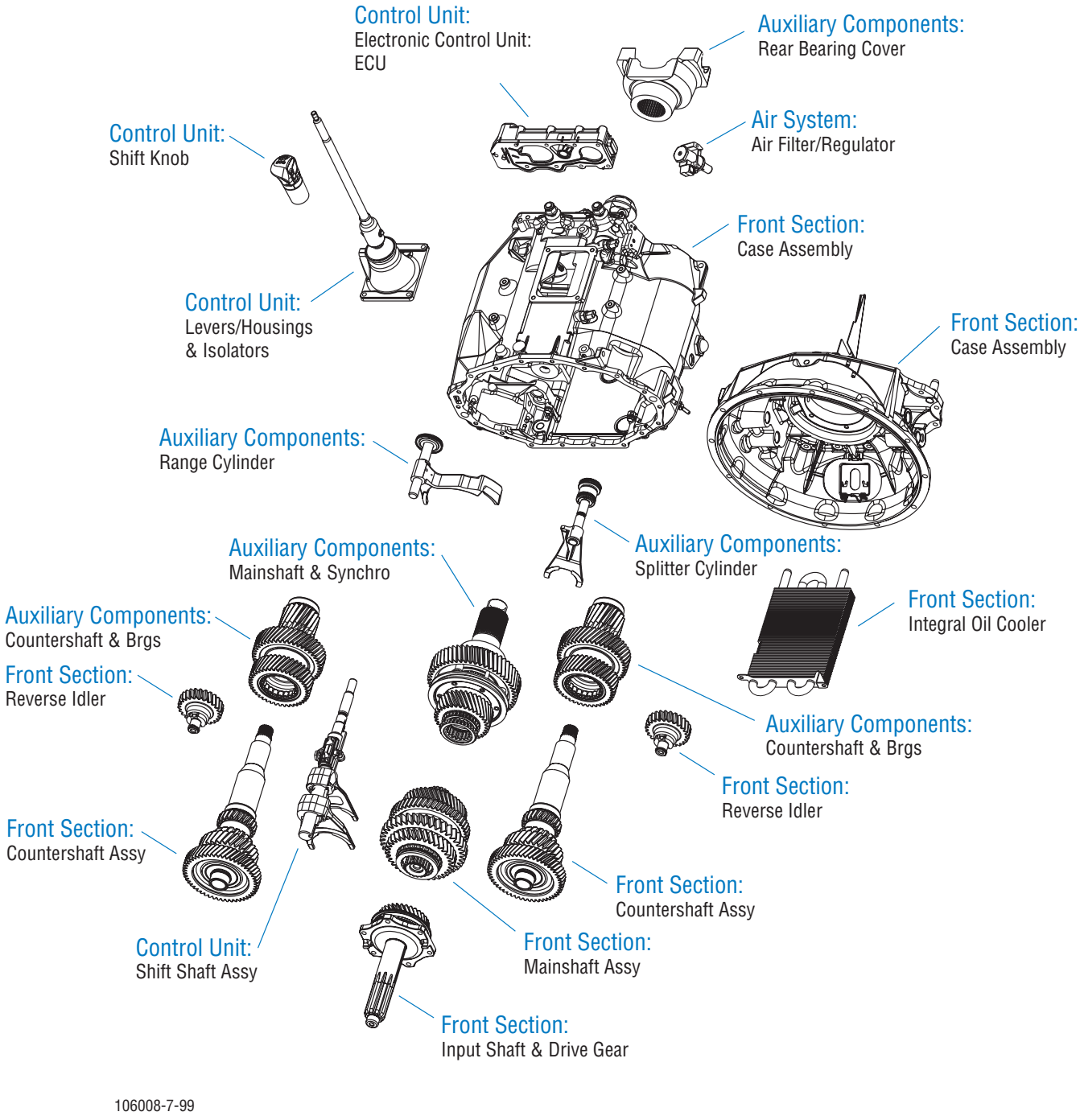
IMPORTANT: Highly recommended procedures for proper service of this unit.

Note: Additional service information not covered in the service procedures.

Tip: Helpful removal and installation procedures to aid in the service of this unit.

Lightning Breakdown

Overview



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Introduction

In-Vehicle Service Procedures

Transmission Overhaul Procedures-Bench Service

Introduction

General Service Practices and Part Inspection

Safety

Always keep personal safety in mind when working on heavy truck transmissions. Do not ignore common sense.

Use appropriate safety equipment including:

- Safety glasses
- Safety shoes
- Gloves
- Proper transmission jack or lift with safety chains
- Guards and protective devices for presses, pullers, and drivers.
- Wheel chocks

Disassembly Tips

Cleanliness
The workplace must be clean to prevent dirt or other foreign material from contaminating the transmission during repairs. Dirt is abrasive and can damage bearings. Eaton® recommends cleaning the outside of the unit before beginning disassembly.

Disassembling Assemblies
As components are removed from assemblies, lay the parts on a clean bench in the order in which they are removed. By laying the parts out in order, they are less likely to be lost, and reassembly will be easier.

If bearings are to be reused, they must be removed with the proper bearing pullers, or they can be damaged. After removing bearings, carefully wash and lubricate them, and wrap them protectively in clean shop rags or towels until they are to be installed in the transmission.

Input Shaft Removal
The input shaft assembly contains the transmission lube pump. The special procedure for removal and disassembly is located in the “Transmission Overhaul Procedures” section.

Snap Ring Removal
Snap rings should be removed with snap ring pliers to avoid overstretching or deforming them.

Removing Parts Using Tools
Use care when removing parts with pullers or drivers to prevent damage to components. Never apply force to driven parts after they stop solidly. Eaton® recommends using only soft hammers, soft bars, mauls, and the special tools indicated in the procedures for all disassembly work.

Marking Parts
To aid in reassembly and prevent unnecessary work, use a toolmaker’s die to mark the countershaft parts and rear bearing cover to indicate position. Mark the countershaft parts, including the countershaft, gears, bearings, and shims, as “upper” or “lower”. Mark the rear bearing cover to indicate the original position to the cover.

Parts Cleaning

⚠ WARNING

DO NOT USE GASOLINE TO CLEAN PARTS AS IT IS HIGHLY EXPLOSIVE.

Clean bearings and ground or polished parts in a cleaning solvent. To prevent corrosion, DO NOT clean ground or polished parts in a hot solution tank, with water, or in alkaline solutions.

Housings can be cleaned with a cleaning solvent or in a hot solution tank with a mild alkaline solution. Dry and oil parts immediately after removal to prevent machined surfaces from corroding. Be careful cleaning aluminum parts; some cleaning solutions may damage them.

Inspection

Gears
Inspect gear teeth for frosting, pitting, spalling, or other damage. Gears with frosting can usually be reused. Often, frosting on gears heals with continuous use of the transmission and more serious pitting does not occur. Gears with light pitting can have considerable life left and can also be reused. For gears with severe pitting, spalling, damage, or confirmed noise issues, the complete gear set (mainshaft gear and both countershaft gears) must be replaced.

Inspect the internal clutching teeth for excessive wear or rounding. Replace the gear and sliding clutch if necessary.

For additional information on wear of gear teeth, including full color photographs, refer to Eaton® Fuller® publication TRSM-0913, Understanding Spur Gear Life.

Bearings
Inspect balls, rollers, races, and thrust surfaces for pitting, spalling, or discoloration. Check for excessive axial (up and down) or radial (side-to- side) play. Replace the bearings as necessary.

Lubricate bearings with clean oil and rotate them to check for tightness or roughness. Replace the bearings as necessary.

Splined Shafts
Inspect splines for twisting, cracking, or wear. Replace splined shafts as necessary.

Note: Worn splines may indicate excessive torsional vibration. Make sure the vehicle system is corrected to prevent recurring damage to the transmission.

Thrust Washers
Inspect thrust washers for wear or scoring, and replace them as necessary.

Snap Rings
Inspect snap rings for wear, twisting, stretching, or other damage. Snap rings must fit tightly in their grooves. Replace them as necessary.

Housings
Inspect housings for cracks. Replace any cracked housings.

Inspect threaded holes for damage, and repair them as necessary.

Inspect bearing bores for wear. Light wear is acceptable. Housings with moderate to heavy wear in the bearing bores must be replaced.

Sliding Clutches
Inspect the clutching teeth for excessive wear or rounding. Light wear or rounding is acceptable. Replace clutches with moderate to heavy tooth wear.

Inspect the yoke slots of the clutches for excessive wear. Replace worn clutches.

Range Synchronizer
Inspect the friction material for excessive wear of damage. Replace the synchronizer as necessary.

Inspect the blocker pins for excessive wear on the chamfered corners, looseness, or torsional vibration damage. If the blocker pins are damaged, replace the range synchronizer.

Fit the low and high range synchronizers in their respective gears. Check for synchronizer bottoming on or in the gears. If bottoming occurs, replace the synchronizer assembly.

Inspect the synchronizer mating surface on the gears for signs of excessive heat. If signs of excessive heat are present, replace the synchronizer assembly.

Clutch Housing
Inspect the pilot diameter where the clutch housing mates with the engine. Replace the clutch housing if the pilot diameter is excessively worn.

Inspect the bushings for the clutch release linkage. Replace the bushings if they are worn.

O-Rings and Seals
Inspect o-rings and seals for wear, gouges, or permanent set, and replace them as necessary.

Shifting Mechanism
Inspect the shift yokes for excessive wear in the fork area. Light wear is acceptable. Replace any moderately or heavily worn shift yokes.

Inspect the shift shaft for burrs or raised metal, and check the notches for excessive wear. Repair or replace parts as necessary.

Inspect the shift shaft, shift block, bias plate, shift key, detent key, plungers, and actuator parts for excessive wear or scoring. Replace any of these parts as necessary.

Range Cylinder Assembly
Inspect the O-rings and piston seal for wear, damage, or permanent set, and replace them as necessary.

Inspect the piston bar, piston bores, and cylinder bores for wear or scoring. Replace any of these parts as necessary.

Shift Lever
Inspect the shift lever tip and spade pin groove for wear. Replace the parts as necessary.

Inspect the spade pin bore in the shift lever housing for excessive wear. Replace the housing as necessary

Input Shaft Seal
The input shaft seal is a lip type seal. Inspect the input shaft grooves and the inside of the front bearing cover for damage. Replace any damaged parts.

Front Bearing Cover
If an input-shaft-mounted clutch brake is used on the transmission, inspect the clutch brake mating surface on the front bearing cover for excessive wear. Replace the front bearing cover if the mating surface is excessively worn.

Gasket Surfaces
Inspect flanges and gasket surfaces for burrs, nicks, and scratches. Repair or replace parts as necessary.

Output Seal System
Inspect the output seal mating surface for wear, scratches, burrs, or other damage. Replace the seal surface if it is worn or damaged. Do not attempt to salvage the seal surfaces with crocus cloth, filing, etc.

For additional information, refer to the Eaton/Fuller® brochure TCSM-0912 “Seal Maintenance Guide”.

Reassembly Tips

Cleanliness
Make sure that parts are kept clean during reassembly. Prevent dirt or other foreign material from contaminating the transmission. Dirt is abrasive and can damage bearings.

Use lint-free shop rags when handling and cleaning parts. Too much lint inside the transmission can clog the oil pump pickup screen.

Bearing Installation
To avoid damaging bearings, use a driver that contacts both the inner and outer race of the bearing. If the bearing balls/rollers or bearing cage is damaged, the bearing must be replaced.

Capscrews
Make sure the threaded holes are clean and free of debris. If necessary, use a tap to clean the threads.

Make sure the capscrew threads are in good condition. If necessary, replace the capscrew.

Use a thread seal/locker compound on all capscrews. Use Eaton® Fuller® P/N 71295 thread sealant of equivalent.

Torque all capscrews to the recommended tightness.

Initial Lubrication
Unless stated specifically, lubricate all mating or sliding parts with transmission oil.

Lubricate all bearings with transmission oil.

Air System Lubrication
Lubricate all air system O-rings, seals, and cylinders with a light coating of silicone lubricant such as Eaton® Fuller® P/N 71203 (8fl.oz.) or P/N 71206 (0.14 fl.oz/).

Snap rings
Eaton® recommends using new snap rings for reassembly. A properly installed snap ring fits tightly in its groove and cannot be easily rotated. All loose or overstretched snap rings must be replaced.

Purpose and Scope of Manual

This manual is designed to provide detailed information necessary to service and repair the Eaton® Fuller® transmissions listed on the front cover.

How to Use This Manual
The service procedures have been divided into two sections: In-Vehicle Service Procedures and Transmission Overhaul Procedures-Bench Service. In-Vehicle Service Procedures contain procedures that can be performed while the transmission is still installed in the vehicle. Transmission Overhaul Procedures contain procedures that are performed after the transmission has been removed from the vehicle.

The procedure sections are laid out with a general heading at the top outside edge of each page, along with more specific headings on the top left of the page and the specific procedures below. To find the information you need, first go to the section that contains the correct procedure (In-Vehicle Service Procedures, Transmission Overhaul Procedures-Bench Service). Then look for the correct heading at the top left of each page and follow the steps.

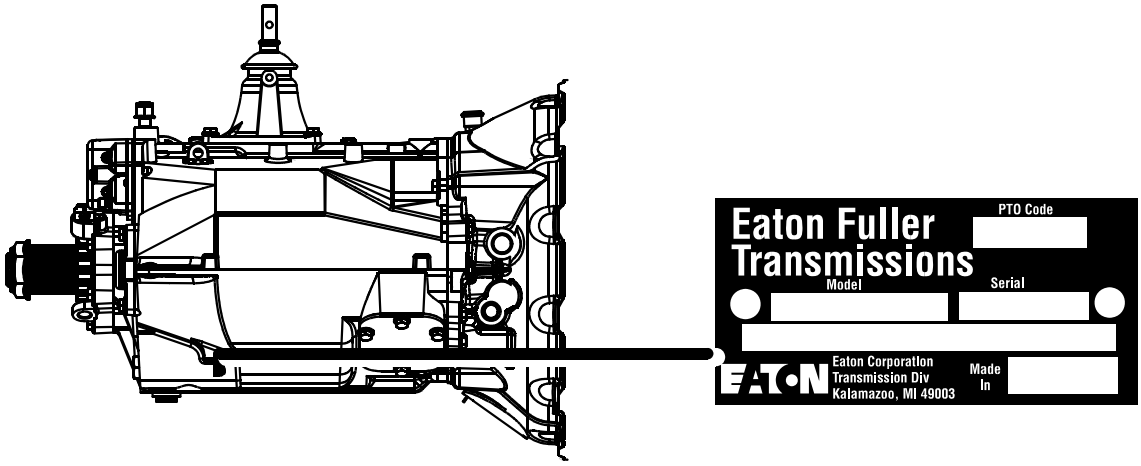
The sections located in front of the repair procedures are intended to give you information that is not included in the Service Repair Procedures.

Serial Tag Information and Model Nomenclature

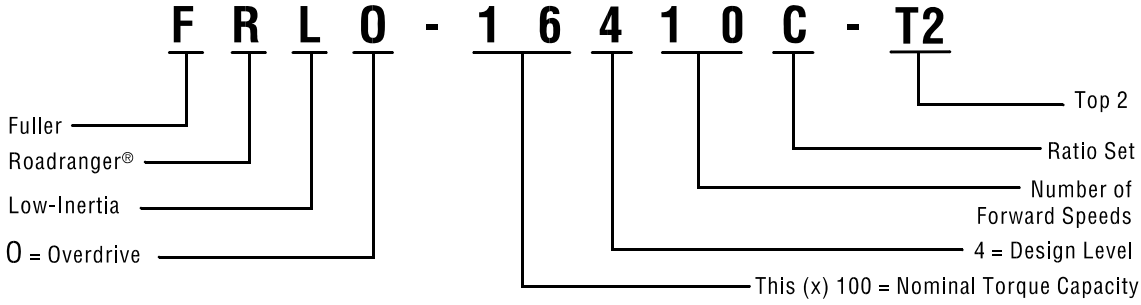
Transmission model designation and other transmission identification information are stamped on the serial tag. To identify the transmission model and serial number, locate the tag on the transmission and then locate the numbers as shown. Figure 1-1 below shows a tag and the tag location on the transmission.

When calling for service assistance or parts, have the model and serial numbers handy

Do not remove or destroy the transmission identification tag!



Model Number
The model number gives basic information about the transmission and is explained below. Use this number when calling for service assistance or replacement parts.



Serial Number
The serial number is the sequential identification number of the transmission. Before calling for service assistance, write the number down.

Bill of material or Customer number
This number may be located below the model and serial numbers. It is a reference number used by Eaton®.

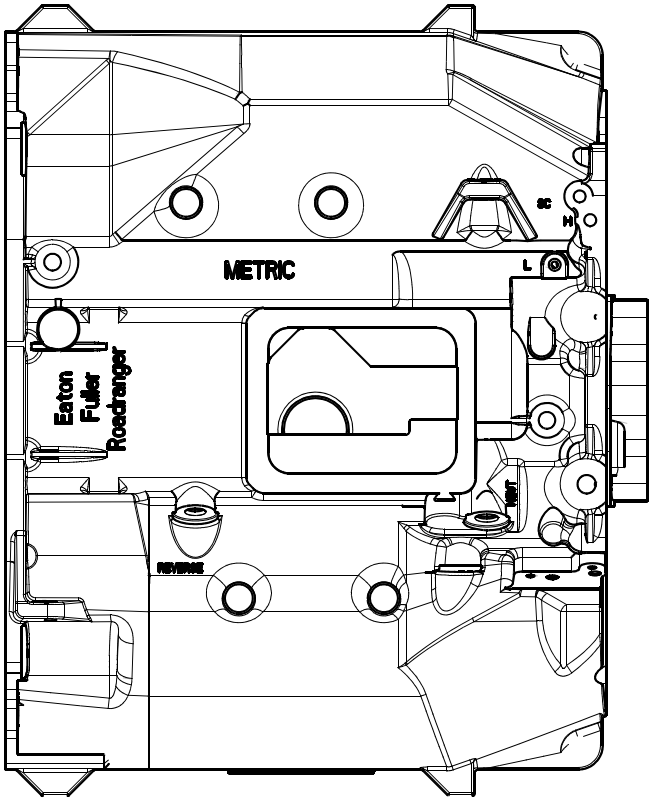
Model Options

Torque Rating
The torque rating of the transmission specified in the model number is the input torque capacity in lb-ft. Various torque ratings are available. For more information, call your Eaton Fuller regional sales and service office at 1-800-826-HELP (4357).

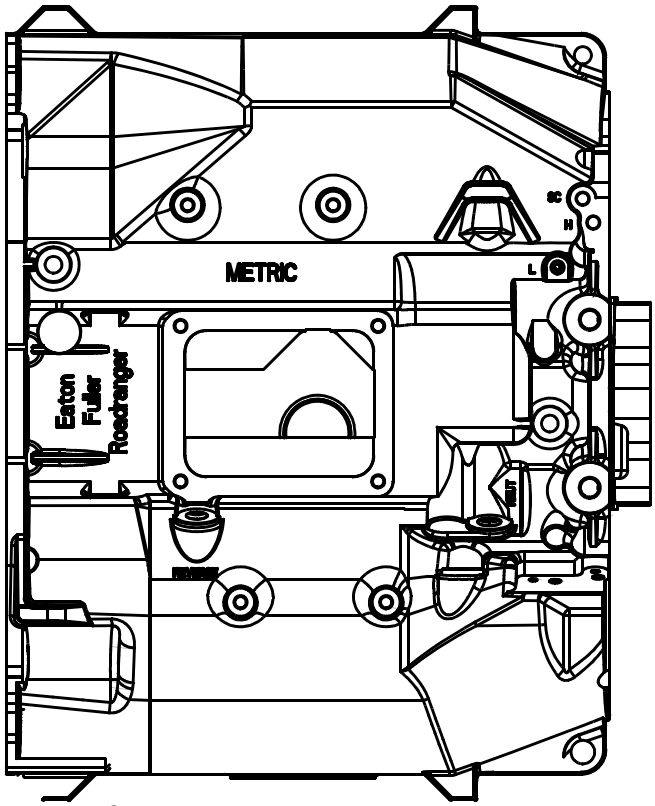
Shift System
Two types of shift systems are available for this transmission. Both are described and shown below.

Standard
The standard shift system has a gear shift lever opening located toward the rear of the transmission.

Forward Opening
The forward opening shift system has a gear shift lever opening located three inches closer to the front of the transmission than the standard opening. This forward design allows greater flexibility in mounting the transmission and is indicated by an “F” in the model number.



Standard Opening



Forward Opening

Lubrication Pumps
Standard internal pump

Power Take Off (PTO) Usage
The 6 bolt openings are standard with the transmission. The PTO is mounted to the opening on either side and driven from the countershaft gear.

Rear Mount
The thru-shaft PTO mounts are on the rear of the transmission. The thru-shaft PTO configuration is standard on the Lightning transmission.

Contact Information for Lightning compatible PTO's

Chelsea Power Take-Off Products
Dana Corporation
P.O. Box 321
Toledo, OH 43697-0321
Phone 1-800-729-3262
www.chelseapower.com

Muncie Power Products
P.O. Box 548
Muncie, IN 47308-0548
Phone 1-800-FOR-PTOS (1-800-367-7867) or 1-765-284-7721
www.munciepower.com

Torque Chart

The chart below lists the torque values for all the fasteners used on this model transmission. The torque values are also given in the procedures any time a fastener must be tightened.

Table

Description	Torque Value lb·ft (Nm)	Thread Size	
Shift Knob Jam Nut	35–45 (48–61)	1/2” X 13	
Shift Lever Housing Capscrews	47–52 (63–70)	M10 X 1.5 X30MM	
Remote Shift Control Mounting Capscrews	47–52 (63–70)	M10 X 1.5 X30MM	
Clutch Release Yoke Capscrews	35–45 (48–61)	3/8” X 24	
Clutch Release Adjusting Arm Capscrews	35–45 (48–61)	3/8” X 24	
Clutch Housing Flange Capscrews			See engine manufacturer recommendations for type, size, and assembly torque.
Rear Support Studs	60 Minimum (81)	M16 X 2.0	Drive until bottomed (When using plugs apply 71206 sealant)
Rear Support Stud Nuts	170-190 (230-257)	M16 X 1.5	
Speed Sensor Retaining Capscrews	20-23 (27-31)	M8 X 1.25	
PTO Cover Capscrews/Studs	47-52 (63-70)	M10 X 1.5 X20MM	
External Attachment Stud Nuts	20-23 (27-31)	M8 X 1.25	
Thermocouple Plug	47-52 (63-70)	1/2" NPT	Use thread sealant
Oil Fill Plug	35-50 (47-67)	1 1/16" X 12	O-ring plug
Oil Drain Plug	35-50 (47-67)	1 1/16" X 12	O-ring plug
Air System Diagnostic Port Plugs	84-120 lb. in.	1/16"-27	Use thread sealant
Oil Level Site Glass	60-70 (81-95)	1 5/8" X 12	O-ring fitting
Air Filter/Regulator Capscrews	9-10 (12-14)	M6 X 1.0 X 55MM	
Neutral Switch	15-20 (20-27)	M16 X 1.5	O-ring seal
Reverse Switch	15-20 (20-27)	M16 X 1.5	O-ring seal
Splitter Detent Plug	15-20 (20-27)	M16 X 1.5	O-ring seal
Output Shaft Nut	450-500 (610-677)	M48 X 2.0	Oil at yoke installation
Cooler Inlet & Outlet Fittings	40-50 (54-67)	7/8" UNF	O-ring fitting
Main Case Breather	15-20 (20-27)	1/4" X 18	Use thread sealant

Table

Description	Torque Value lb·ft (Nm)	Thread Size	
ECU Breather	84-120 lb-in (9.5-13.6)	1/8" X 27	Use thread sealant
Clutch Housing / Front Cover Capscrews	47-52 (63-70)	M10 X 1.5	
Front Bearing Cover Capscrews	35-40 (48-55)	M10 X 1.5 X 35MM	
Front Cover Oil Dam Plate Capscrew	20-23 (27-31)	M8 X 1.25 X 12MM	
Oil Trough Capscrews	20-23 (27-31)	M8 X 1.25 X 12MM	
Rear Countershaft Bearing Cover-Capscrews	47-52 (63-70)	M10 X 1.5 X 30MM	
Output Shaft Bearing Cover Capscrews	47-52 (63-70)	M10 X 1.5 X 45MM	
Vehicle Wiring Harness Connector Retaining Screw at ECU	7-13 lb-in (.8-1.5)	10 X 24	Part of connector assembly
ECU Mounting Capscrews	20-23 (27-31)	M8 X 1.25 X 70MM	
ECU Position Sensor Capscrews	22-28 lb-in (2.4-3.2)	M4 X.75 X 16MM	
ECU Solenoid Pack Capscrews	22-28 lb-in (2.4-3.2)	M4 X.75 X 16MM	
Range Piston Retaining Nut	25-35 (34-47)	M10 X 1.5	
Eccentric Pump Setscrew	3 Maximum (4) maximum	M4 X.75 X 25MM	Drive until the setscrew bottoms into pump eccentric
Shift Shaft Neutral Detent Plunger Plug	15-20 (20-27)	M16 X 1.5	
Shift Shaft Reverse Bias Detent Plug	15-20 (20-27)	M18 X 1.75	
Reverse Idler Retaining Capscrews	47-52 (63-70)	M10 X 1.5 X 30MM	
Cooler Retaining Capscrews	20-23 (27-31)	M8 X 1.25 X 12MM	

Lubrication Information

Proper lubrication procedures are the key to a good all-around maintenance program.

Eaton® Fuller® Transmissions are designed so internal parts operate in an oil circulating bath created by the motion of the gears and shafts.

All parts will be properly lubricated if these procedures are closely followed:

a. **Maintain oil level and inspect regularly.**

b. **Follow maintenance interval chart.**

c. **Use the correct grade and type of oil.**

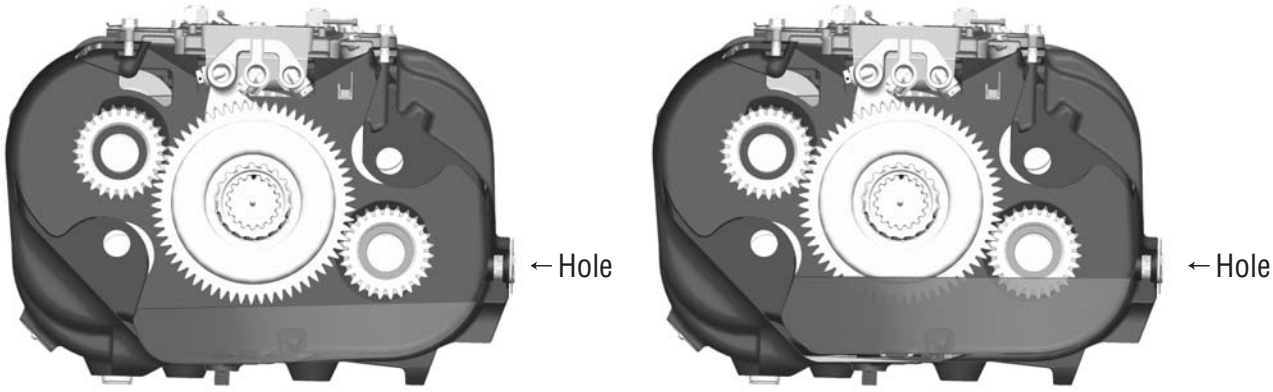
d. **Buy from a reputable dealer.**

Maintain Proper Oil Level

Make sure the oil is level with the filler opening. Being able to reach the oil with your finger does not mean the oil is at The proper level. (One inch of oil level is about one gallon of oil.)

⚠ IMPORTANT

When adding oil, never mix engine and gear oils in the same transmission.



Improper Oil Level

Proper Oil Level

Oil Capacity is 27 pints

Maintenance Interval Chart

Eaton® Roadranger® CD50 Transmission Fluid	
HIGHWAY USE-Heavy duty and Mid-Range initial Fill with Eaton® Roadranger® CD50 E500 (PS-164)	
HIGHWAY	
Every 10,000 miles	Check fluid level. Check for leaks.
Every 500,000 miles	Change transmission lubricant.
OFF-HIGHWAY USE	
First 30 hours	Change transmission lubricant on new units.
Every 40 hours	Inspect lubricant level. Check for leaks.
Every 1,000 hours	Change transmission fluid where severe dirt conditions exist.
Every 2,000 hours	Change transmission fluid (Normal off-highway use).

If your vehicle has a transmission oil filter, you must change the filter when fluid or lubricant is changed.

The use of lubricants not meeting these requirements will affect warranty coverage.

For a list of Eaton Approved Synthetic Lubricants, see TRSM-0911 or call 1-800-826-HELP (4357).

Buy from a Reputable Dealer

For a complete list of approved and reputable dealers, write to:

Eaton Corporation

Global Marketing Services

P.O. Box 4013

Kalamazoo, MI 49003

Transmission Operating Angles

If the transmission operating angle is more than 12 degrees, improper lubrication will occur. The operating angle is the transmission mounting angle in the chassis plus the percent of upgrade (expressed in degrees).

For operating angles over 12 degrees, the transmission must be equipped with an oil pump or cooler kit to insure proper lubrication.

Operating Temperatures with Oil Coolers

The transmission must not be operated consistently at temperatures above 250°F. However, intermittent operating temperatures to 300°F do not harm the transmission. Operating temperatures above 250°F increase the lubricant's oxidation rate and shortens its effective life. When the average operating temperature is above 250°F, the transmission can require more frequent oil changes or external cooling.

Oil coolers are standard on Lightning transmissions.
The following conditions in any combination can cause operating temperatures of over 250°F:

a. Operating consistently at slow speed.

b. High ambient temperatures.

c. Restricted air flow around transmission or engine radiator.

d. Exhaust system too close to transmission.

e. High horsepower operation.

f. Restricted engine coolant flow to transmission cooler.

Oil coolers are effective in reducing operating temperatures when the above conditions are encountered.

Oil Cooler Chart

Transmission Oil Coolers are:
Recommended With engines of 350 H.P. and above.
Required With engines 399 H.P. and above and GCW's over 90,000 lbs. With engines 399 H.P. and above and 1400 lb-ft or greater torque. With engines 450 H.P. and above.

Recommended Tools

Some repair procedures pictured in this manual show the use of specialized tools. Their actual use is recommended as they make transmission repair easier, faster, and prevent costly damage to critical parts.

But for the most part, ordinary mechanic's tools such as socket wrenches, screwdrivers, etc., and other standard shop items such as a press, mauls and soft bars are all that is needed to successfully disassemble and assemble any Eaton Fuller Transmission.

Recommended Tools

The following tables list and describe the typical tools required to properly service this model transmission above and beyond the necessary basic wrenches, sockets, screwdrivers, and prybars.

General Tools

The following tools are available from several tool manufacturers such as Snap-On, Mac, Craftsman, OTC, and many others.

General Tools

TOOL	PUPOSE
0 - 100 lb·ft 1/2" drive Torque Wrench.	General torquing of fasteners. (Typically 15-80 lb·ft.)
0 - 600 lb·ft 3/4" or 1" drive Torque Wrench.	Torquing of output nut to 500 lb·ft.
0 - 150 lb·in 3/8" drive Torque Wrench.	Torquing of pipe plugs 60-120 lb·in.
70 MM or 2 3/4" Socket - Standard Depth	To remove/install the output yoke nut
5/64” Allen Wrench Driver	To remove/install eccentric pump set screw
Snap Ring Pliers - small external	To remove/install snap ring at input shaft thrust washer
Snap Ring Pliers - medium external	To remove/install snap ring at rear of mainshaft
Snap Ring Pliers - small internal	To remove/install snap ring at range cylinder
Dial Indicator and Magnetic Base	To check mainshaft endplay
(2) Rolling Head (Crow's Foot) Prybars	To remove the rear auxiliary countershaft bearings
Air Pressure Gauge 0 - 100 PSI (0-1034 kPa)	To troubleshoot and verify correct air system operation

Eaton Fuller Model Special Tools

The following special tools are designed for this Eaton® Fuller® transmission. The addresses and phone numbers of the tool suppliers are listed after the table. This list is provided as a convenience to our customers. These tools are manufactured by independent companies with no relationship to Eaton Fuller. Eaton Fuller does not warrant the fit or function of the listed tools. To obtain the tools, contact the tool supplier directly.

Special Tools

REFERENCE NUMBER	TOOL	PURPOSE	KENT MOORE TOOL NUMBER	OTC TOOL NUMBER
T1	Output Yoke Puller	Required to remove an output yoke.		7075**
T2	Transmission Jack Adapter Plate	Provides stable base for removing the transmission from the truck	J-44076	
T3	Transmission Service Mounting Plate	Allows for correct orientation of transmission during bench service	J-44075	
T4	Bearing Puller	To remove front countershaft bearings from clutch housing	J-44096	
T5	Bearing Race Puller	To remove input shaft bearing race	J-44077	
T6	Bearing Race Puller	To remove front countershaft bearing races	J-44352	
T7	Bearing Race Puller	To remove auxiliary countershaft front bearing races from front countershafts	J-44353	
T8	Bearing Puller	To remove auxiliary countershaft front roller bearings	J-44354	
T9	Bearing Race Puller	To remove shift shaft bushing from front cover	J-44098	
T10	Bearing, Race, & Bushing Installer Kit	To install all bearings, bearing races, and bushings	J-44751	
T11	Seal Puller/Installer	To remove and install the rear shift shaft seal	J-44099	
T12	Seal Puller	To remove output shaft seal	J-44355	
T13	Transmission/Engine Stand	Supports transmission service mounting plate during bench service		1726
** OTC 7070A kit includes 7075 yoke puller				

Tool Suppliers

The following vendor makes tools specifically for Eaton® Fuller® Lightning transmissions:

SPX / Kent-Moore

28635 Mound Road

Warren, MI 48092–3499

Phone: 800-328–6657

Fax: 800–578–7375

The specialized tools can be obtained from a tool supplier or made from tool prints as required by the individual user. Detailed Eaton Fuller Transmission Tool Prints are available upon request by writing to:

Eaton Corporation

Truck Components Operations

Technical Service

P.O. Box 4013

Kalamazoo, Michigan 49003

Eaton Aftermarket Parts

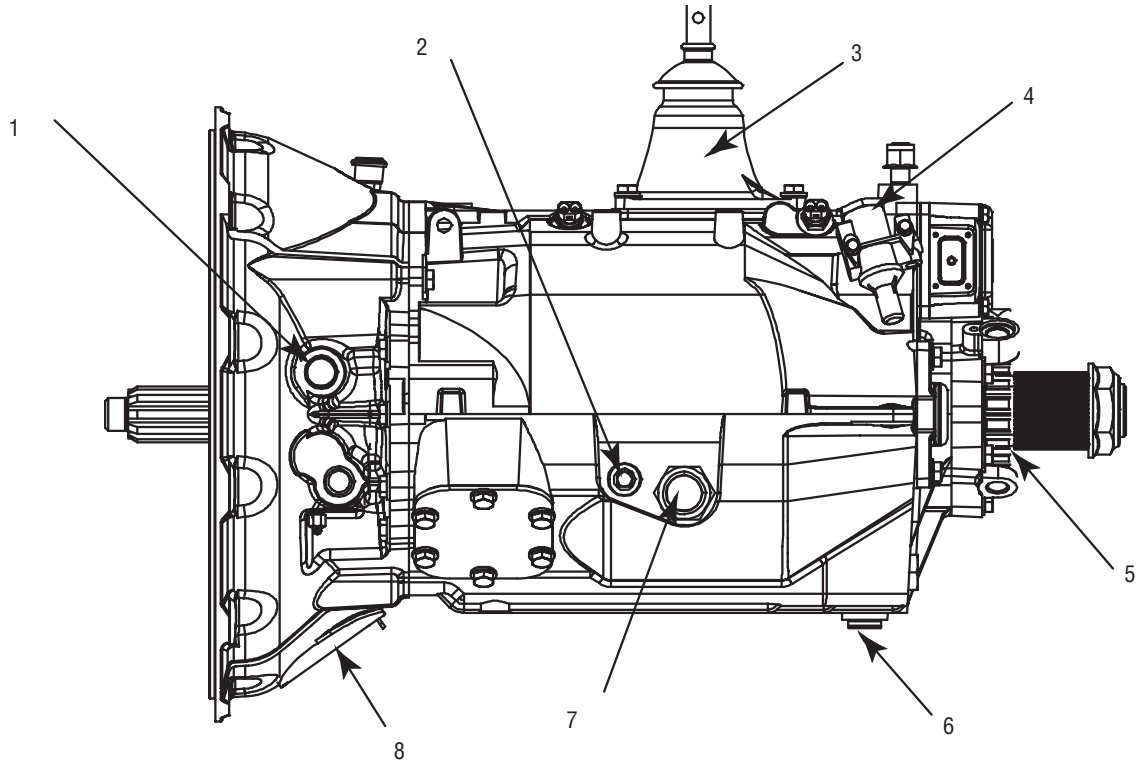
The following tools are available through Eaton Aftermarket Parts. To obtain any of the tools listed, contact your local Eaton® parts distributor.

Aftermarket Parts

TOOL	PURPOSE	EATON PART NUMBER
Output Seal Driver	To Install Output Seal	5564509 adapter with 5564501 driver - both parts included in complete Eaton Seal Kit P/N TCMT-0912
Tension Spring Driver	Install Shift Lever Spring	T-11938 Eaton Transmission Print

Preventive Maintenance

The preventive maintenance items below are necessary to prevent costly transmission failures that may not be covered by warranty. Parts of the transmission to be checked or accessed for preventive maintenance are shown.



1. Clutch Release Bushings
2. Oil Fill Plug
3. Shift Tower
4. Air filter/Regulator
5. Output Seal
6. Oil Drain Plug
7. Oil fill Sight Glass
8. Clutch Inspection Cover

ECU

- Avoid any heat source close to the transmission. The exhaust system or any other source of heat must be at least four (4) inches from the transmission ECU.
- Maintain vehicle electrical system in proper working condition.
- Check for clogged or plugged vents on ECU.

Transmission Oil

- Check transmission weekly for oil leaks. Repair promptly to prevent oil loss and subsequent transmission failure.
- Check transmission oil level at every engine oil change interval. Add transmission oil as necessary.
- Drain and replace transmission oil as recommended by the schedule in the lubrication interval chart.

Air System

- Drain moisture from the vehicle air system daily.
- Listen for air leaks daily, and repair them promptly.
- This model requires an air dryer. Confirm the air dryer system is working properly. Repair as necessary.
- Service the vehicle air compressor as required to prevent oil from entering the vehicle air system.

Master Clutch System

- Have the clutch checked and adjusted if any of the following occurs:

  Clutch does not disengage completely.

  Clutch brake does not function.

  Clutch pedal free-play is less than 1/2".
- When replacing the clutch, use a high quality spring damped replacement unit without free travel.

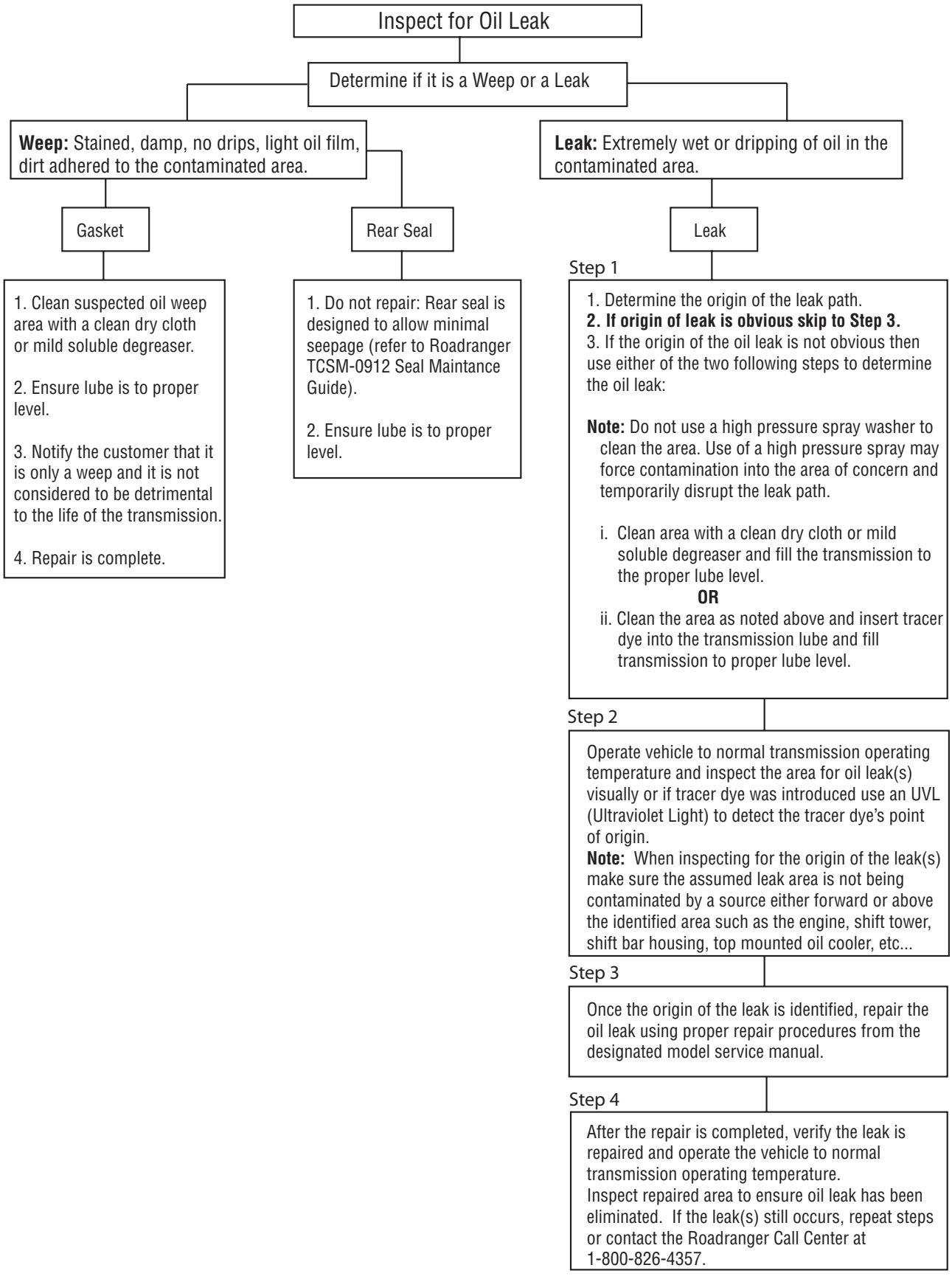
Drivetrain

- Inspect the driveshaft for loose or worn U-joints weekly. Repair promptly to prevent excessive driveline vibration.
- Inspect air ride suspension ride height per OEM requirements.

Overall Inspection

- Inspect the transmission at the chassis lubrication interval for loose or missing capscrews and fasteners.
- Pay particular attention to the capscrews that attach the transmission to the engine.

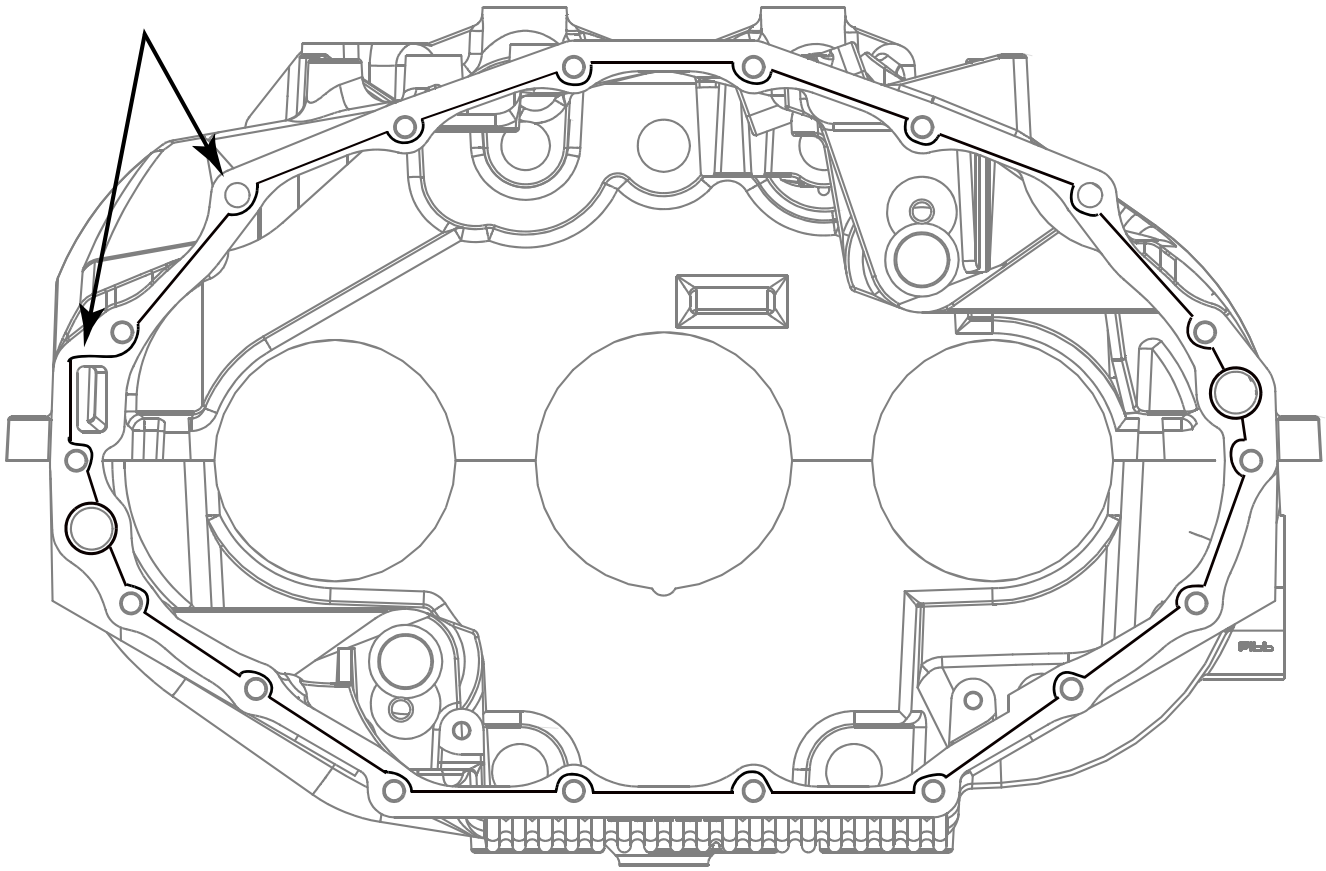
Oil Leak Inspection Process



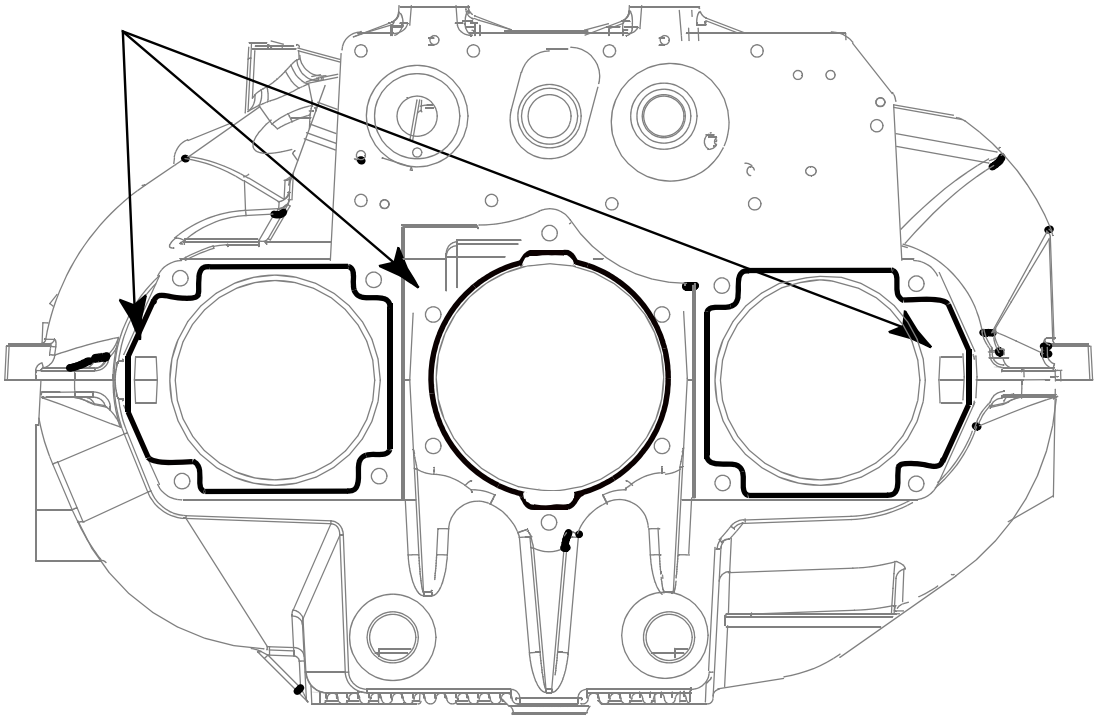
RTV Sealant Application Procedures

1. Clean and remove all foreign material from surfaces to be sealed.
2. Use solvent to prep surface before application.
3. Use the precut applicator nozzle to apply a continuous and even 1/8” bead to one of the surfaces to be assembled.
4. Apply the sealant bead inboard of all capscrew holes.
5. Parts must be assembled with 10 minutes of application, maximum RTV cure is achieved after 90 minutes.
6. Reference bead paths shown below for exact location for applying sealant.
7. Follow assembly instructions and torque specifications shown in the Lightning Series Manual. Eaton literature # TRSM-0580

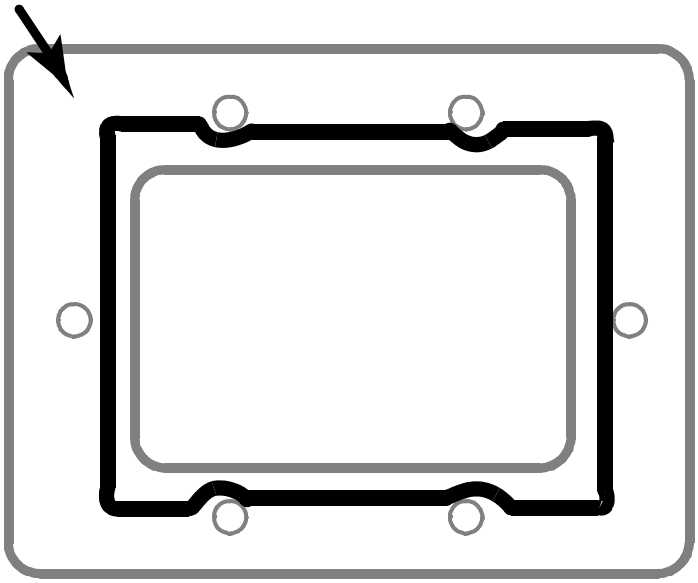
Sealant Bead Pattern for Main Case to Front Cover



Sealant Bead Pattern for Main Case Rear Bearing Covers



Sealant Bead Pattern for Main Case PTO Covers



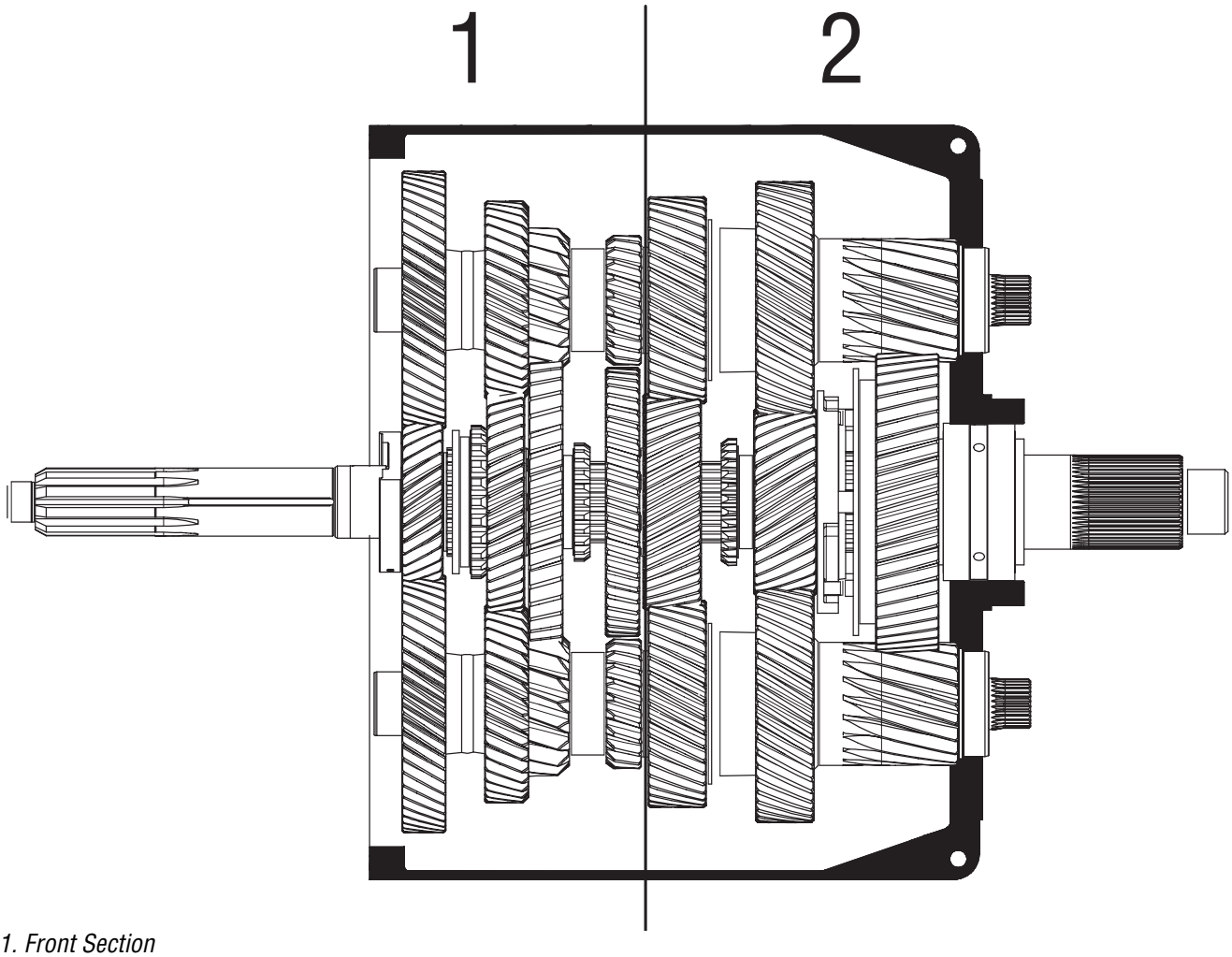
Power Flow

An understanding of the engine's power flow through a transmission in each particular gear assists the technician in troubleshooting and servicing a transmission.

The Eaton Fuller Lightning series transmission is really two transmissions combined into one unit. The first transmission or front section contains three sets of forward gears and one reverse gear controlled by the driver's movement of the shift lever. The second transmission called the auxiliary, or back box contains three sets of gears with two air shift cylinders. However, unlike other Eaton Fuller Roadranger products, you cannot separate the front section from the auxiliary of the transmission for servicing. Troubleshooting of the mechanical subsystem is similar to current Eaton Fuller mechanical products, although transmission disassembly may now be necessary to inspect the internal components.

The unique design of the Lightning transmission uses concentric countershafts. The front box countershaft fits through the hollow center of the auxiliary countershaft providing support for the auxiliary countershaft. The illustration shows the transmission gearing with a cross sectional view of how the front section countershaft fits through the auxiliary countershaft.

The Lightning transmission uses constant mesh helical gearing throughout. When in operation, all gears rotate together even though a few transfer power to the driveline at any one time.

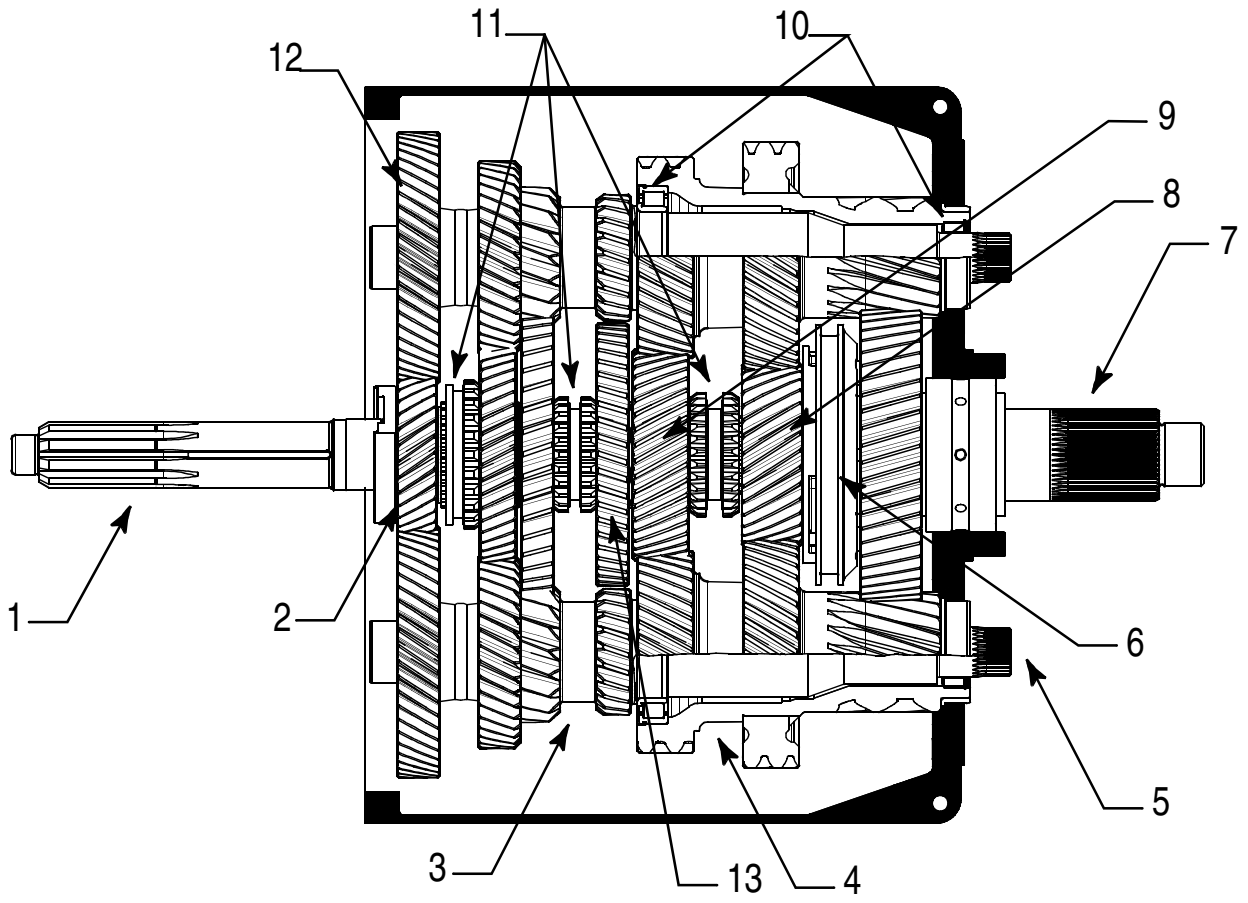


1. Front Section
2. Auxiliary Section

Transmission Power Flow

Understanding power flow can help to isolate the individual gear set when diagnosing noise or shift complaints. However, complete knowledge of truck systems benefits the technician when diagnosing either of these complaints.

The figure illustrates the transmission with the main components called out. Note specifically, the sectional view of the auxiliary countershaft showing how the front box countershaft supports the auxiliary countershaft. Left out of the picture is the clutch housing. The clutch housing pilots into the transmission case with dowel pins and supports the transmission's front section gearing and input shaft.



Component Nomenclature and Auxiliary Countershaft Sectional View

1. Input Shaft
2. Main Drive Gear
3. Front Section Countershaft
4. Auxiliary Countershaft
5. Shaft Splined For PTO
6. Synchronizer Assembly
7. Output Shaft (Auxiliary Mainshaft)
8. Auxiliary Splitter Gear (Auxiliary Mainshaft)
9. Auxiliary Drive Gear
10. Auxiliary Countershaft Support Bearings
11. Sliding Clutches
12. Countershaft Drive Gear
13. Reverse Gear

Power Flow by Gear

Note: The heavy lines in all figures represent the power flow path.

All the gearing in the transmission is constantly rotating because the transmission uses constant mesh gearing. However, only the engaged gears have power (torque) transmitted across the gear set. Sliding clutches located on the front section and auxiliary section mainshafts slide forward or rearward to engage into a selected gear. Torque comes through the gear set only after the sliding clutch engages the gear.

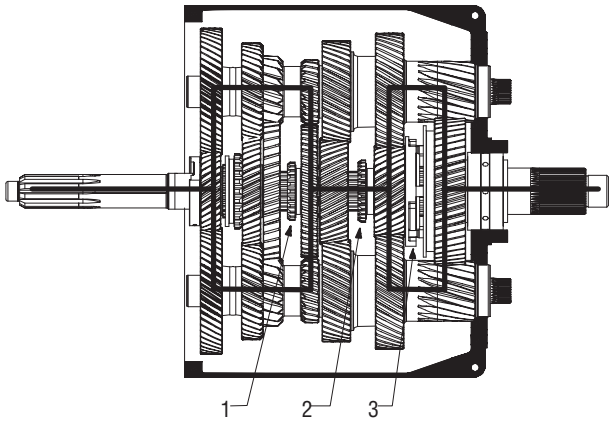
a. Power (torque) from the vehicle's engine is transferred to the transmission's input shaft.

b. The input shaft rotates the main drive gear through internal splines in the hub of the gear.

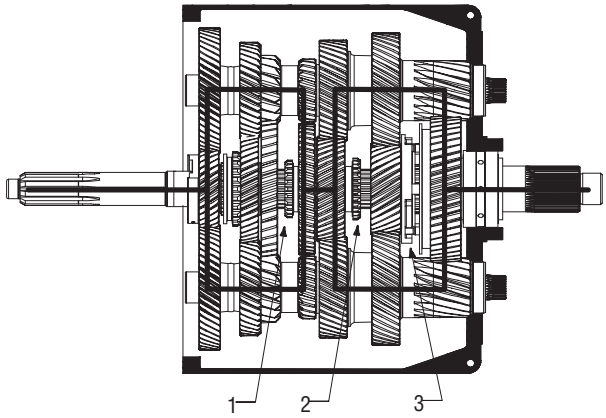
c. The main drive gear meshes with both countershaft drive gears splitting the engine torque equally across both gears.

d. Only those gears selected by the sliding clutches have torque across them even though all gears in the transmission turn all the time.

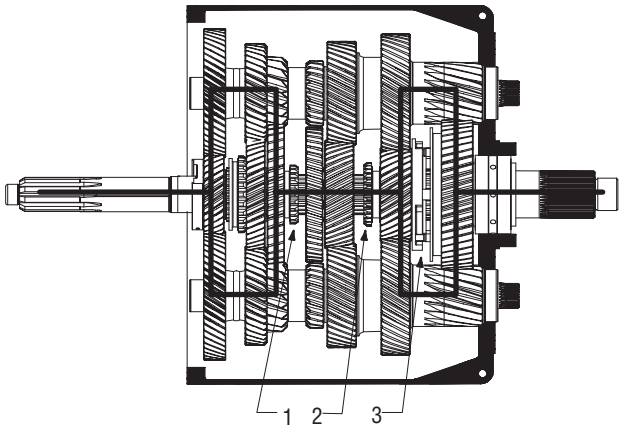
e. The following illustrations show the torque path in all ten (10) gears and both reverse gears.



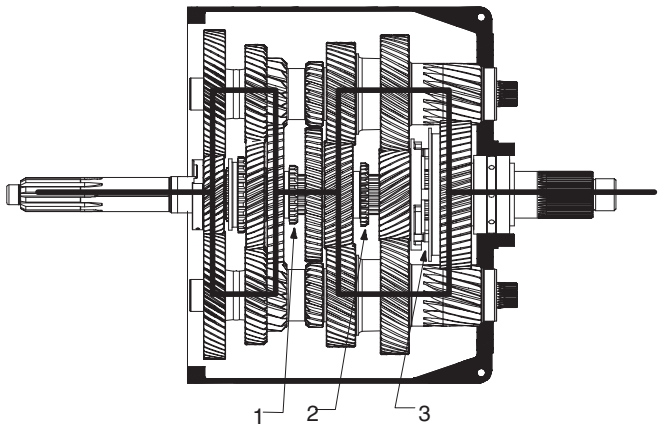
Low Reverse Gear
1. Sliding Clutch Rearward
2. Splitter Clutch Rearward
3. Synchronizer in Low Range



High Reverse Gear
1. Sliding Clutch Rearward
2. Splitter Clutch Forward
3. Synchronizer in Low Range

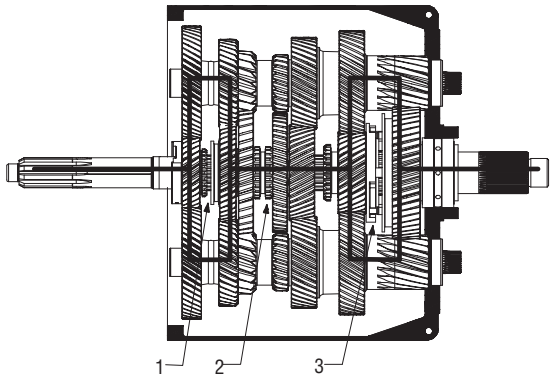


1st Gear
1. Sliding Clutch Forward
2. Splitter Clutch Rearward
3. Synchronizer in Low Range



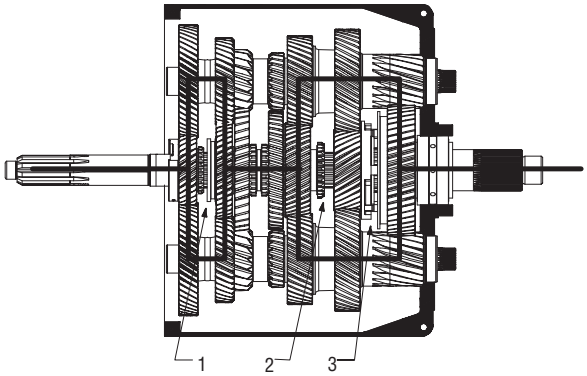
2nd Gear
1. Sliding Clutch Forward
2. Splitter Clutch Forward
3. Synchronizer in Low Range

Transmission Power Flow



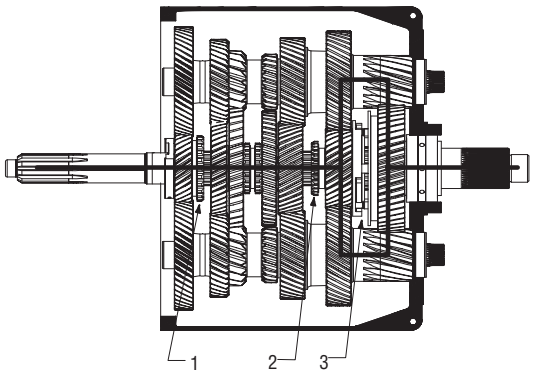
3rd Gear

1. Sliding Clutch Rearward
2. Splitter Clutch Rearward
3. Synchronizer in Low Range



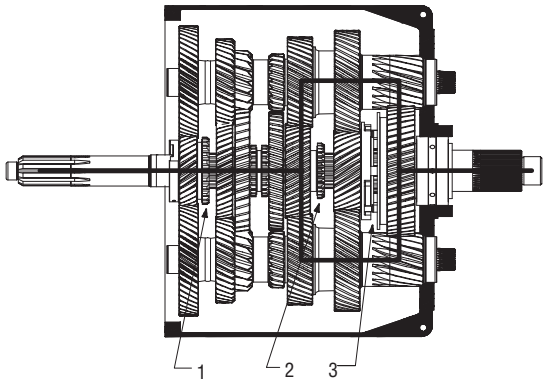
4th Gear

1. Sliding Clutch Rearward
2. Splitter Clutch Forward
3. Synchronizer in Low Range



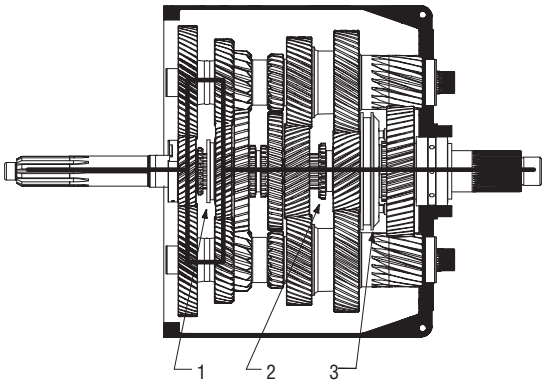
5th Gear

1. Sliding Clutch Forward
2. Splitter Clutch Rearward
3. Synchronizer in Low Range



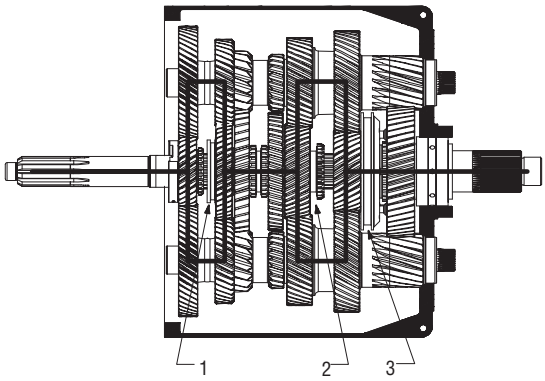
6th Gear

1. Sliding Clutch Forward
2. Splitter Clutch Forward
3. Synchronizer in Low Range



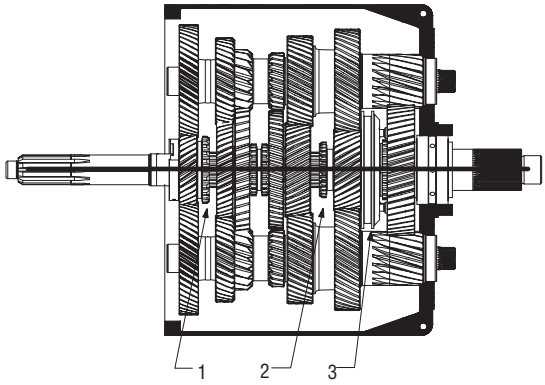
7th Gear

1. Sliding Clutch Rearward
2. Splitter Clutch Rearward
3. Synchronizer in High Range



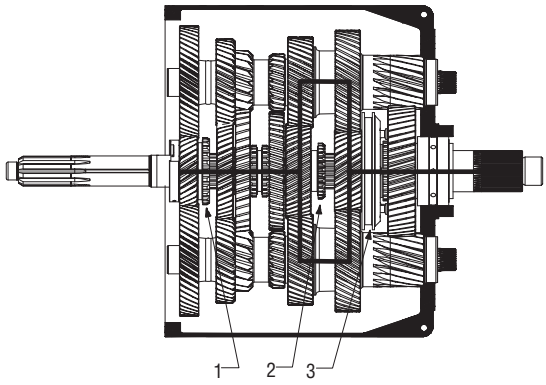
8th Gear

1. Sliding Clutch Rearward
2. Splitter Clutch Forward
3. Synchronizer in High Range



9th Gear

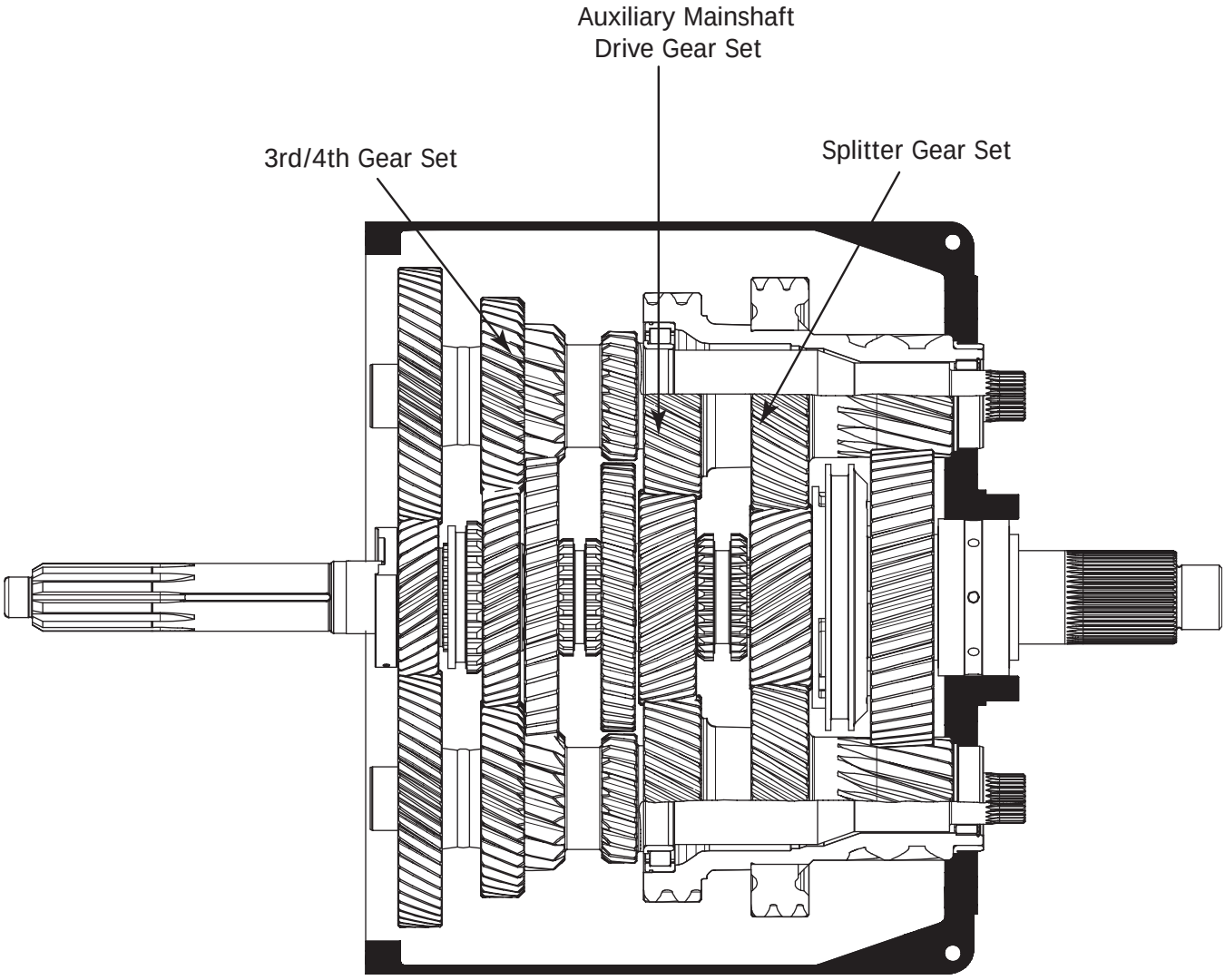
1. Sliding Clutch Forward
2. Splitter Clutch Rearward
3. Synchronizer in High Range



10th Gear

1. Sliding Clutch Forward
2. Splitter Clutch Forward
3. Synchronizer in High Range

Gear Sets to be Timed



Timing Procedures

Special Instructions

Both front and rear countershaft assemblies must be "timed". Correct timing assures the mainshaft gears will be properly centered between the countershafts.

Timing is a simple service procedure completed by marking the appropriate teeth of a gear set prior to installation and placing them in proper mesh during assembly. Since Lightning models are assembled as a single unit, there are three critical gear sets that must be timed. In the order in which they are assembled, these gears include: the splitter gear set, the auxiliary mainshaft drive gear set, and the 3rd/4th gear set.

Since Lightning transmission models contain all helical style gearing and the countershafts are single piece units, the process of marking the gear teeth is unique compared to other models.

Special Tools

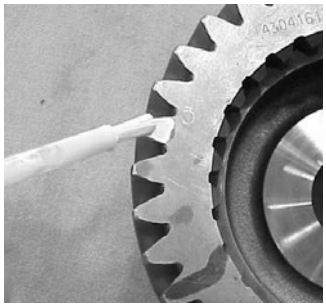
- Tool Markers Dye

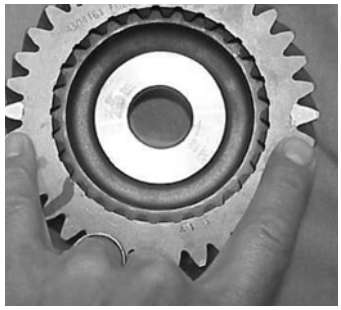
Procedure -

1. **Marking the auxiliary mainshaft splitter gear**

2. Prior to installing the splitter gear on the end of the auxiliary mainshaft, clearly mark any two teeth that are directly opposite of each other. Mark the teeth on the front side of the gear identified by the internal clutching teeth.

3. There should be an equal number of unmarked gear teeth between the marked teeth.

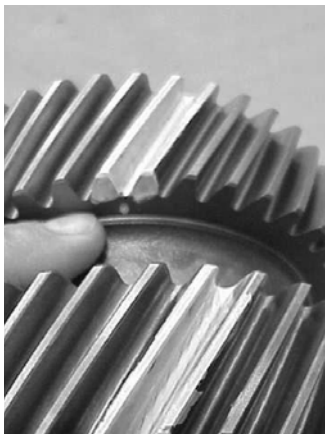


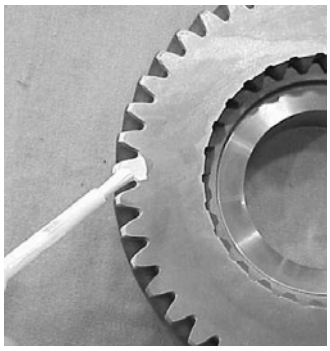


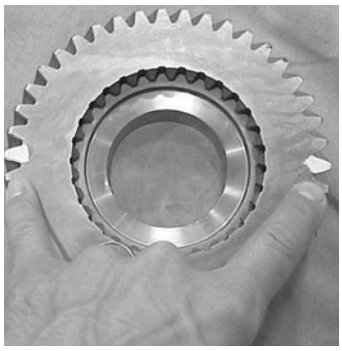
1. **Marking the auxiliary countershaft gears**

2. Locate the timing mark on the rear side of the forward most gear (auxiliary coutershaft driven gear) and mark the two adjacent teeth next to the timing mark as shown.

3. Repeat the procedure for the two teeth on the next gear (auxiliary countershaft splitter gear) that line up exactly with the timing mark on the drive gear.



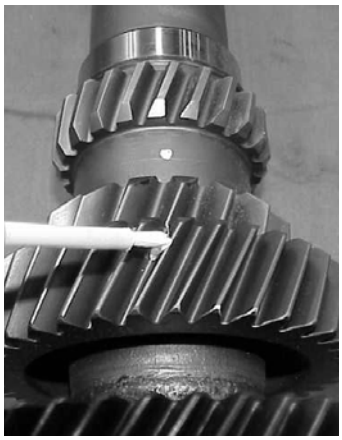




1. **Marking the mainshaft gears**

2. Prior to building the mainshaft assembly the auxiliary countershaft drive gear and the 3rd /4th mainshaft gear must be marked for timing purposes. Clearly mark any two teeth that are directly opposite of each other. Mark the teeth on the front side of the gear so the teeth can be identified during transmission assembly.

3. There should be an equal number of unmarked gear teeth between the marked teeth.



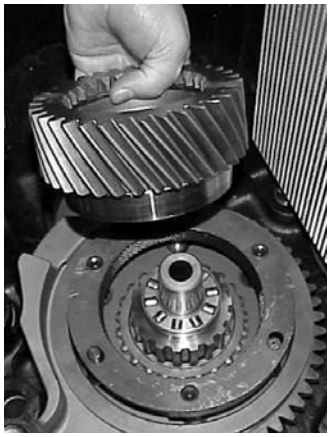
1. **Marking the front countershaft gears**

2. Locate the timing mark on the flat section of the countershaft between the two smallest gears.

3. Mark the two adjacent teeth on the 3rd/4th gear that line up with the timing mark.

1. **Meshing the marked gearing during assembly**

2. Install the splitter gear.

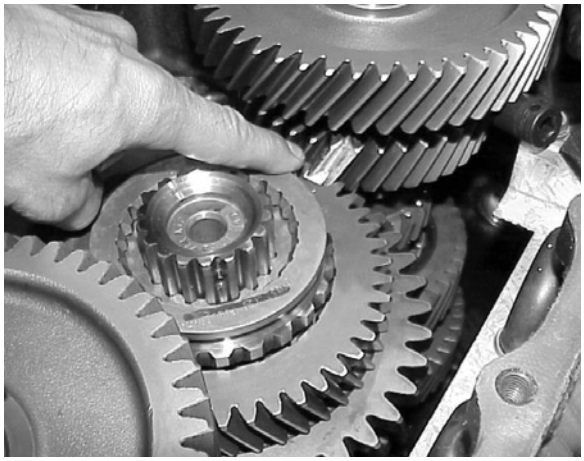


3. Install the auxiliary countershafts in the transmission case with the timing marks lined up with the splitter gear marked teeth.

4. Install the mainshaft assembly with the marked teeth on the auxiliary drive gear lined up between the marked teeth on the auxiliary countershaft driven gears.

5. Install the countershafts with the two adjacent marked teeth lined up on each side of the marked tooth on the mainshaft gears.

6. Follow the assembly procedures in the "Bench Service" section.



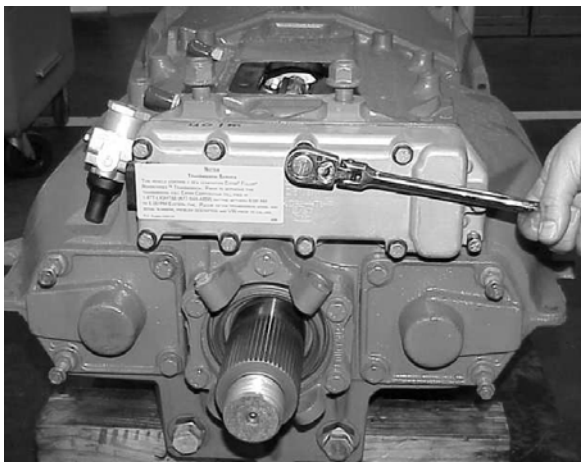
How to Remove the ECU

Special Instructions

None

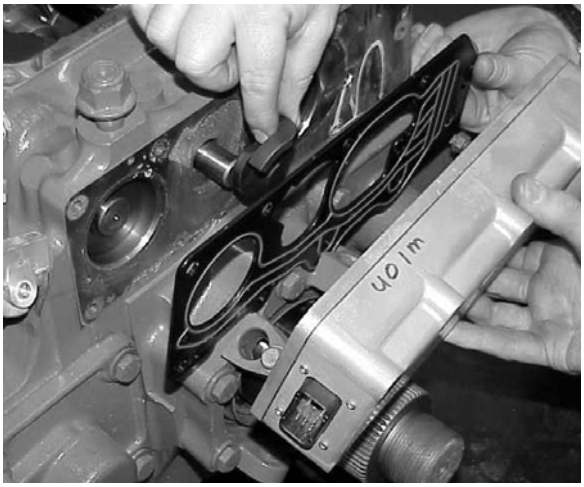
Special Tools

- Typical Service Tools



Procedure -

1. Place the transmission in the reverse gear position.
2. Drain the vehicle air tanks.
3. Disconnect the vehicle wire harness connector from the ECU using a 1/4" nut driver.
4. Remove the nine ECU capscrews.



5. Remove the ECU, spacer plate, sealing plate, and actuating washer.

How to Install the ECU

Special Instructions

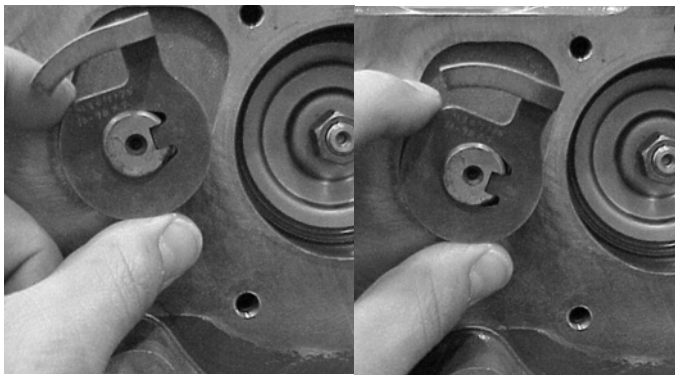
None

Special Tools

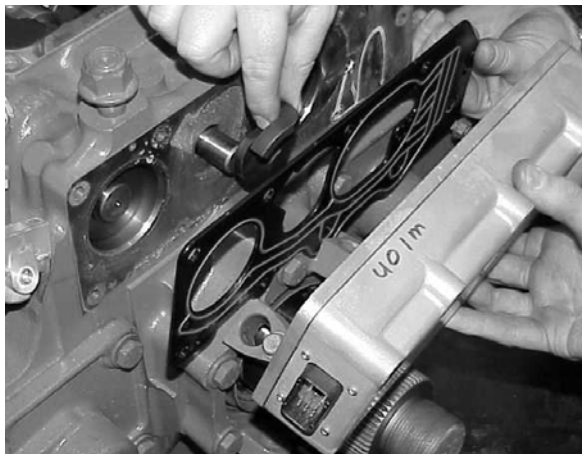
- Typical Service Tools

Procedure -

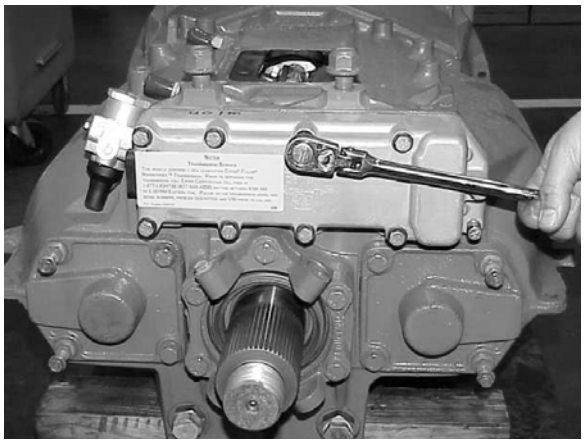
1. Place the transmission in the reverse gear position.
2. Position the actuating washer onto the end of the shift shaft and make sure it is rotated fully clockwise.



3. Assemble the ECU, spacer plate, and sealing plate.
4. Position the ECU assembly over the actuating washer so the finger lines up with the range position sensor.



5. Make sure the ECU is fully seated against the case and install the nine ECU capscrews.
6. Torque the ECU capscrews to 20-23 lb-ft (27-31 Nm).
7. Attach the vehicle interface harness to the ecu, tighten connector screw to 7–13 lb-in (.8–1.5 Nm).



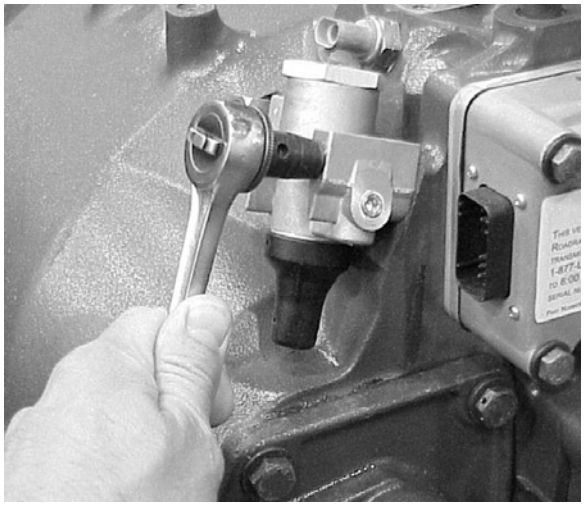
How to Remove the Air Filter/Regulator

Special Instructions

The air filter/regulator has two (2) O-rings located between the filter/regulator and the transmission case mounting surface.

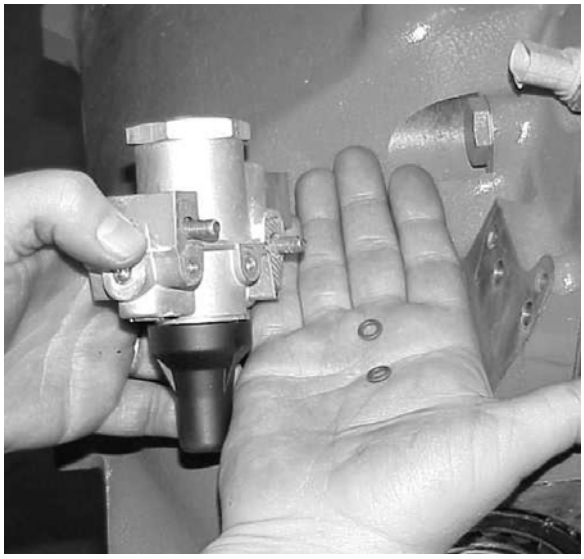
Special Tools

- Typical Service Tools



Procedure -

1. Drain pressure from the vehicle air system.
2. Disconnect the air supply line from vehicle air system.
3. From the air filter/regulator, remove the two (2) capscrews.



4. From the main case, remove the air filter/regulator.
5. From the air filter/regulator, remove the two (2) O-rings.
6. Inspect the O-rings for cracks or distortion.
7. Remove the air supply fitting.

How to Install the Air Filter/Regulator

Special Instructions

The air filter/regulator has two (2) O-rings located between the filter/regulator and the transmission case.

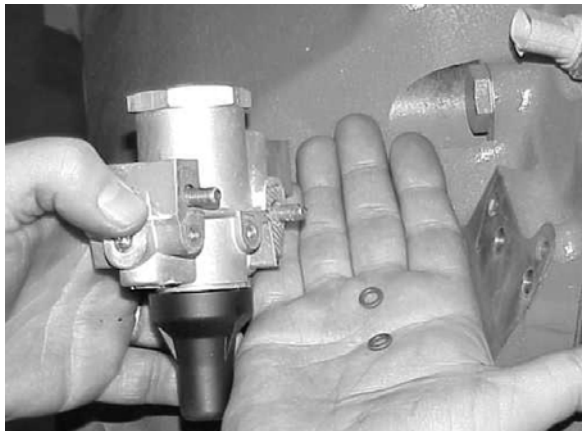
Special Tools

- Typical Service Tools

Procedure -

1. Insure the two o-rings are positioned in the recessed ports located on the air filter/regulator mounting surface on the transmission case.

2. Install the vehicle air supply line fitting with pipe thread sealant and position for correct air line routing.



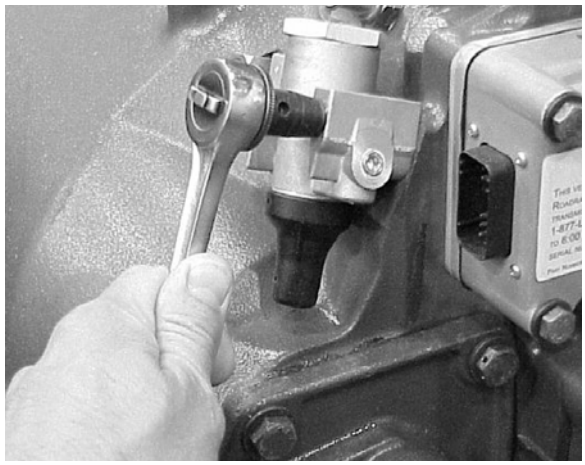
3. Position the air filter/regulator assembly on the transmission case.

4. Apply Eaton/Fuller Sealant #71205 or equivalent to the two (2) retaining capscrews.

5. Install the two (2) retaining capscrews, tighten to 9-10 lb-ft (12-14 Nm) of torque.

6. Connect the air supply line from the vehicle air supply.

7. Charge the vehicle air system and inspect for air leaks.



How to Remove the Shift Knob

Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -

1. Pull down on the skirt portion of the shift knob to reveal the electrical connector and the jam nut.

2. Disconnect the three-wire electrical connector.
3. Loosen the jam nut at the base of the knob.

4. Unscrew the knob from the shift lever.
5. If the skirt is to be removed from the lever, note the location of the wire harness or harnesses in the skirt slots, and remove the jam-nut before removing the skirt section.

How to Install the Shift Knob

Special Instructions

None

Special Tools

- Typical Service Tools

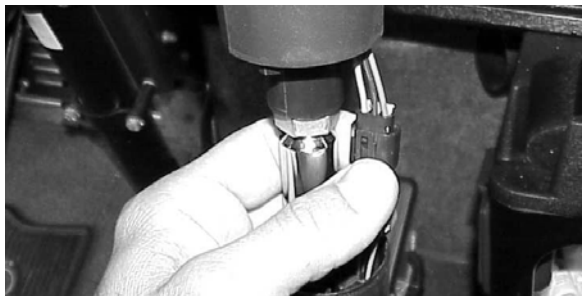
Procedure -

1. Slide the skirt over the shift lever and position the electrical harness or harnesses into the appropriate slots, so the alignment pins on the skirt match the alignment holes in the knob when installed.

2. Thread the jam nut and shift knob on the shift lever. Position the shift knob so the splitter button faces the driver's side of the vehicle.

3. Tighten the jam nut against the bottom of the shift knob and torque the nut to 35-45 lb-ft.

4. Attach the electrical connector from the lever harness to the shift knob.



5. Slide the skirt up to the shift knob and position the electrical connector in the skirt. Line up the pins from the skirt to the holes on the shift knob and snap the skirt on the shift knob.

   Note: The shift knob skirt is designed to snap correctly on the knob only one way. If it is installed in the opposite direction it will not line up correctly.

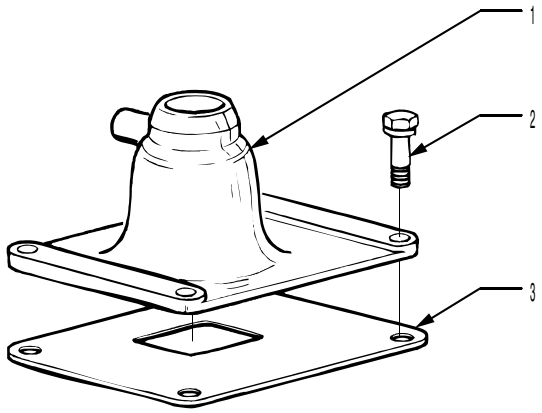
How to Remove the Gear Shift Lever/Remote Shift Control

Special Instructions

Remote control housings are removed the same way as gear shift levers.

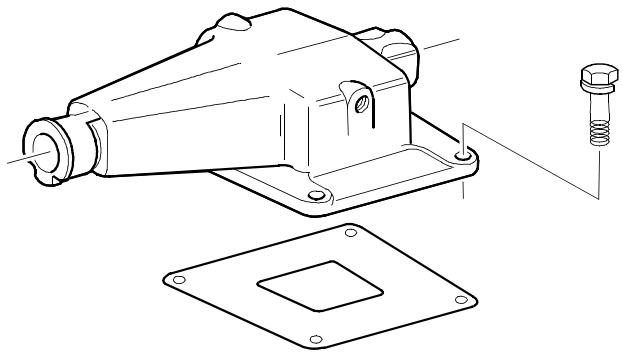
Special Tools

- Typical Service Tools

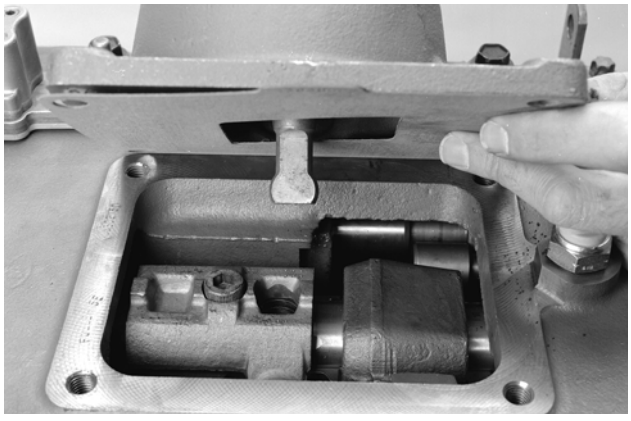


Procedure -

1. Remove the four retaining capscrews from the shift lever base.
    1. Housing
    2. Capscrew
    3. Gasket



2. To break the gasket seal, lightly strike the gear shift control housing.



3. Remove the gear shift lever control housing to expose the gasket.
4. Remove the gasket and clean the surface area the replacement gasket will contact.

How to Install the Gear Shift Lever/Remote Shift Control

Special Instructions

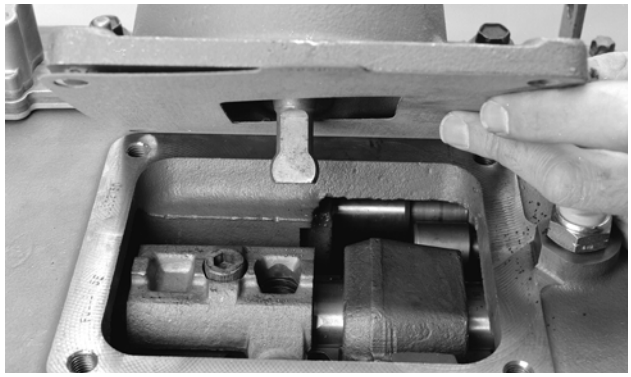
Remote control housings are installed the same way as gear shift levers.

Special Tools

- Typical Service Tools

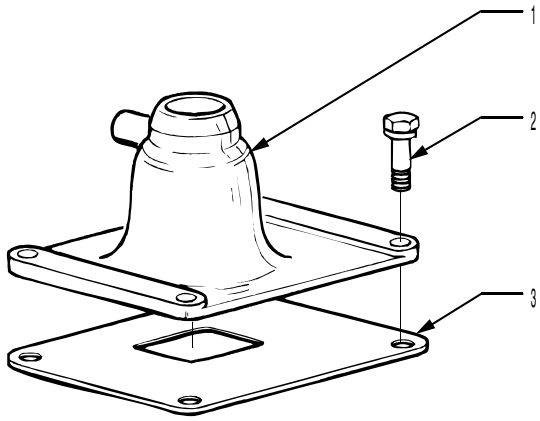
Procedure -

1. Position a new gasket on the shift lever/shift control housing mounting surface.

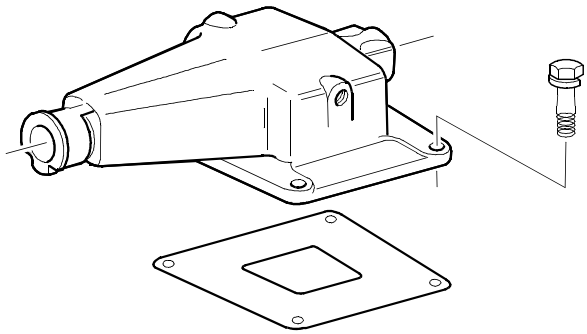


2. Install the gear shift lever base/shift control housing. Make sure the tip (finger) of the shift lever fits into the round hole in the shift block.

3. Apply Eaton®Fuller® thread sealant #71205 or equivalent to the retaining capscrews.
   1. Housing
   2. Capscrew
   3. Gasket



4. Install the retaining capscrews and tighten to 40-45 lb-ft (54-61 Nm) of torque.



Final Check

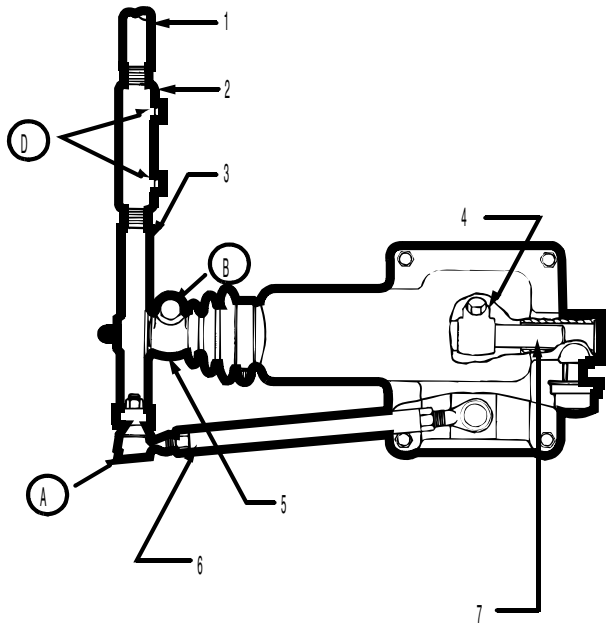
Make sure the capscrews are properly torqued.

Make sure you can shift the transmission.

How to Adjust the Remote Shift Control (LRC Type)

Special Instructions

The following is a typical adjustment procedure for an LRC type slave control. It is recommended that the OEM Chassis Service Manual be consulted first.



Procedure -

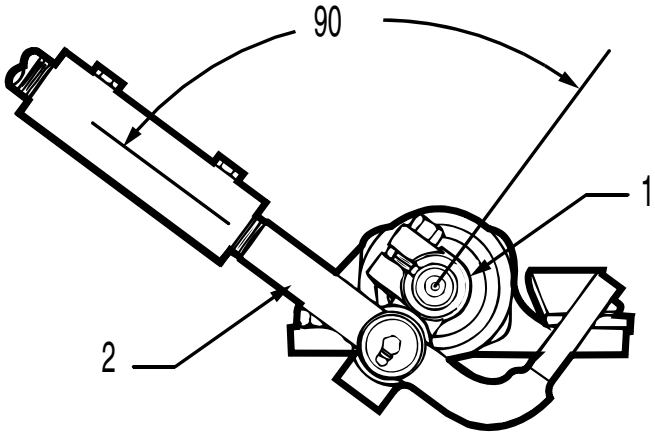
1. Move the gear shift lever forward or backward to the neutral position.

2. Move the gear shift lever sideways, toward reverse, until you feel resistance from the reverse plunger spring. DO NOT shift to reverse. The shift finger must remain in this position while you are making all the adjustments.

3. Remove the cotter pin, castle nut and ball joint A from the selection lever. Do not remove the ball joint from the pivot link.

4. Loosen the capscrew B and remove the shift arm from the inner shift shaft. Do not disconnect the selection lever from the shift arm.

    1. Reach Rod
    2. Turnbuckle
    3. Selection Lever
    4. Inner Shift Finger
    5. Shift Arm
    6. Pivot Link Assembly
    7. Inner Shift Shaft



5. Turn the shift arm until it is at a right angle (90°) to the selection lever as viewed from the side.

    Note: Ideally, the shift arm should be adjusted 90° to the selection lever as described, but in some chassis configurations it may be necessary to index the shift arm in the vertical position. Indexing the shift lever is done to prevent shift lever jump out. This type of adjustment will cause an unequal amount of gear shift lever travel between neutral and a forward lever position as compared to neutral and a rearward lever position.

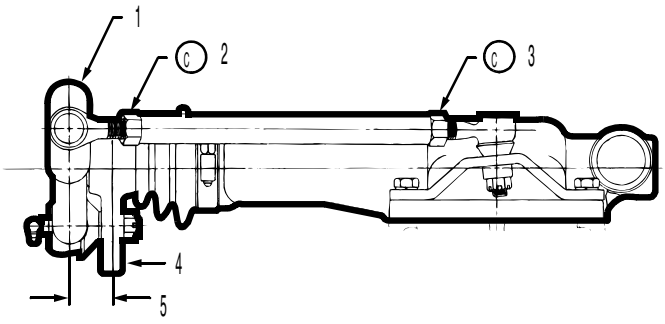
    1. Selection Lever
    2. Shift Arm

6. Install the shift arm on the splines of the inner shift shaft. You may have to move the shift arm 4° or 5° to align the splines of the two parts. Disregard any movement of the gear shift lever at this point. The gear shift lever will be adjusted later.

7. Tighten the capscrew B on the shift arm.

8. Connect the pivot link assembly ball joint to the selection lever. Secure it with the castle nut and cotter pin.

9. Loosen the jam nuts C on the pivot link.
   1. Selection Lever
   2. L.H. Thread
   3. R.H. Thread
   4. Shift Arm
   5. Parallel



10. Check to be sure the inner shift finger is still in place.

11. Rotate the pivot link until the curved end of the selection lever is parallel with the shift arm as viewed from the rear .

12. Tighten the pivot link jam nuts C .

13. Loosen both capscrews on the turnbuckle D .

14. Check to be sure inner shift finger is still in place.

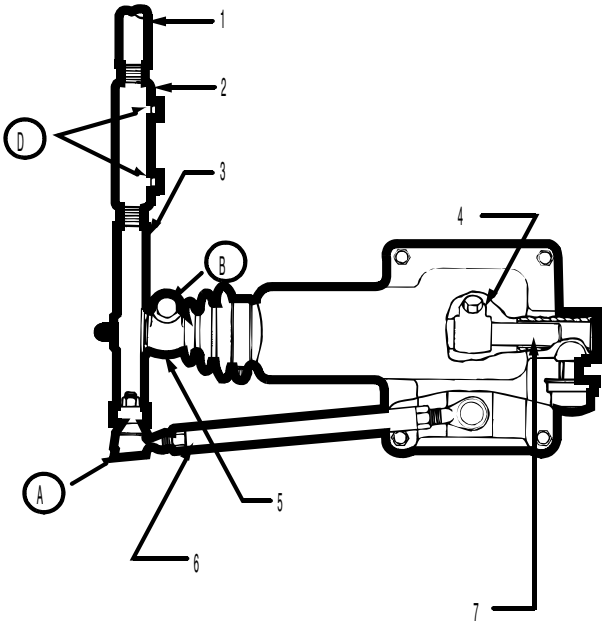
15. Rotate the turnbuckle to obtain the proper forward-backward neutral position of the gear shift lever in the cab.

16. Tighten one turnbuckle D capscrew .

17. Move the gear shift lever to the desired position.

18. Turn the second turnbuckle D capscrew.

19. Check for linkage obstructions in all gear positions.



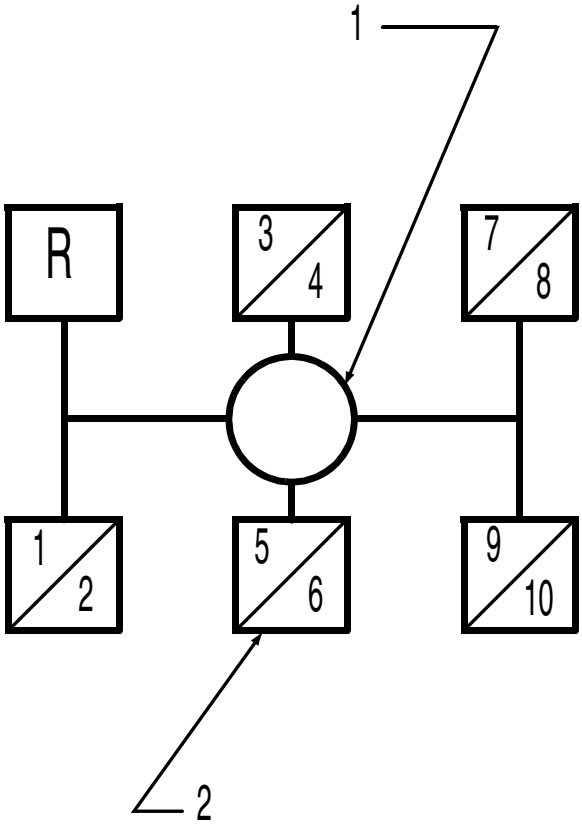
Neutral Switch Operation and Testing

Special Instructions

The neutral switch is a normally closed switch. An electrical current flows through it when the transmission shifter is in the neutral position. When the transmission shifter is in gear, the switch is open and no current flows through it. Likewise, the switch is open when the ball is depressed. The switch is actuated by the shift rail.

Special Tools

- Typical Service Tools



Procedure -

1. Disconnect the wiring from the switch.
2. Connect an ohm meter to check for continuity or a small reading.
3. Place the transmission shift lever in the neutral position. The ohm meter should register continuity or a small reading. If it does, go to the next step. If it does not, remove the switch and replace it.
4. Shift the transmission into all gear positions. The ohm meter should read open or infinity. If it does not, remove the switch. Then, depress the switch ball and check for continuity. The ohm meter should read open or infinity when the ball is depressed.
    1. Central Neutral Position (Neutral Switch Active)
    2. Shift Position Diagram
5. Look into the neutral switch hole and verify the neutral switch pin moves as the transmission is shifted from neutral into gear.

    If it does, replace the switch.

    If not, remove and inspect the neutral switch pin for excessive wear. Replace, if necessary, or refer to bench service procedures for disassembly of the shift shaft for inspection.

How to Remove the Neutral Switch

Special Instructions

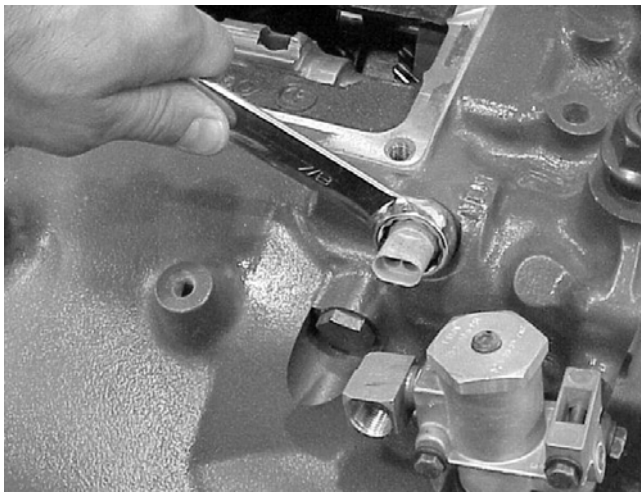
None

Special Tools

- Typical Service Tools

Procedure -

1. Remove the switch using a 7/8" deep well socket or box end wrench.



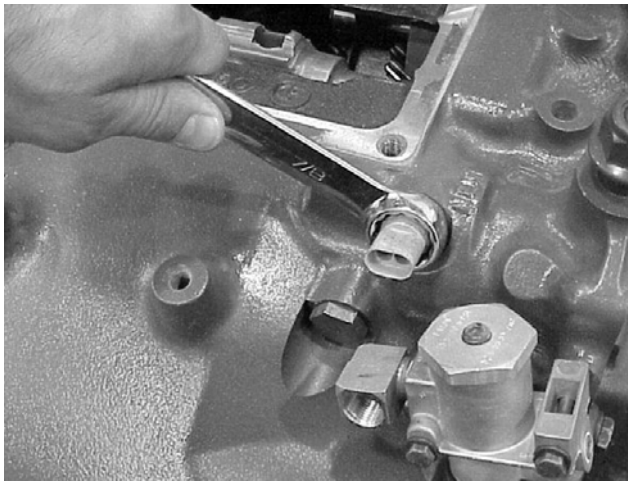
How to Install the Neutral Switch

Special Instructions

None

Special Tools

- Typical Service Tools



Procedure -

1. Install a new gasket.
2. Install the neutral switch. Tighten it to 15-20 lb-ft (20-27 Nm) of torque.
3. Connect the wiring to the switch.

Reverse Switch Operation and Testing

Special Instructions

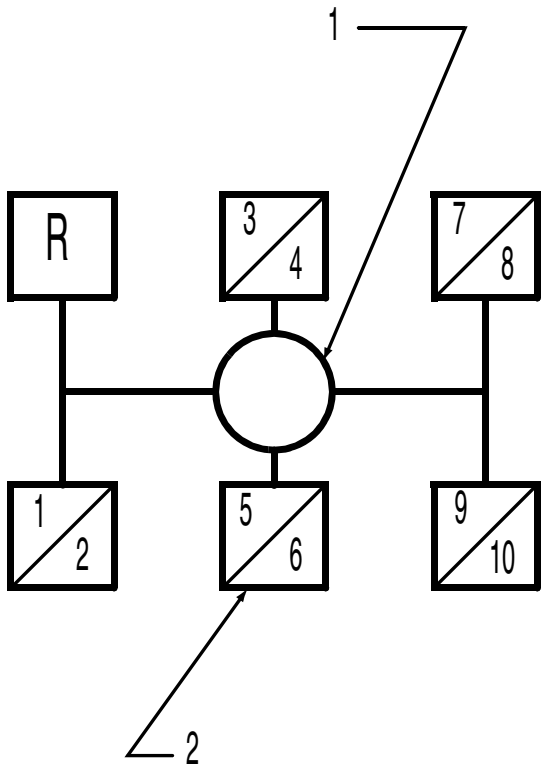
The reverse switch is a normally open ball switch. When the transmission is shifted into reverse, a ramp on the reverse yoke bar contacts and raises a pin. The pin depresses the ball on the switch, which closes the switch contact, allowing current to flow through the switch and light up the vehicle's backup lights.

Special Tools

- Typical Service Tools

Procedure -

1. Disconnect the wiring from the switch.
2. Connect an ohm meter to check for continuity.
3. Place the transmission shift lever in any position except reverse. If the switch is working properly, the ohm meter should read open or infinity. If it is not, remove the switch and recheck it for continuity. Replace as necessary.
    1. Reverse Position (Rev Switch Active)
    2. Shift Position Diagram
4. Place the transmission shift lever in the reverse position. If the switch is working properly, the ohm meter should register continuity, or a small reading. If it does not, remove the switch and recheck it for continuity. Replace as necessary. Also, check for sticking or excessive wear of the reverse pin.



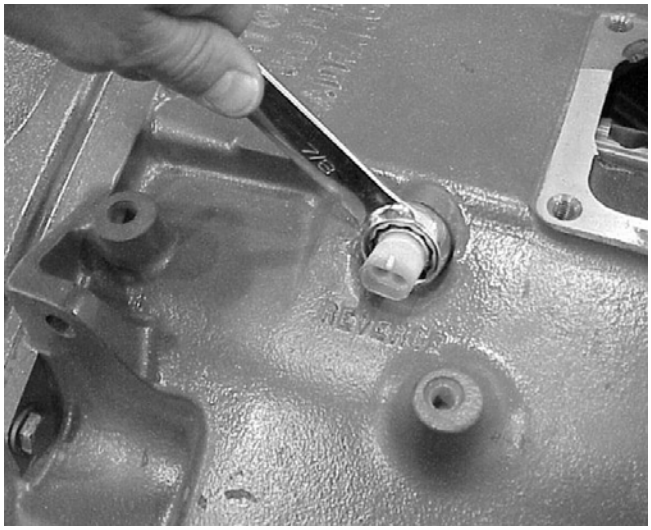
How to Remove the Reverse Switch

Special Instructions

None

Special Tools

- Typical Service Tools.



Procedure -

1. Remove the switch using a 7/8" deep well socket or box end wrench.

How to Install the Reverse Switch

Special Instructions

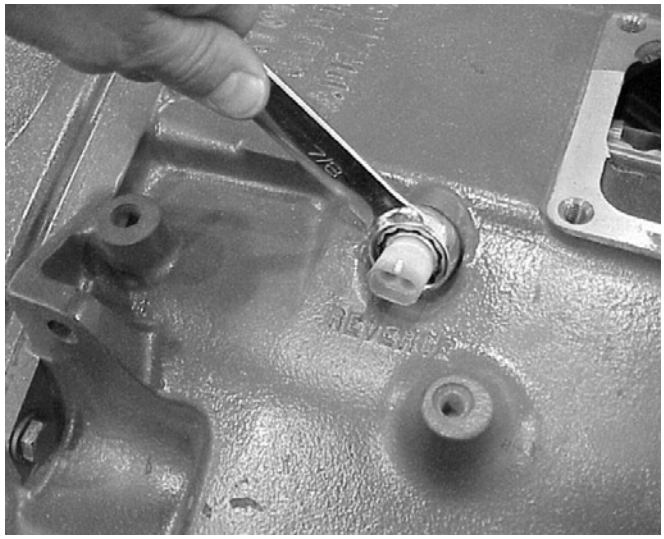
None

Special Tools

- Typical Service Tools

Procedure -

1. Insert the reverse pin in the reverse switch bore (only if pin is removed).
2. Install new gasket on switch.
3. Install the reverse switch. Tighten it to 15-20 lb-ft (20-27 Nm) of torque.
4. Connect the wiring to the switch.



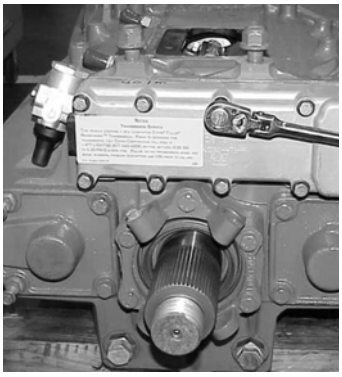
How to Remove the Shift Shaft Seal

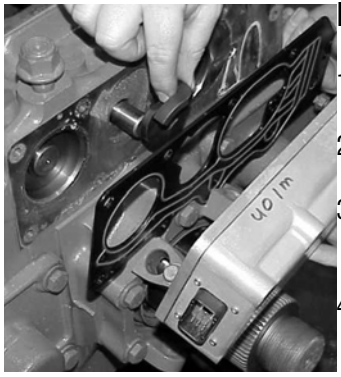
Special Instructions

None

Special Tools

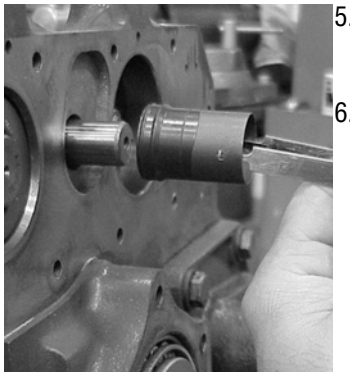
- Typical Serivce Tools





Procedure -

1. Place the transmission in the reverse gear position.
2. Drain the vehicle air tanks.
3. Disconnect the vehicle wire harness connector from the ECU using a 1/4" nut driver.
4. Remove the nine ECU capscrews.



5. Remove the ECU, spacer plate, sealing plate, and actuating washer.
6. Locate the two opposing holes on the metal sleeve of the seal assembly and insert the tips of the seal pulling tool (Tool ID T11, SPX P/N J44099). Then slide the seal out of the shift shaft bore.

How to Install the Shift Shaft Seal

Special Instructions

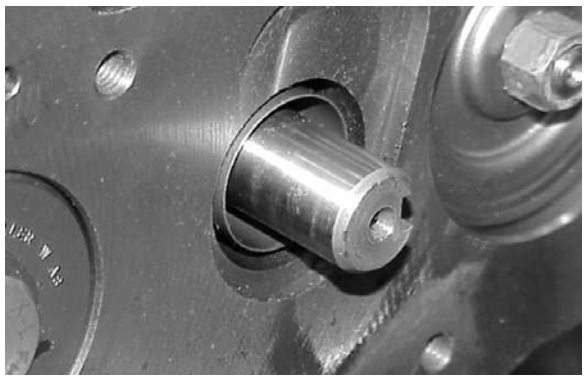
None

Special Tools

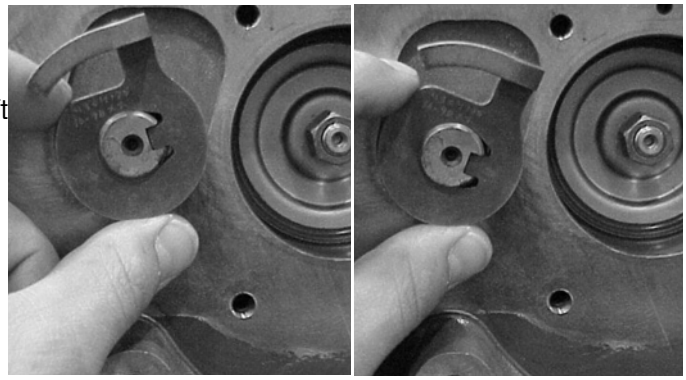
- Typical Service Tools

Procedure -

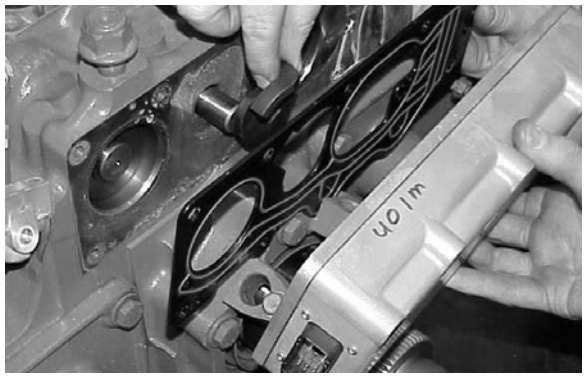
1. **Lubricate** the seal with transmission oil.
2. Slide the seal into the shift shaft bore until it is flush with the edge of the hole.

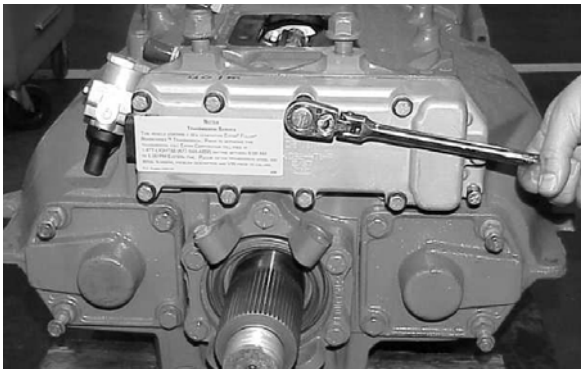


3. Place the transmission in the reverse gear position.
4. Position the actuating washer onto the end of the shift shaft and make sure it is rotated fully clockwise.



5. Assemble the ECU, spacer plate, and sealing plate.
6. Position the ECU assembly over the actuating washer so the finger lines up with the range position sensor.





7. Make sure the ECU is fully seated against the case and install the nine ECU capscrews.

8. Torque the ECU capscrews to 20-23 Lb-ft (27-31 Nm).

9. Attach the vehicle interface harness to the ECU and tighten connector screw to 7–13 lb-in (.8–1.5 Nm).

How to Remove the Oil Seal - Magnetic Speedometer

Special Instructions

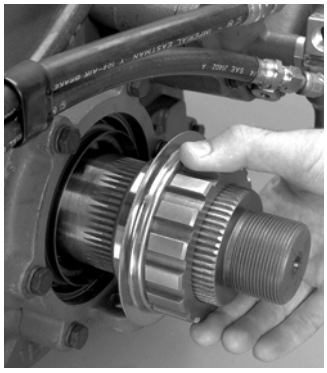
Prior to replacing the seal, carefully inspect the transmission to make sure the oil leakage is coming from the seal. Pay particular attention to the speedometer parts, rear bearing cover gasket surfaces, rear countershaft bearing covers, and shift bar housing. For additional information on rear seal service, refer to the Seal Maintenance Guide TCSM-0912.

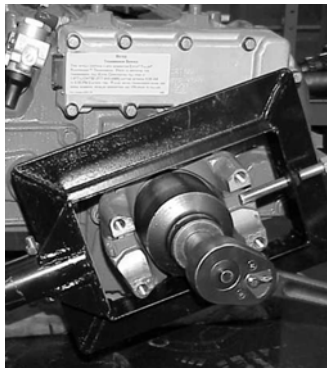
Special Tools

- Brass drift
- Item T1: Output yoke puller
- Item T15: Slide hammer

See Tool Information

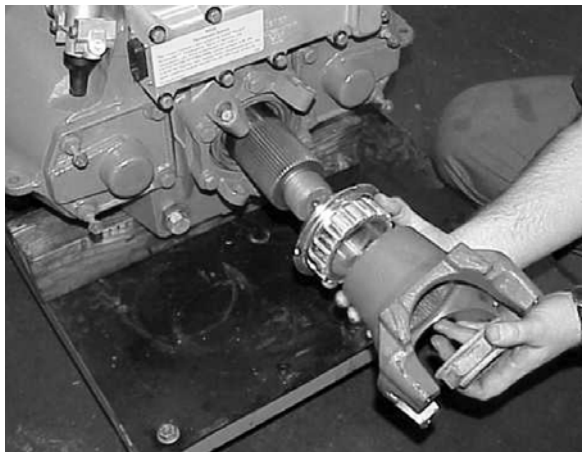
Procedure -

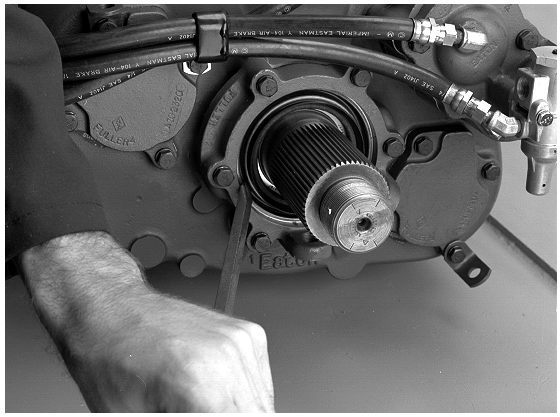




1. Disconnect the driveshaft and U-joint from the output yoke according to the OEM or driveshaft manufacturer's instructions.
2. Shift the transmission into 1st gear or low gear (Low Range) to prevent the output yoke from turning when loosening the output yoke nut.
3. Remove the output yoke nut using a 70 mm or 2 3/4" socket.
4. Use an output yoke puller to remove the output yoke (Tool ref. ID T1).
5. Remove the speedometer sensors from the rear bearing cover.

   TIP: If the sensor is a thread in type, note the number of threads exposed so the sensor can be reinstalled to the same depth. If the sensor is a push in type, remove the hold down capscrew and pull the sensor out of the bore.
6. Remove the speedometer rotor/seal sleeve and the O-ring.





7. Pry the seal out using a large screwdriver or prybar in the metal groove of the seal.

   NOTE: The seal will be damaged during removal and must be replaced.

8. Remove seal slinger from the speedometer rotor/seal sleeve using a brass drift and hammer.

9. Inspect all parts of the oil seal for wear, scratches, burrs, or other damage.

   NOTE: Replace the seal surface if it is worn or damaged. Do not attempt to salvage the seal mating surface with crocus cloth, filing, etc.

How to Install the Output Shaft Oil Seal - Magnetic Speedometer

Special Instructions

To prevent oil leaks, do not touch the seal lip, and make sure the seal driver is clean.

Special Tools

- Oil seal driver
- Oil seal slinger driver

See Tool Information, Eaton Aftermarket Tools for part numbers.

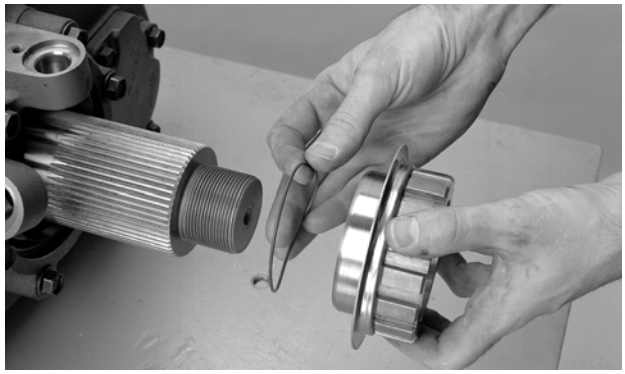
Procedure -

1. Place a seal on the oil seal driver, and drive the new seal into the rear bearing cover. The seal is fully installed when the flange on the seal is flush with the shoulder in the bore.

2. Install the new slinger on speedometer rotor/seal sleeve using a slinger driver.

3. If previously removed, install the O-ring over the output shaft.

   Note: To avoid creating oil leaks, make sure the speedometer rotor/seal sleeve is free from contaminants.



4. Install the speedometer rotor/seal sleeve over the output shaft, and install the speedometer sensors.

5. Install the output yoke over the output shaft. The yoke should slide on and stop before contacting the speedometer rotor. As the output shaft nut is installed, the output yoke will contact the speedometer rotor.

6. Inspect the output shaft nut for damage and wear. If the nylon locking material is damaged or excessively worn, use a new output nut.

   Note: The nylon locking material must be in good condition so the nut does not loosen when the vehicle is in use.

7. Lightly oil the output shaft threads and the output nut threads, and install the nut. Torque the nut to 450-500 Lb - ft (610-677 Nm).

8. Connect the driveshaft and U-joint according to the OEM or driveshaft manufacturer's instructions.

How to Remove the Output Bearing Cover

Special Instructions

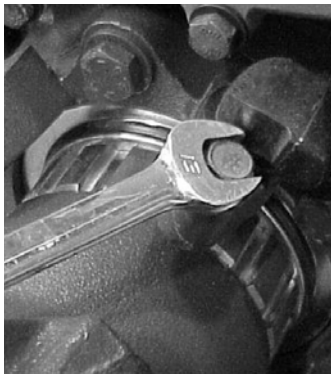
None

Special Tools

- Typical Service Tools

Procedure -

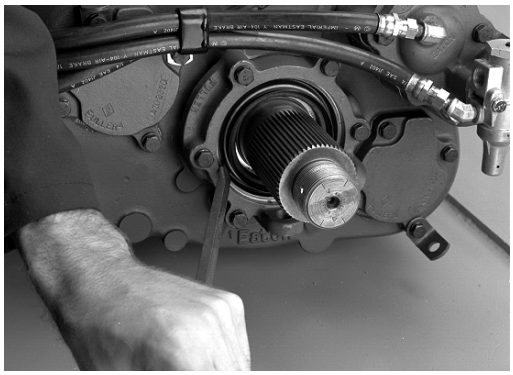
1. Disconnect the driveshaft and universal joint from the output yoke according to OEM or driveshaft manufacturer's instructions.
2. Drain the transmission oil.
3. Shift the transmission into 1st gear or low gear to prevent the output yoke from turning when you loosen the output yoke nut.
4. Remove the output yoke nut using a 70 mm or 2 3/4" socket.
5. Remove the output yoke. Use an output yoke puller (Tool ref. ID T1).
6. Remove the speedometer sensor from the rear bearing cover.
7. Remove the six bearing cover capscrews.



8. Use a pry-bar to break the bearing cover loose from the case, note the orientation of the speed sensor openings for later re-assembly.

   Note: If the sensor is a thread in type, note the number of threads exposed so the sensor can be reinstalled to the same depth. If the sensor is a push in type, remove the hold down capscrew and pull the sensor out of the bore.

9. Remove the speedometer rotor/seal sleeve and the O-ring.



10. Pry the seal out using a large screwdriver or prybar in the metal groove of the seal.

    Note: The seal will be damaged during removal and must be replaced.

11. Remove seal slinger from the speedometer rotor/seal sleeve using a brass drift and hammer.

12. Inspect all parts of the oil seal for wear, scratches, burrs, or other damage.

    Note: Replace the seal surface if it is worn or damaged. Do not attempt to salvage the seal mating surface with crocus cloth, filing, etc.

How to Install the Output Bearing Cover

Special Instructions

None

Special Tools

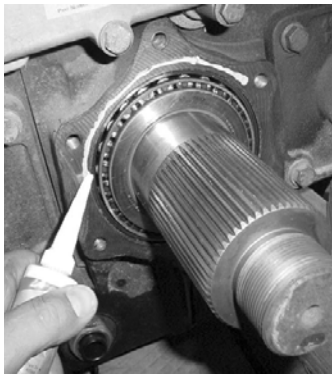
- Typical Service Tools

Procedure -

1. Thoroughly clean and inspect the sealing surfaces on the transmission case and the output bearing cover for gouges or distortion, replace if necessary.

2. Apply RTV sealant per application guidelines to the transmission case.

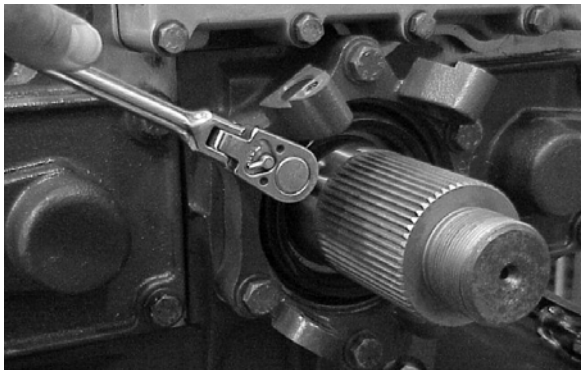
3. Place the bearing cover on the case in the same orientation as the one removed.

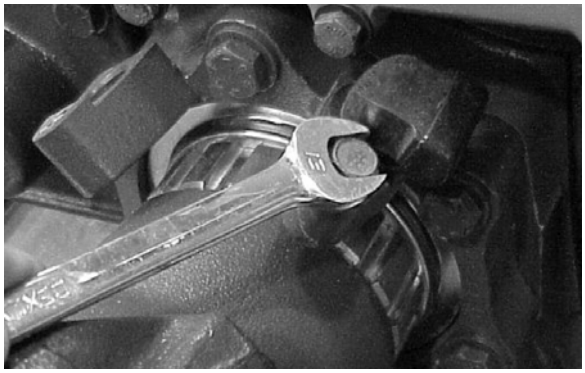


4. Install the six bearing cover retaining capscrews.

5. Torque the capscrews to 47-52 lb-ft (63-70 Nm).

6. Make sure the output shaft O-ring seal is in place and install the speedometer rotor/spacer and output yoke. The yoke should slide on and stop before contacting the speedometer rotor. As the output shaft nut is installed, the output yoke will contact the speedometer rotor and output yoke nut. Tighten the output yoke nut to 450-500 lb-ft (610-677 Nm).





7. Install the output speed sensor and retaining capscrew. Tighten capscrew to 20-23 lb-ft (27-31Nm).

8. Add required amount of oil per transmission oil fill specifications.

9. Connect vehicle driveshaft to output yoke per vehicle OEM and driveshaft manufacturer's instructions.

How to Remove the Oil Cooler Fitting

Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -

1. Locate the vehicle transmission cooler lines running to the rear of the transmission.

   If the vehicle is equipped with cooler line shut-off valves, close the cooler shut-off valves and drain the cooler lines.

   If the vehicle is not equipped with cooler line shut-off valves, completely drain the engine cooling system and cooler lines running to the transmission according to vehicle OEM guidelines.

2. Remove the transmission drain plug and drain the transmission oil.

3. Disconnect the cooler lines at the rear of the transmission. Remove the cooler hose adapter fittings that thread into the transmission cooler interface fittings. Note the orientation of the hose fittings for future reassembly.

How to Install the Oil Cooler Fitting

Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -

1. Install new O-rings on existing fittings or replace the complete fittings if damaged.

2. Generously coat the cooler fitting internal and external O-rings with Eaton Fuller silicon lubricant #71206 or equivalent before installing them into the transmission case.

3. Pilot the fitting over the ends of the cooler tube and slide into the threaded fitting bore, until the threads on the fitting contact the threads in the bore. Because of the tight O-ring fit both into the bore and over the end of the tube, you must push the fitting into the borewhile turning to engage the threads. Tighten fittings to 40-50 lb-ft (54-67 Nm).

4. Install the O-ring type cooler hose adapter fittings into the transmission interface fittings. Then adjust the inlet and outlets in the direction they were removed, and tighten the locking nuts on the fittings.

5. Install the cooler hoses to the transmission and open the cooler line shut-off valves, or refill the vehicle cooling system according to the vehicle OEM guidelines.

   Replace the transmission drain plug and tighten to 35-50 lb-ft (47-67 Nm). Refill the transmission to the required lubrication fill level.

How to Remove the Auxiliary Countershaft Bearing Cover

Special Instructions

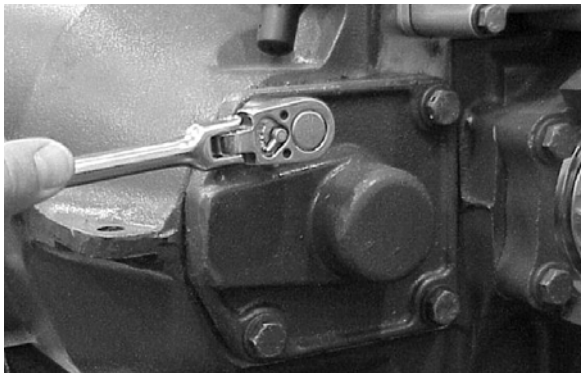
None

Special Tools

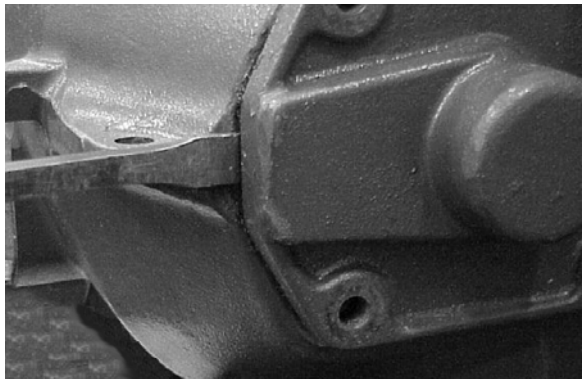
- Typical Service Tools

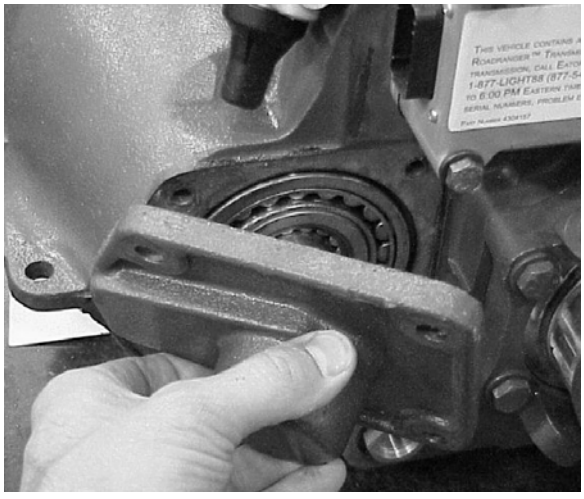
Procedure -

1. Drain the transmission oil.
2. Remove the four bearing cover capscrews.



3. Use a pry bar between the case and bearing cover to break the bearing cover seal.





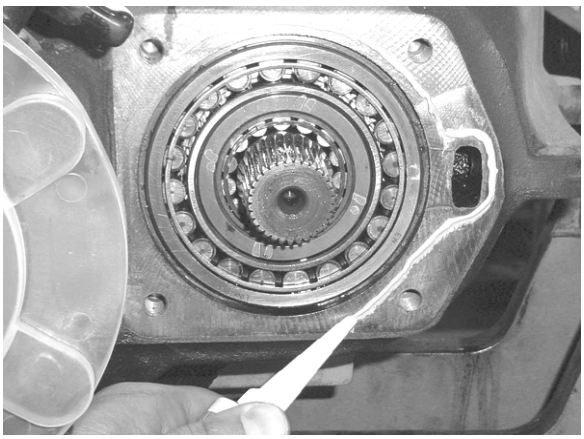
How to Install the Auxiliary Countershaft Bearing Cover

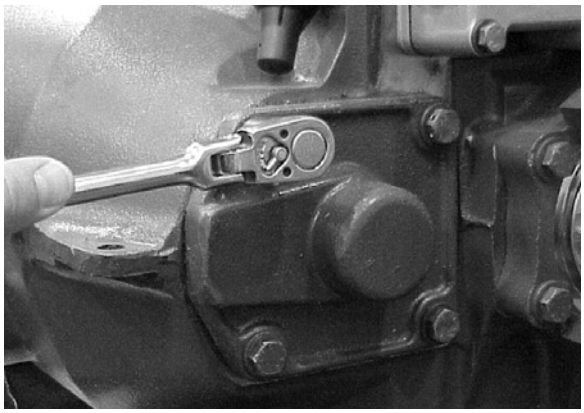
Special Instructions

None

Special Tools

- Typical Service Tools





Procedure -

1. Thoroughly clean and inspect the sealing surfaces on the transmission case and the output bearing cover for gouges or distortion, replace if necessary.

2. Apply RTV sealant per application guidelines to the transmission case.

3. Install the bearing cover on the case with the lube slot in the cover lined up with the lube hole in the case.

4. Install the four bearing cover capscrews and torque to 47-52 lb-ft (63-70 Nm).

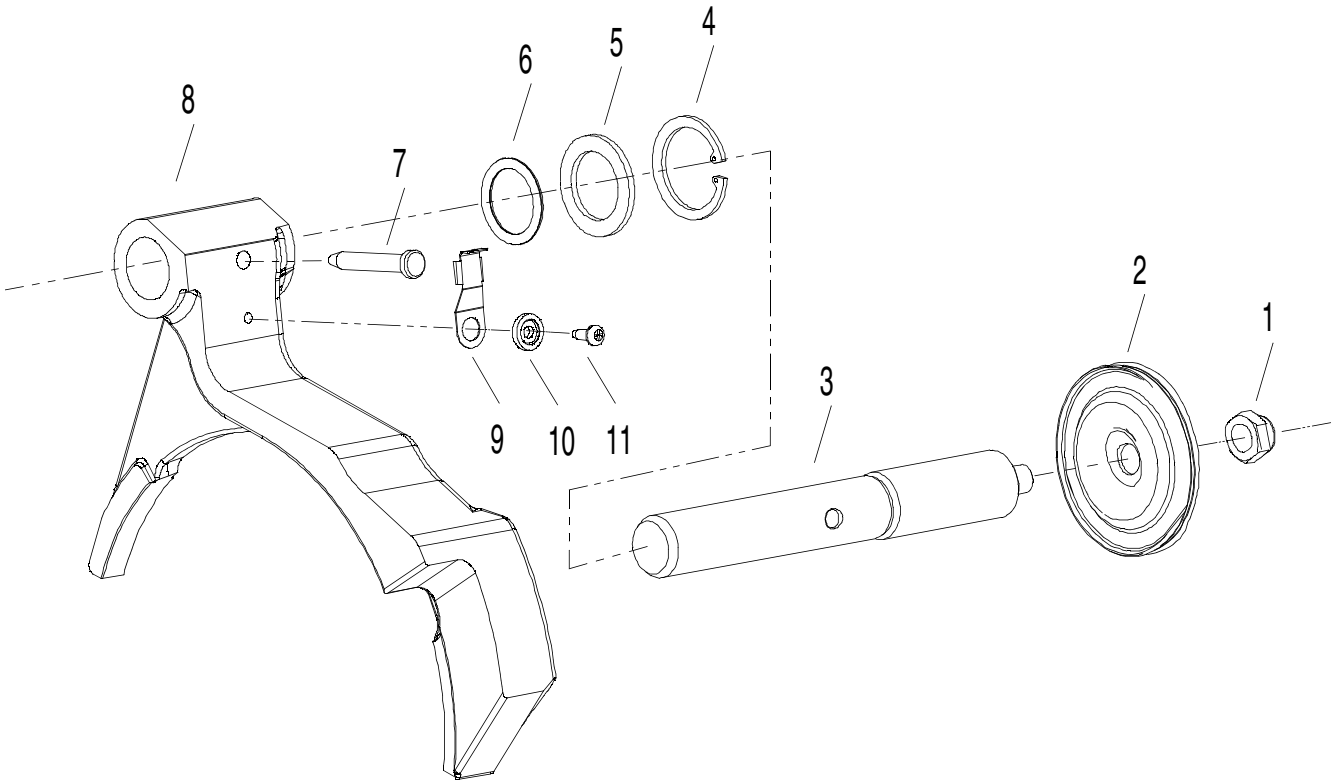
How to Remove the Range Piston and Range Bar O-Ring

Special Instructions

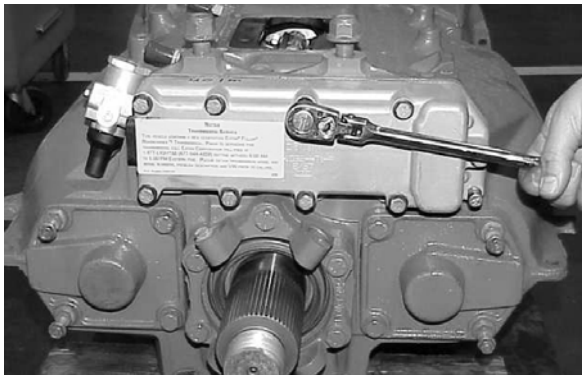
None

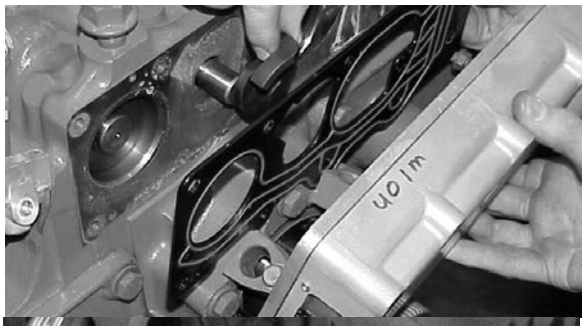
Special Tools

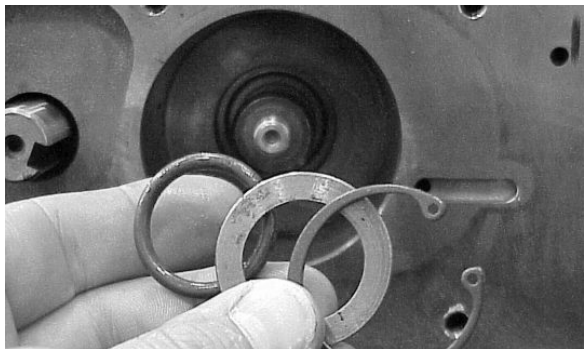
- Typical Service Tools



1. Nut
2. Piston
3. Yoke Bar
4. Snap Ring
5. Washer
6. O- Ring
7. Pin
8. Range Yoke Assy
9. Retainer
10. Step Washer
11. Screw







Procedure -

1. Place the transmission in the reverse gear position.
2. Drain the vehicle air tanks.
3. Disconnect the vehicle wire harness connector from the ECU using a 1/4" nut driver.
4. Remove the nine ECU capscrews.
5. Remove the ECU, spacer plate, sealing plate, and actuating washer.
6. Loosen the range piston retaining nut, but leave a few threads still attaching.
7. Use a rubber tipped air gun to supply air pressure to the low range air port located just to the right of the range cylinder. This forces the piston out of the range bore and allows you to remove the retaining nut and piston.
8. Remove the inner snap ring, then remove the washer and range bar O-ring using a small magnet and O-ring pick tool or small screwdriver.

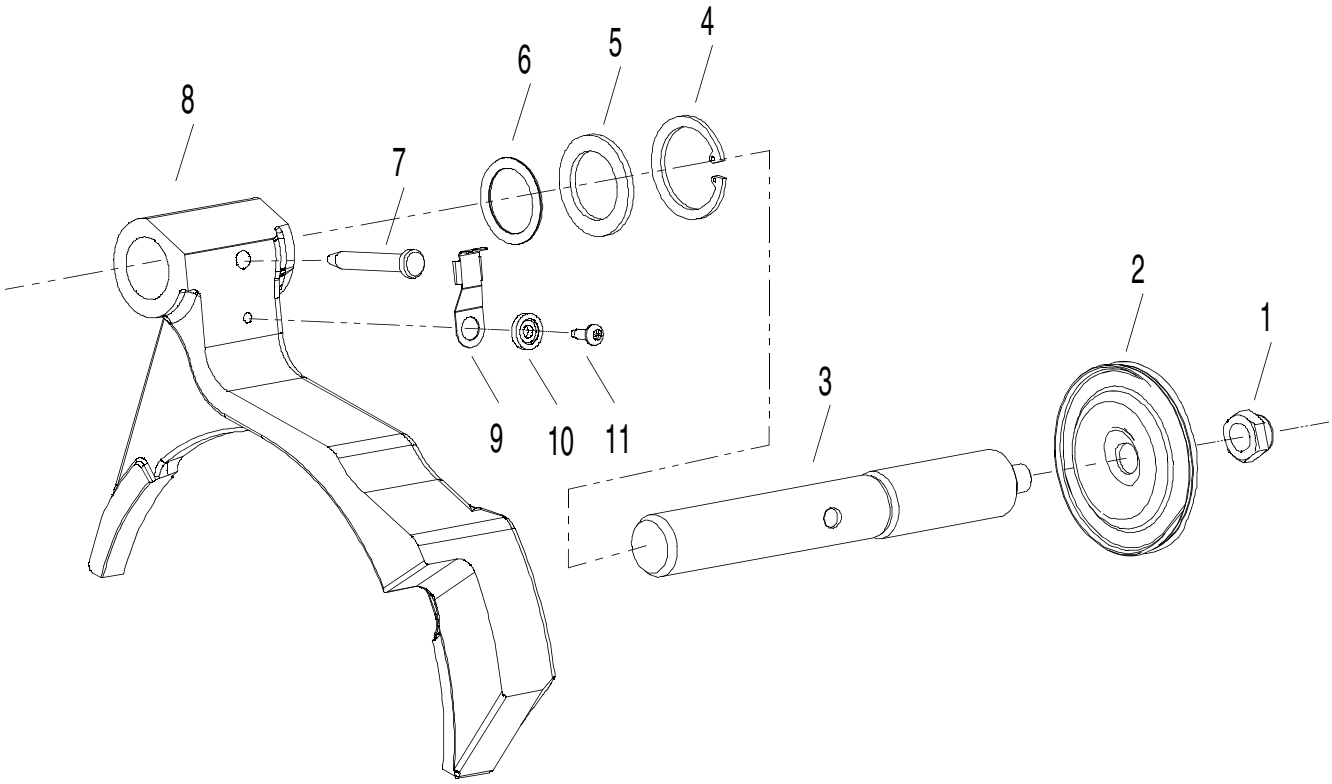
How to Install the Range Piston and Range Bar O-Ring

Special Instructions

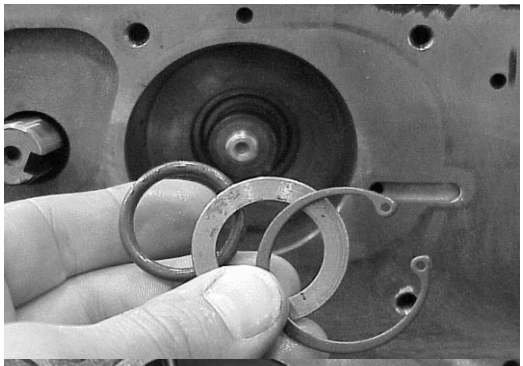
None

Special Tools

- Typical Service Tools



1. Nut
2. Piston
3. Yoke Bar
4. Snap Ring
5. Washer
6. O- Ring
7. Pin
8. Range Yoke Assy
9. Retainer
10. Step Washer
11. Screw



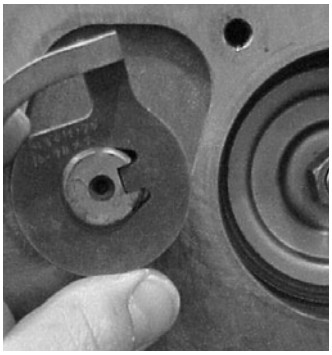
Procedure -

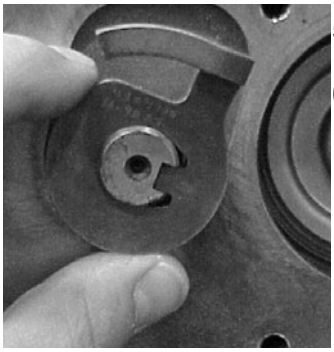
1. Apply a thin coating of silicon lube to the new range bar O-ring and install the O-ring over the range bar. Make sure it fully seats into the bore.

2. Install the washer and snap ring into the bore. Make sure the snap ring fully expands and seats into the snap ring groove.

3. Apply a thin coating of silicon lube to the outside diameter of the new range piston and install the piston on the end of the range bar with the rubberized sealing surface toward the range bar. Push the range bar and piston forward into the bore.

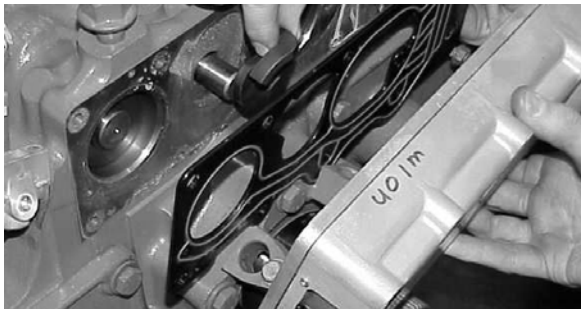
4. Install the new range piston retaining nut and torque to 25-35 lb-ft (34-47 Nm).

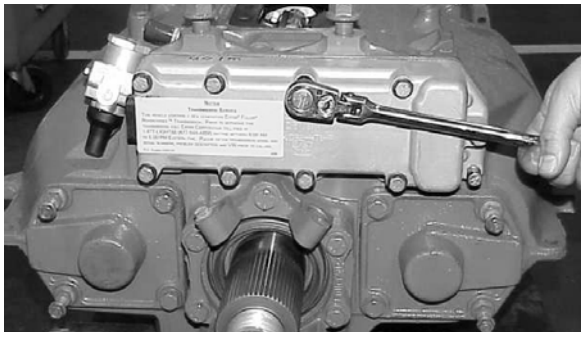




5. Place the transmission in reverse.

6. Position the actuating washer onto the end of the shift shaft and make sure it is rotated fully clockwise.





7. Assemble the ECU, spacer plate, and sealing plate.

8. Position the ECU assembly over the actuating washer so the finger lines up with the range position sensor.

9. Make sure the ECU is fully seated against the case and install the nine ECU capscrews.

10. Torque the ECU capscrews to 20-23 lb-ft (27-31 Nm).

11. Attach the vehicle interface harness to the ECU, and tighten the connector screw to 7–13 lb-in (.8–1.5 Nm).

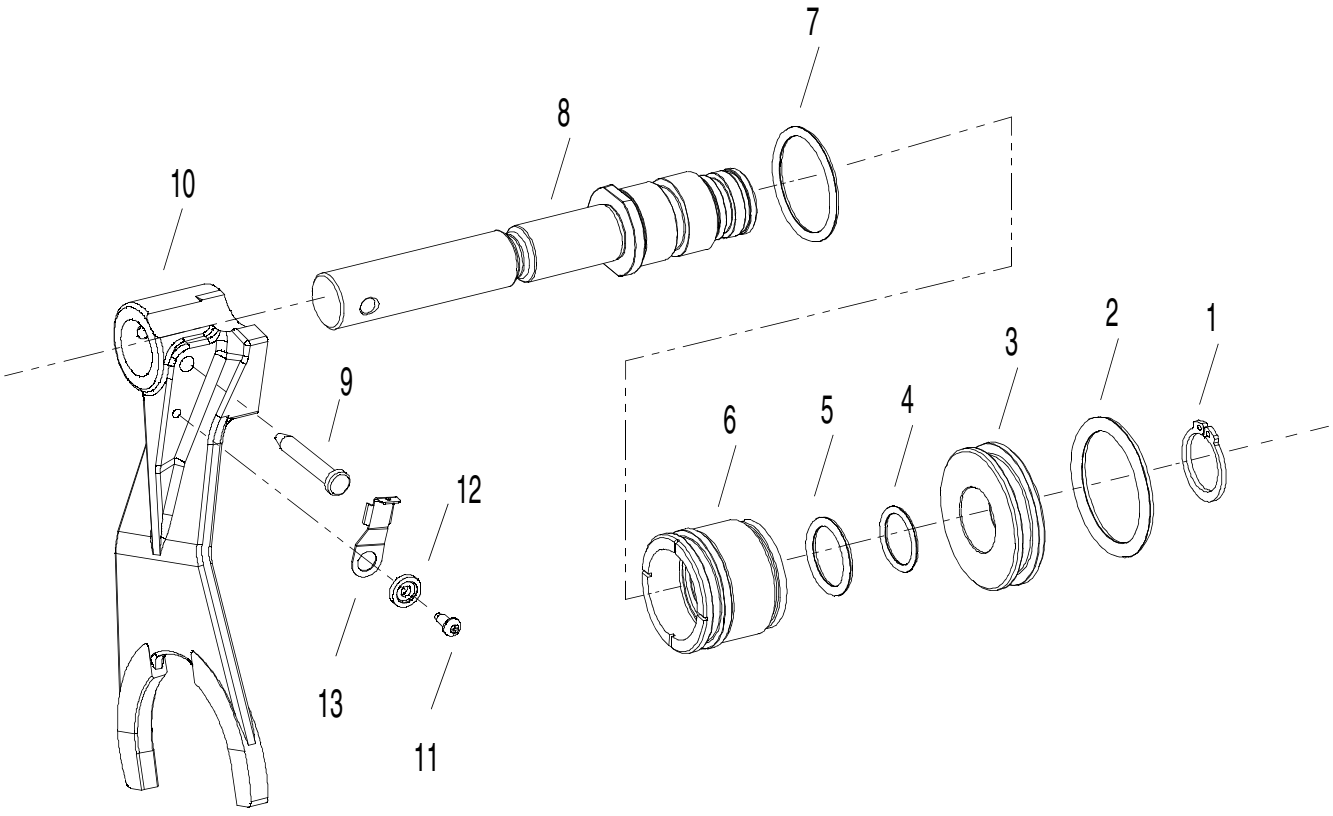
How to Remove the Splitter Piston

Special Instructions

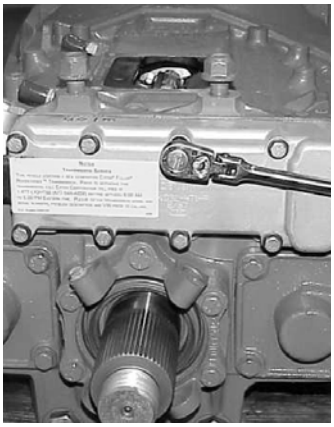
None

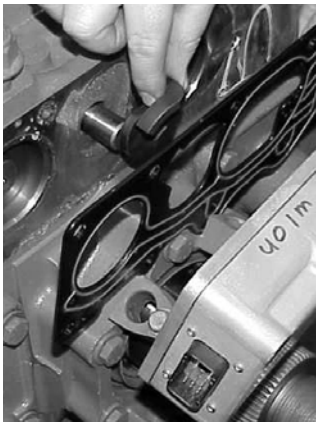
Special Tools

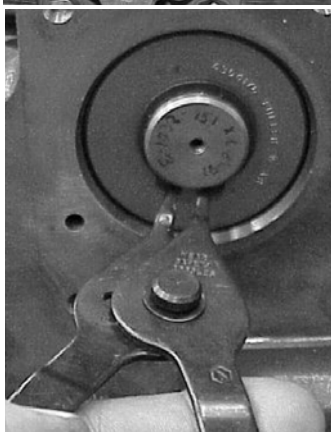
- Typical Service Tools

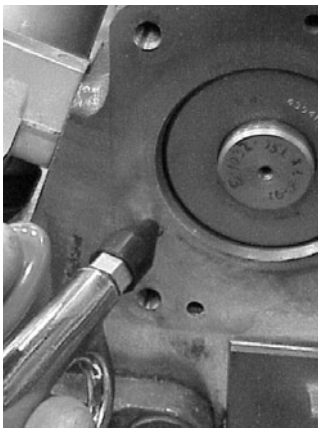


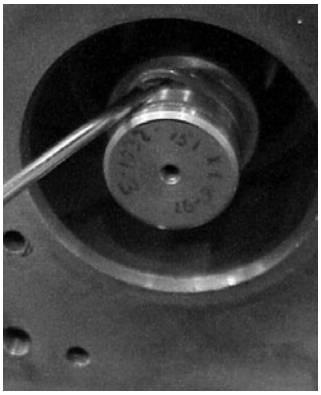
1. Snap Ring
2. O- Ring
3. Piston
4. O- Ring
5. O- Ring
6. Piston
7. O- Ring
8. Yoke Bar
9. Pin
10. Splitter Yoke Assy
11. Screw
12. Step Washer
13. Retainer







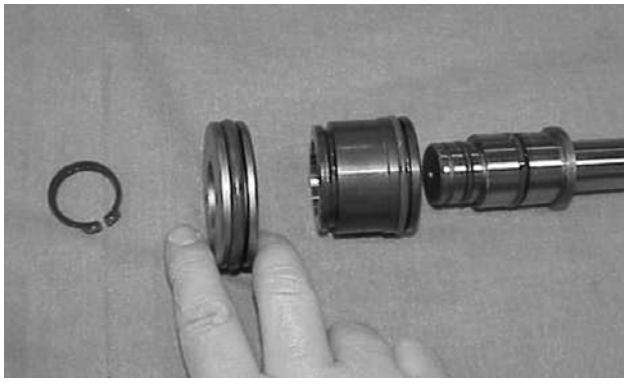




Procedure -

1. Place the transmission in the reverse gear position.
2. Drain the vehicle air tanks.
3. Disconnect the vehicle wire harness connector from the ECU using a 1/4" nut driver.
4. Remove the nine ECU capscrews.
5. Remove the ECU, spacer plate, sealing plate, and actuating washer.
6. Remove the splitter piston snap ring.

   CAUTION: Very little air pressure is needed to remove piston, place a shop rag over the splitter piston to dampen the force when the piston exits the splitter bore.
7. Use a rubber tipped air gun to supply air pressure to the constant air supply port located just to the left of the splitter cylinder bore. This will force the piston out of the splitter bore.
8. Remove the inner (neutral) piston from the splitter bar.
9. Use a small screwdriver or O-ring pick tool to remove the two O-rings from the OD of the splitter bar, the O-ring from the inner piston, and the O-ring from the outer splitter piston.



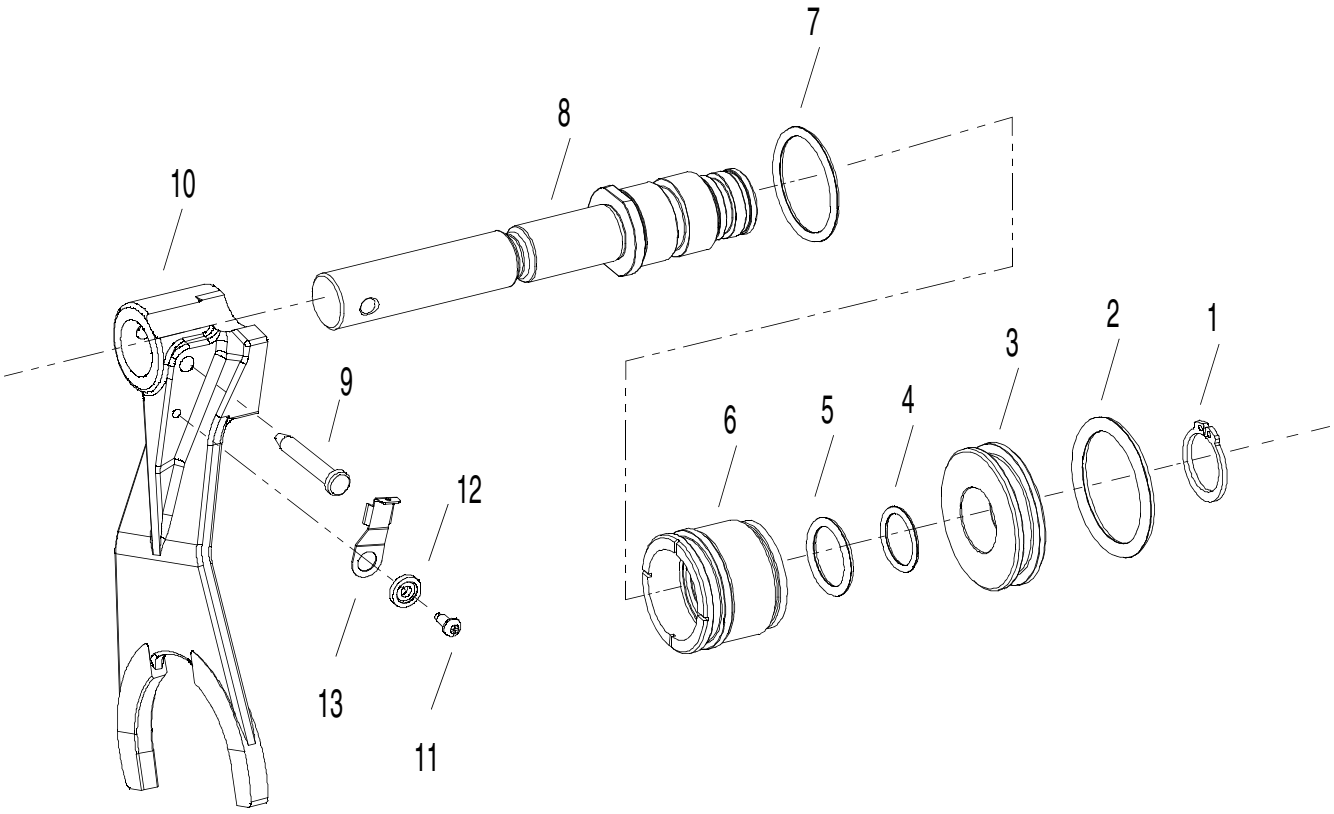
How to Install the Splitter Piston

Special Instructions

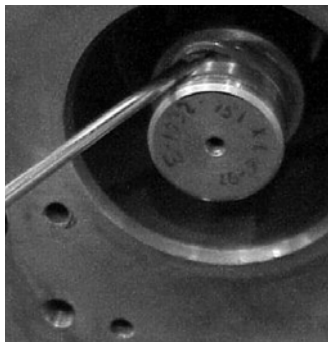
None

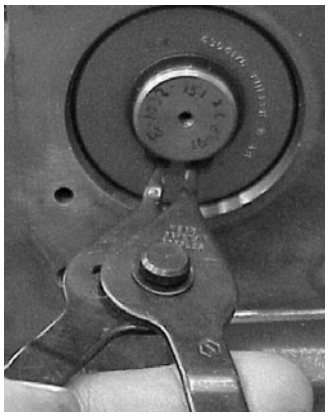
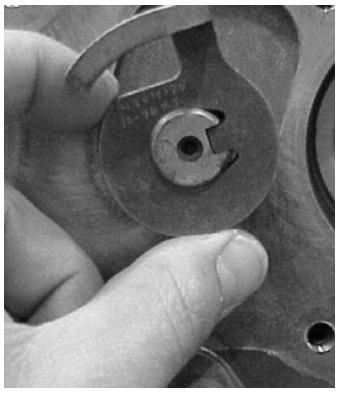
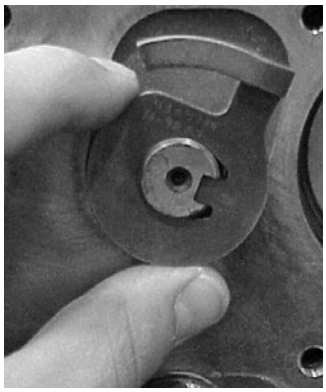
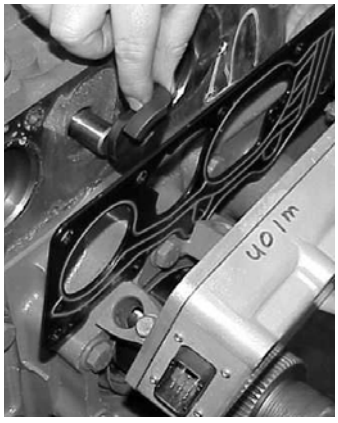
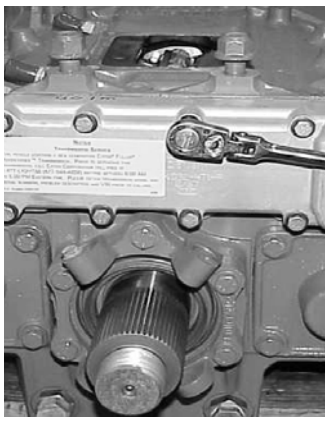
Special Tools

- Typical Service Tools



1. Snap Ring
2. O- Ring
3. Piston
4. O- Ring
5. O- Ring
6. Piston
7. O- Ring
8. Yoke Bar
9. Pin
10. Splitter Yoke Assy
11. Screw
12. Step Washer
13. Retainer

Procedure -

1. Apply a thin coating of Eaton Fuller silicon lubricant #71206 or equivalent to the new O-rings before installing them onto the pistons and splitter bar.
2. Install the two smaller O-rings into the proper grooves on the splitter bar.
3. Install the next larger O-ring on the proper groove of the inner splitter piston.
4. Install the inner piston into the splitter bore with the o-ring end in first, so it fully seats over the splitter bar.
5. Install the largest O-ring onto the proper groove of the splitter piston.
6. Install the splitter piston into the splitter cylinder bore over the end of the splitter bar, so the snap-ring groove is exposed.
7. Install the snap ring making sure it completely seats into the snap-ring groove.
8. Place the transmission in the reverse gear position.
9. Position the actuating washer onto the end of the shift shaft and make sure it is rotated fully clockwise.
10. Assemble the ECU, spacer plate, and sealing plate.
11. Position the ECU assembly over the actuating washer so the finger lines up with the range position sensor.
12. Make sure the ECU is fully seated against the case and install the nine ECU capscrews.
13. Torque the ECU capscrews to 20-23 lb-ft (27-31 Nm).
14. Attach the vehicle interface harness to the ECU and tighten the connector screw to 7–13 lb-in (.8–1.5 Nm).

How to Remove the Clutch Access Cover

Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -

1. Squeeze the spring tabs together and remove from the slots.
2. Pull the cover down starting with the front first.

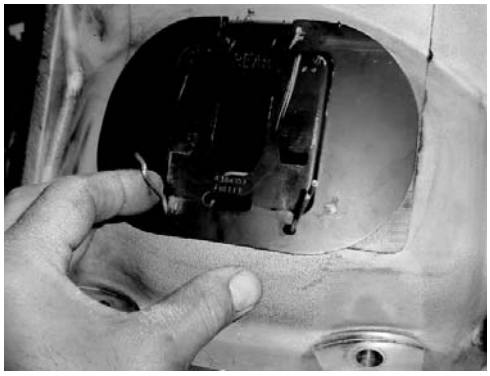
How to Install the Clutch Access Cover

Special Instructions

None

Special Tools

- Typical Service Tools



Procedure -

1. Rotate the spring so the coil faces up and begin installing the cover with the tabs to the rear.

2. Reinstall the spring tabs in the slots.

How to Disassemble the Gear Shift Lever

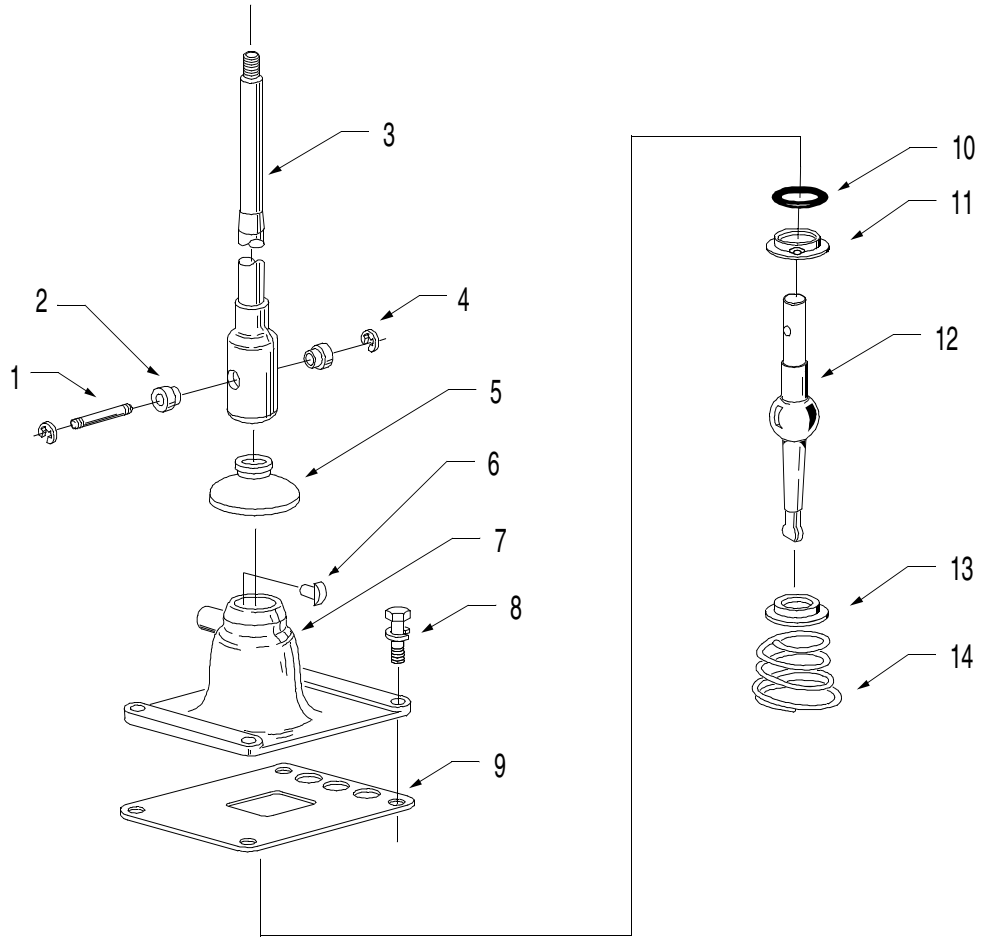
Special Instructions

If total disassembly is needed, the Roadranger valve or Shift Knob, if present, must be removed first.

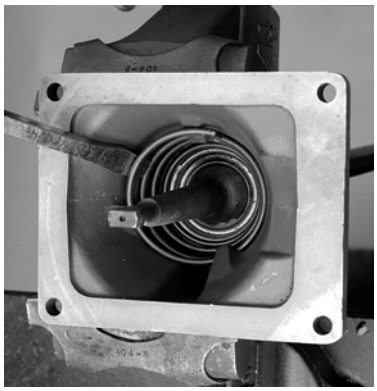
Release the spring one coil at a time.

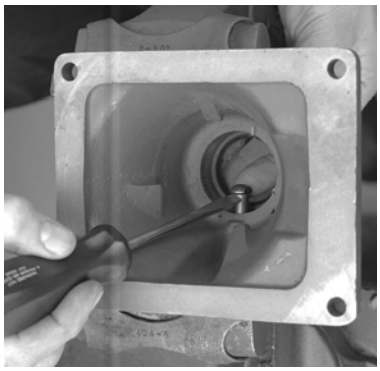
Special Tools

- A vise with brass jaws or wood blocks



1. Pin
2. Bushing
3. Upper Lever
4. Snap Ring
5. Rubber Boot
6. Spade Pin
7. Housing
8. Capscrew
9. Gasket
10. O-Ring
11. Washer
12. Lower Lever
13. Stepped Washer
14. Tension Spring





Procedure -

1. On a non-isolated shift lever, remove the Roadranger valve using the "How to Remove the Shift Knob" instructions in In-Vehicle Service Procedures. If the shift lever is equipped with a lever isolator, remove the snap ring, bushing, and cross pin to disconnect and remove the upper lever.

2. Slide the rubber boot up and off the shift lever shaft.

3. With the housing bottom facing up, secure the assembly in a vise.

4. Use a large screwdriver to twist between the spring and housing, forcing the spring from under the housing lugs.

5. From inside the housing tower, remove the tension spring, washer, and gear shift lever.

6. In models so equipped, remove the nut and washer from the housing bore.

7. Remove and inspect the spade pin from the housing tower spade pin bore. Replace if damaged.

8. Inspect the O-ring in the housing tower inside groove. Replace if damaged.

How to Assemble the Gear Shift Lever

Special Instructions

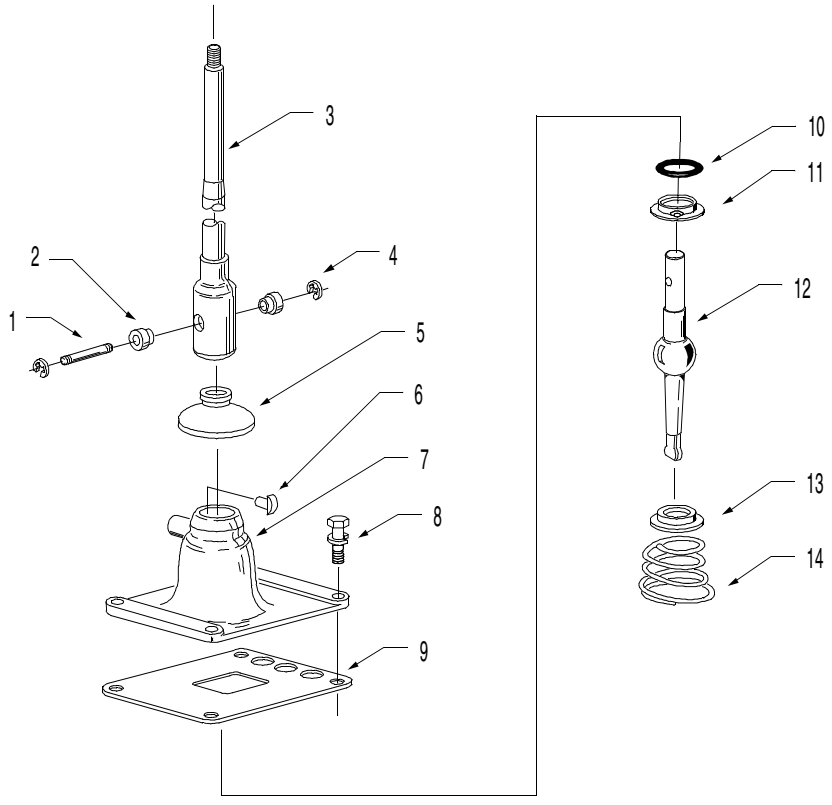
Inspect tension spring and washer for wear.

Apply Eaton rust preventative lubricant #71212 or equivalent to the shift lever pivot ball. A rust preventative lubricant film should cover all surfaces between and including the pivot ball.

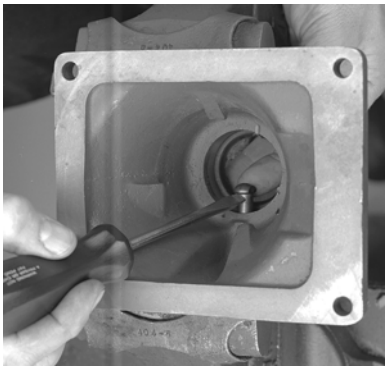
Seat the tension spring one coil at a time.

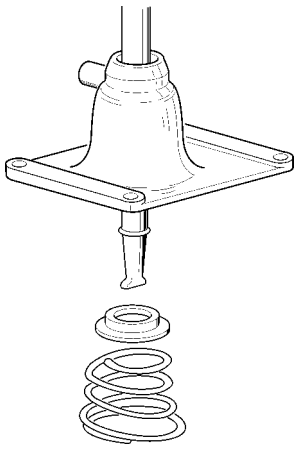
Special Tools

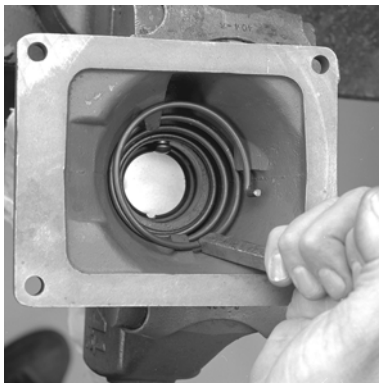
- A vise with brass jaws or wood blocks
- Tension Spring Driver (see recommended tool list)



1. Pin
2. Bushing
3. Upper Lever
4. Snap Ring
5. Rubber Boot
6. Spade Pin
7. Housing
8. Capscrew
9. Gasket
10. O-Ring
11. Washer
12. Lower Lever
13. Stepped Washer
14. Tension Spring







Procedure -

1. With housing bottom facing up, secure the assembly in a vise.
2. If the spade pin is damaged, install a new spade pin in the-housing tower bore.
3. In models so equipped, install the nut and washer in the housing bore.
4. If the O-ring is damaged replace it. Lubricate the new O-ring with Eaton/Fuller lubricant #71206 or equivalent. Install the O-ring in the housing tower inside groove.
5. Align the lever ball slot with the spade pin and position the gear shift lever in the housing tower.
6. With dished-side up, install the washer over the ball.
7. Use a tension spring driver to install the tension spring under the housing lugs.
8. Remove the assembly from the vise.
9. Install a rubber boot over the gear shift lever and against the housing.

Final Check

Make sure the gear shift lever moves freely.

How to Remove Output Yoke

Special Instructions

None

Special Tools

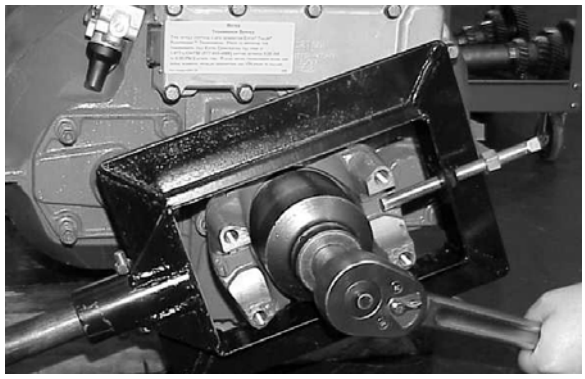
- Output Yoke Puller (Tool ref. ID T1)

Procedure -

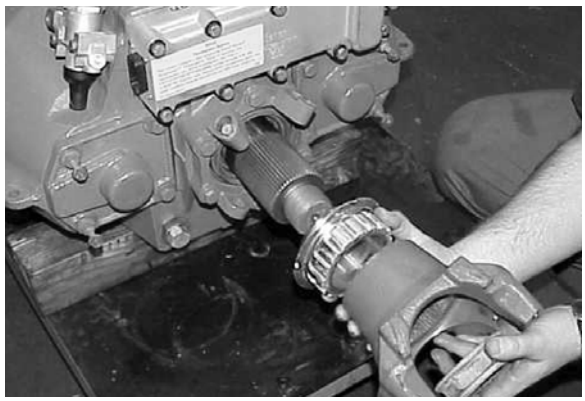
1. Remove the speedometer sensor retaining capscrew and the speedometer sensor from the rear bearing cover.

2. Remove the output nut using a 70 mm or 2 3/4" socket.

   TIP: To prevent the output shaft and yoke from rotating while removing the nut, use a fixture to hold the yoke.



3. Remove the output yoke. Use the output yoke puller (Tool ref. ID T1).
4. Remove the speedometer rotor and O-ring from the output shaft.



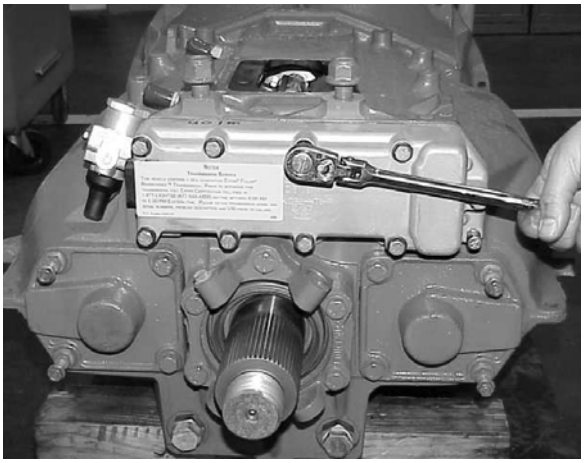
How to Remove the ECU

Special Instructions

None

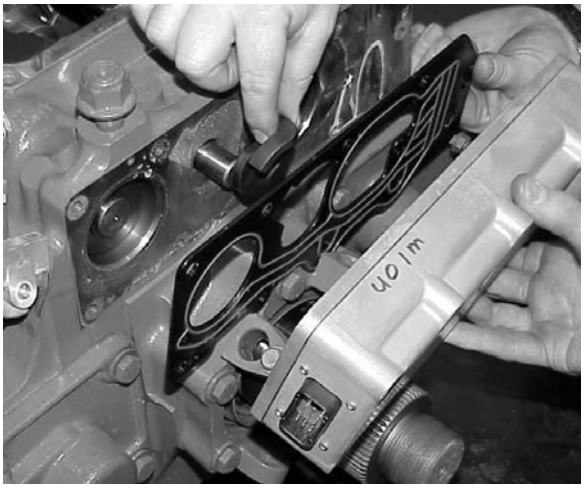
Special Tools

- Typical Service Tools



Procedure -

1. Place the transmission in the reverse gear position.
2. Disconnect the vehicle wire harness connector from the ECU using a 1/4" nut driver.
3. Remove the nine ECU capscrews.



4. Remove the ECU, spacer plate, sealing plate, and actuating washer.

How to Remove the Auxiliary Countershaft Bearing Cover

Special Instructions

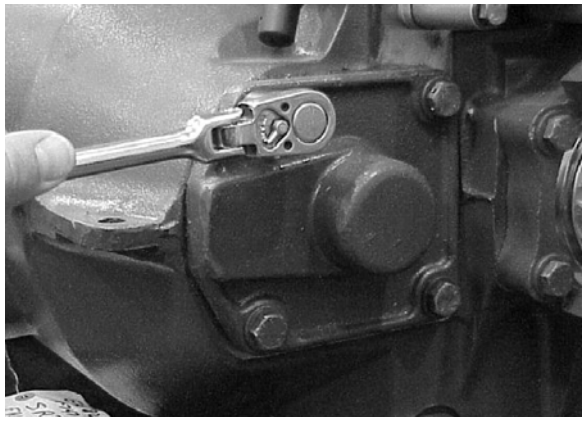
None

Special Tools

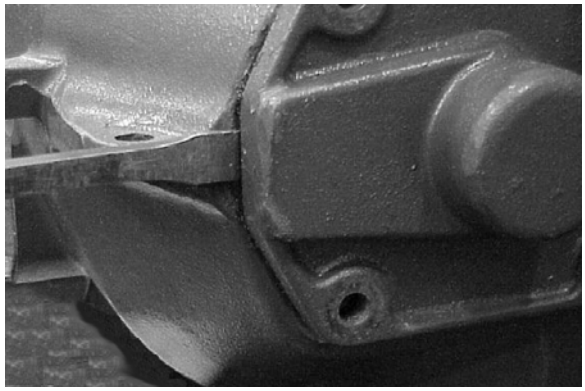
- Typical Service Tools

Procedure -

1. Drain the transmission oil.



2. Remove the four bearing cover capscrews.



3. Use a pry bar between the case and bearing cover to break the bearing cover seal.

How to Orient Transmission for Overhaul

Special Instructions

None

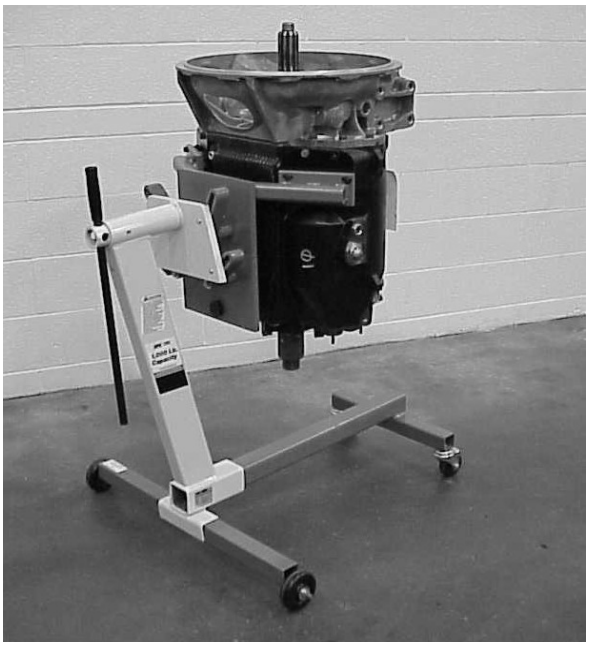
Special Tools

- Lifting Chain
- Over Head Crane

Procedure -

1. Before beginning the overhaul procedure the transmission must be mounted to a fixture that will allow for disassembly and re-assembly in the vertical position.

2. Lift the transmission using a chain, a lifting device, and two lifting eyelets attached to front cover capscrews inside the clutch housing/front cover. The chain and lifting device must have a minimum capacity of 1000 lbs.



3. Mount the transmission to the stand attached to a standard 1000 lb. minimum capacity automotive engine repair stand. A stand that allows for rotation of the transmission is helpful during tear down and assembly. (Tool ref. ID T2)

4. Do not disturb the RTV fasteners when mounting the transmission to the stand - use the extended PTO mounting studs and the drain plug threaded opening for mounting.

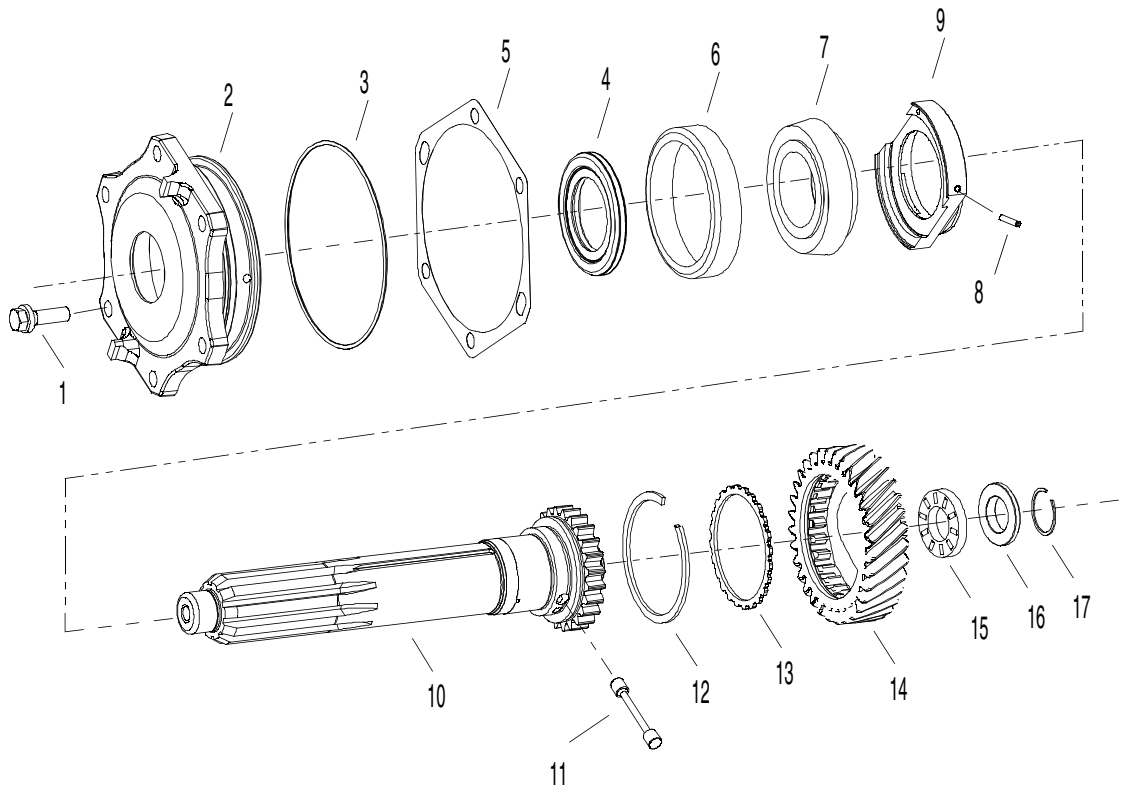
How to Remove and Disassemble Input Shaft and Oil Pump

Special Instructions

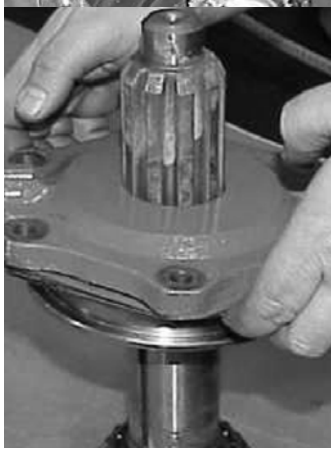
None

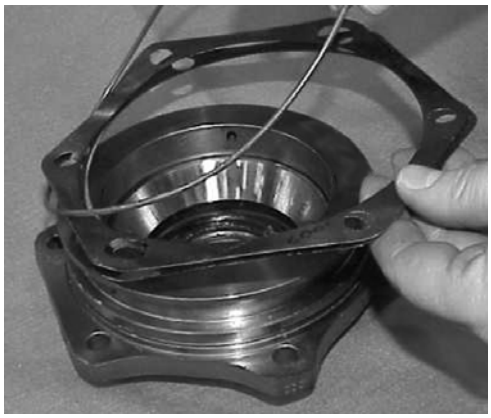
Special Tools

- Typical Service Tools
- Bearing Race Puller (Tool ref. ID T5)



1. Capscrew & Washer
2. Front Brg Cover Assy
3. O- Ring
4. Oil Seal
5. Shim Kit
6. Bearing Cup
7. Bearing Cone
8. Screw
9. Eccentric Pump Assy
10. Input Shaft
11. Piston Pump
12. Snap Ring
13. Washer
14. Main Drive Gear
15. Bearing
16. Spherical Washer
17. Snap Ring





Procedure -

1. Remove the six (6) capscrews from the input shaft bearing cover.

2. Remove the input shaft assembly from the clutch housing/ front cover.

⚠ WARNING

When removing the input shaft and bearing cover, striking the input shaft with a maul can cause damage to the input shaft and/or break the oil pump set screw.

3. Remove the set-screw that holds the eccentric pump in place (5/64" allen wrench).

4. Remove the bearing cover and shim-pack from the input shaft.

5. Remove and discard the rubber O-ring from the bearing cover. Remove and set aside the shim-pack for future assembly.

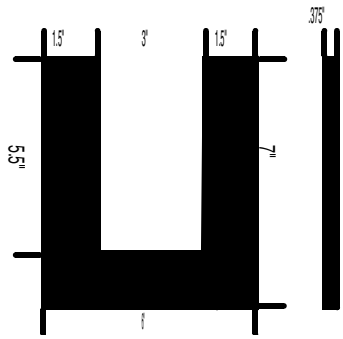
   Note: The shim pack will likely contain several shims of varying thickness, it is helpful to keep the shim pack together to provide a starting point when shimming the mainshaft endplay during assembly.

6. Install the bearing race puller (Tool ref. ID T5) as shown and remove the input bearing race from the input shaft bearing cover.

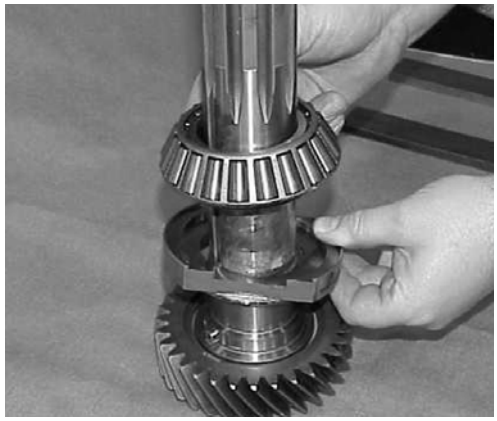
7. Remove the input shaft seal as shown and discard.

8. Press the input shaft bearing off the input shaft with an arbor press using two flat 1/4' plates inserted between the gear and bearing cone hub or use bearing puller plate as shown.

9. (See Bearing Plate Puller Design)



10. Remove the eccentric pump.



11. Remove the input snap ring from the main drive gear using a small flat blade screwdriver.

12. Remove the snap ring and splined washer from the input shaft.

13. Separate the input shaft and main drive gear then remove the pump piston from the input shaft.

14. Remove the snap ring, beveled washer, and thrust bearing from the end of the input shaft.

Note: The input shaft is hollow to provide lubrication into the mainshaft, be sure to inspect and flush any debris from the internal passage when servicing the input shaft.

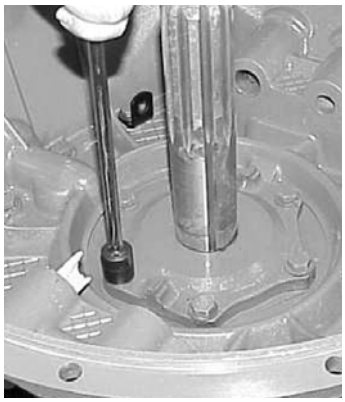
How to Remove and Disassemble Clutch Housing/Front Cover

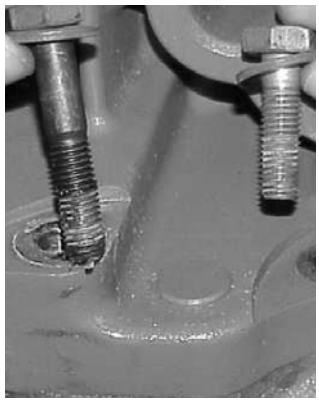
Special Instructions

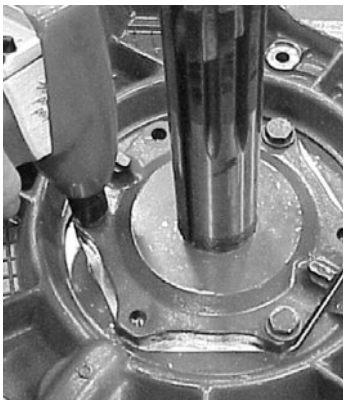
None

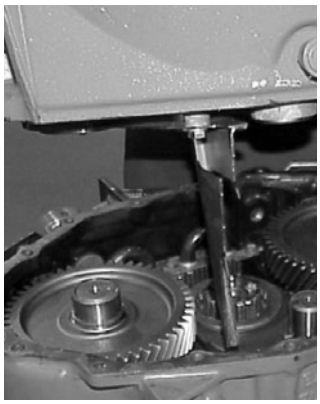
Special Tools

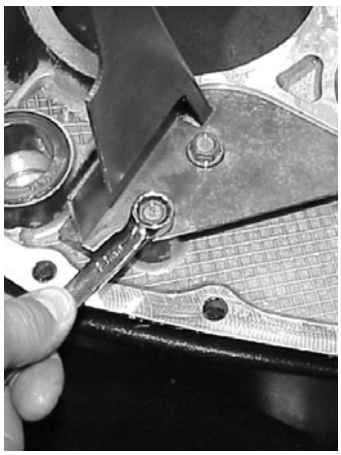
- Typical Service Tools











Procedure -

1. Remove the sixteen (16) capscrews holding the front cover to the main case (Eight (8) inside the clutch housing, six (6) outside the housing threading into the main case, and two (2) threading into the clutch housing from the main case).

2. Inspect capscrews.

   Note: One (1) of the capscrews threading into the main case on the right side of the housing is longer than the other. This capscrew must be reassembled in the same location.

3. To break the seal between the clutch housing/front cover and the transmission main case start with the output bearing cover installed. Remove the O-ring and shim pack from the input shaft and front bearing cover assembly and reinstall into the front cover. Install three (3) opposing capscrews and tighten until the front cover pops loose from the main case. With the shim pack removed, the negative mainshaft clearance will force the front cover seal to be broken.

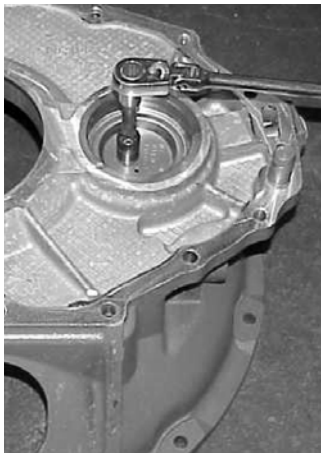
4. Remove the housing.

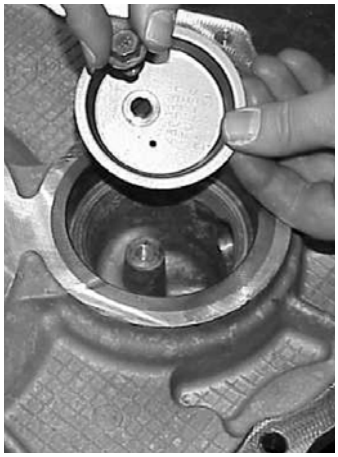
5. Remove the two (2) capscrews holding the oil trough and remove the oil trough from front cover.

6. Remove front countershaft bearings from front cover using a bearing puller (Tool ref. ID T4).

7. Remove the capscrew holding the oil dam plate.

8. Remove oil dam plate from front cover.





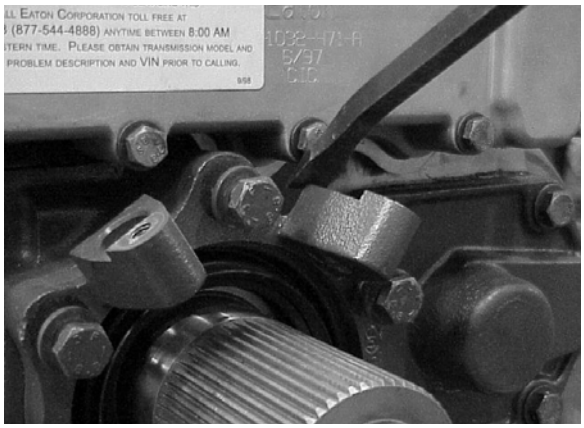
How to Remove Output Bearing Cover

Special Instructions

None

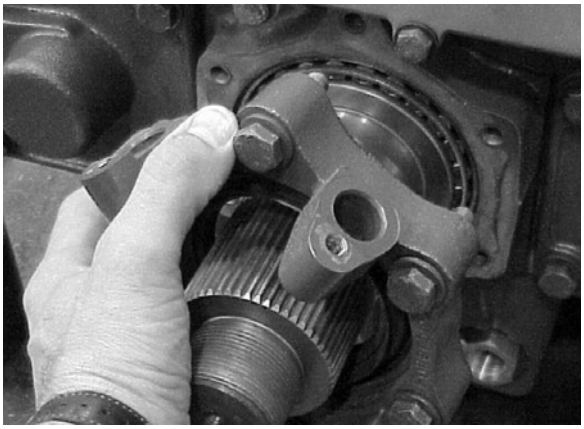
Special Tools

- Typical Service Tools



Procedure -

1. Mark the output bearing cover in such a way to allow the bearing cover to be reinstalled in the same location. The cover can be installed in two opposite positions.



2. Remove the six bearing cover capscrews. Use a pry-bar to break the bearing cover loose from the case.

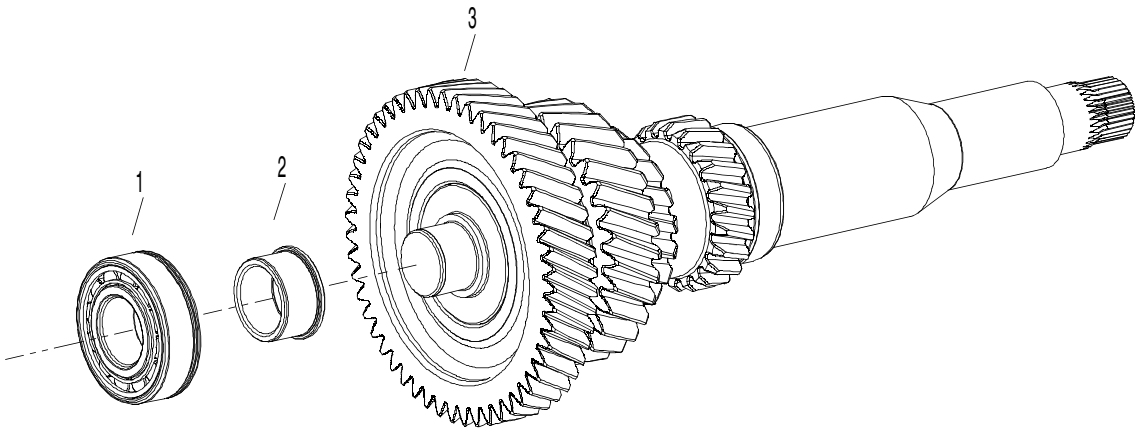
How to Remove and Disassemble Front Countershaft

Special Instructions

None

Special Tools

- Bearing Race Puller (Tool ref. ID T6)
- Bearing Race Puller (Tool ref. ID T7)

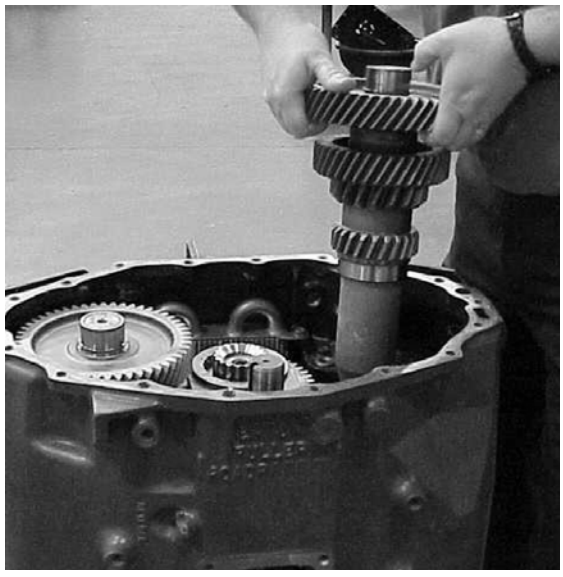


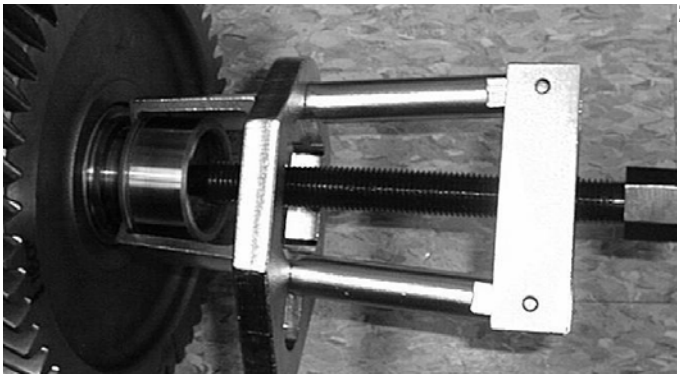
1. Bearing — Outer Roller
2. Bearing — Inner Race
3. Welded Countershaft Assy

Procedure -

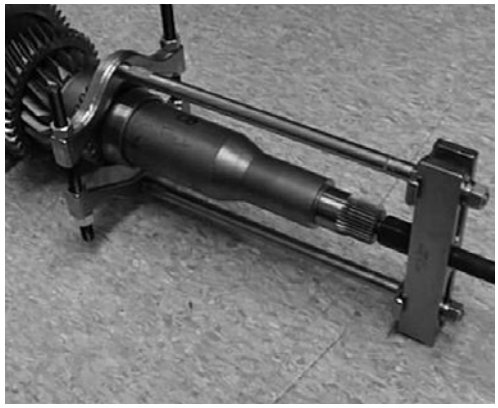
1. Remove the left and right front countershafts by lifting them directly out of the case from the front.

   Note: Identify countershafts as they are removed by marking them 'left' & 'right' for future re-assembly.





2. Use the bearing race puller (Tool ref. ID T6) to remove the countershaft front bearing races.



3. Use the bearing race puller (Tool ref. ID T7) to remove the auxiliary countershaft front bearing races from the front countershafts.

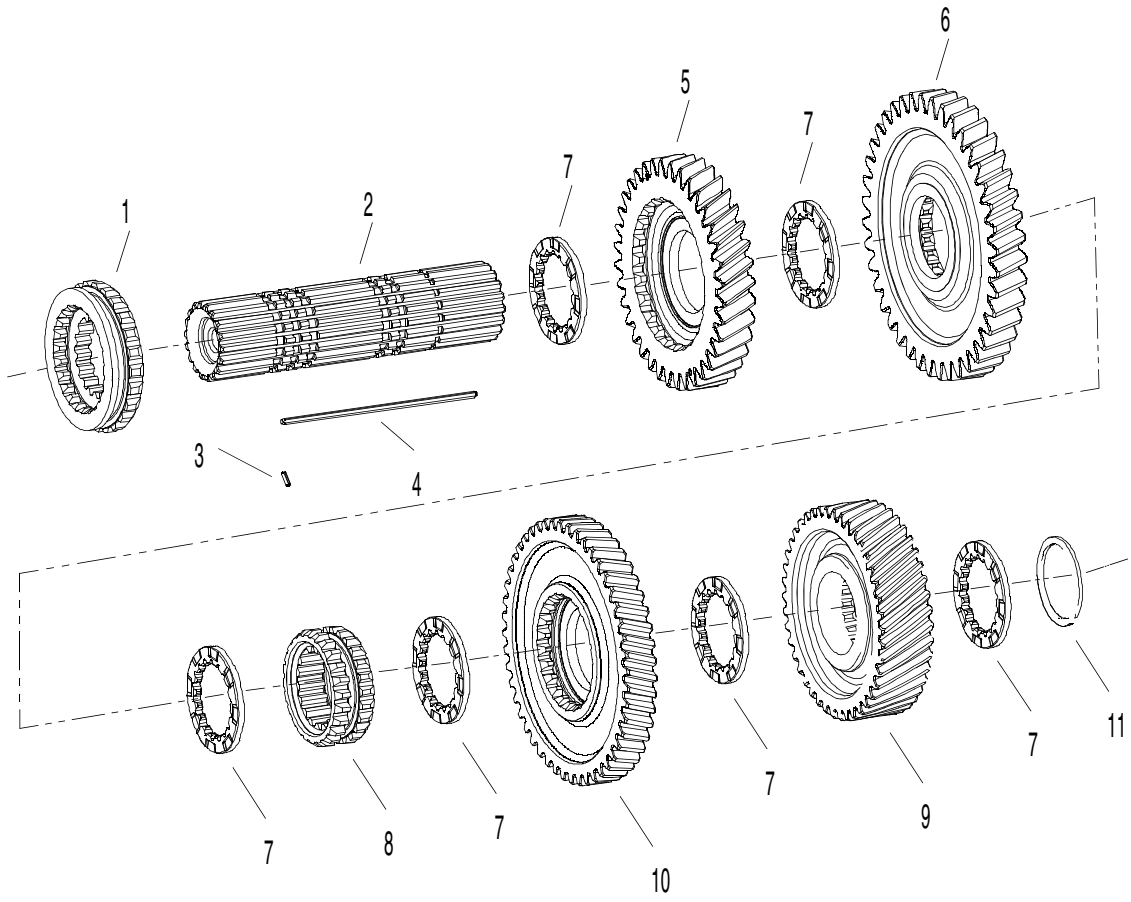
How to Remove and Disassemble Mainshaft

Special Instructions

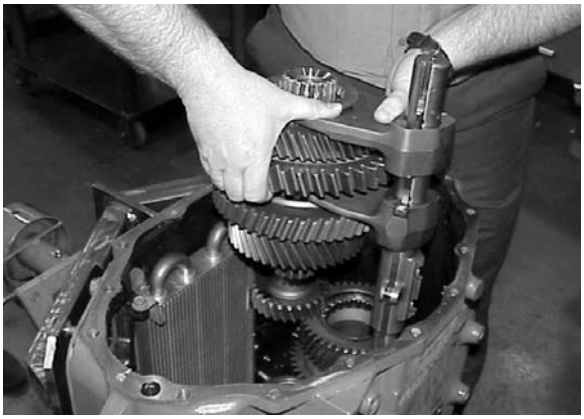
None

Special Tools

- Typical Service Tools



1. Sliding Clutch
2. Mainshaft Key
3. Roll Pin
4. Key
5. 4th Gear-Mainshaft
6. 1st Gear-Mainshaft
7. Washer
8. Sliding Clutch
9. Auxiliary Drive Gear
10. Reverse Gear-Mainshaft
11. Snap Ring

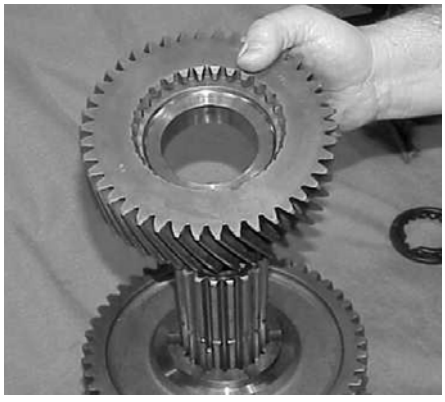


Procedure -

1. Lift the mainshaft and shift shaft assembly out of the maincase as one unit.

2. Separate the shiftshaft assembly from the mainshaft assembly.
3. Remove the sliding clutch from the front of the mainshaft.

4. Remove snap ring.
5. Remove the snap ring and washer from the rear of the mainshaft.

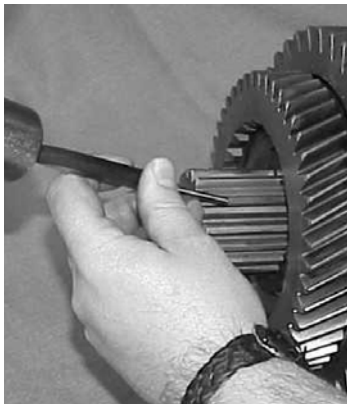


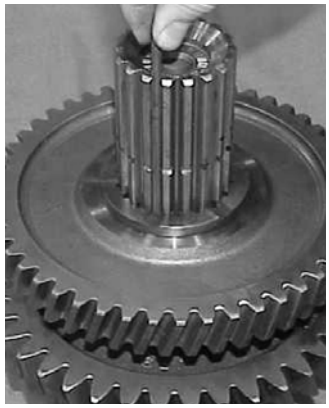
6. Remove the auxiliary drive gear from the rear of the mainshaft as shown.

7. Tap the mainshaft key out of the groove as shown with a small punch.

8. Remove the key from the rear of the shaft.

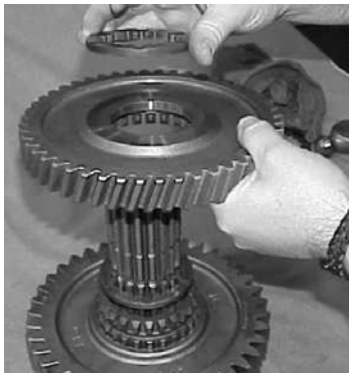
   Note: The three-sided mainshaft key is rounded on one corner to fit into the mainshaft groove. Installing the key with one of the squared off corners into the mainshaft groove makes disassembly and assembly very difficult.





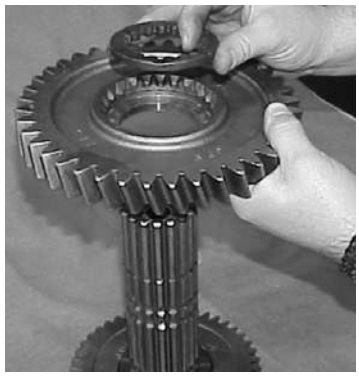
9. Remove the reverse gear and washer.

10. Remove washer and sliding clutch.

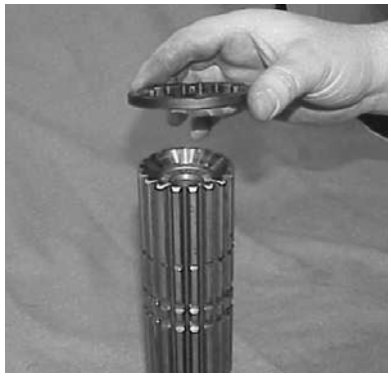


11. Remove 1st /2nd gear and washer.

12. Remove 3th/4th gear and washer.



13. Remove washer.



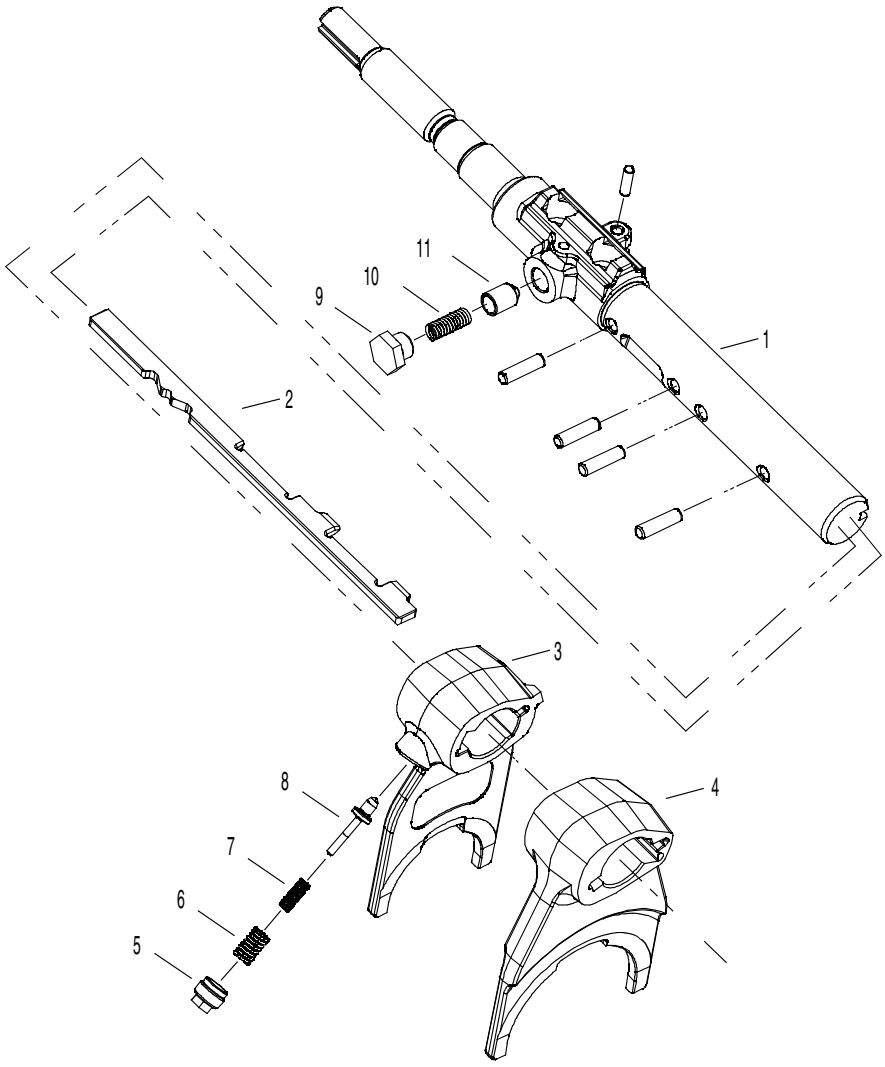
How to Remove and Disassemble the Shift Shaft

Special Instructions

None

Special Tools

- Typical Service Tools

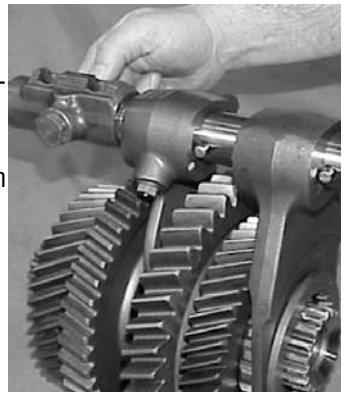


1. Shift Shaft Assy
2. Key
3. Shift Yoke
4. Shift Yoke
5. Plug
6. Spring
7. Spring
8. Plunger
9. Plug
10. Compression Spring
11. Plunger

Procedure -

1. Separate the shiftshaft assembly from the mainshaft assembly.

2. Mount the shiftshaft assembly horizontally in a vise with brass jaw protectors by clamping the small end in the vise.

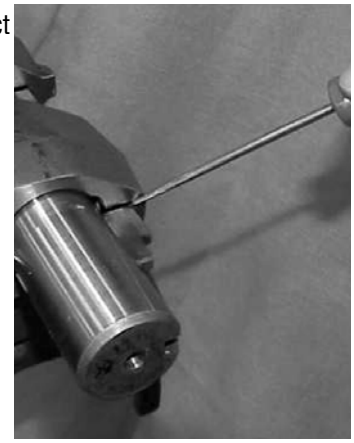


3. Remove the neutral detent plug and spring.

4. Rotate the 1st & reverse shift fork clockwise into the reverse detent position to align the shiftshaft key with the slot in the fork.

5. Line up the shiftshaft key with the slot in the 3rd & direct shift fork.

6. Remove the shiftshaft key.



7. Remove the neutral detent plunger.

8. Line up the 3rd & direct shift fork slot with the shiftshaft pin and remove the fork.

9. Remove the reverse bias plug, spring, and plunger from the 1st & reverse shift fork.

10. Line up the 1st & reverse shift fork slot with the shiftshaft pin and remove the fork.

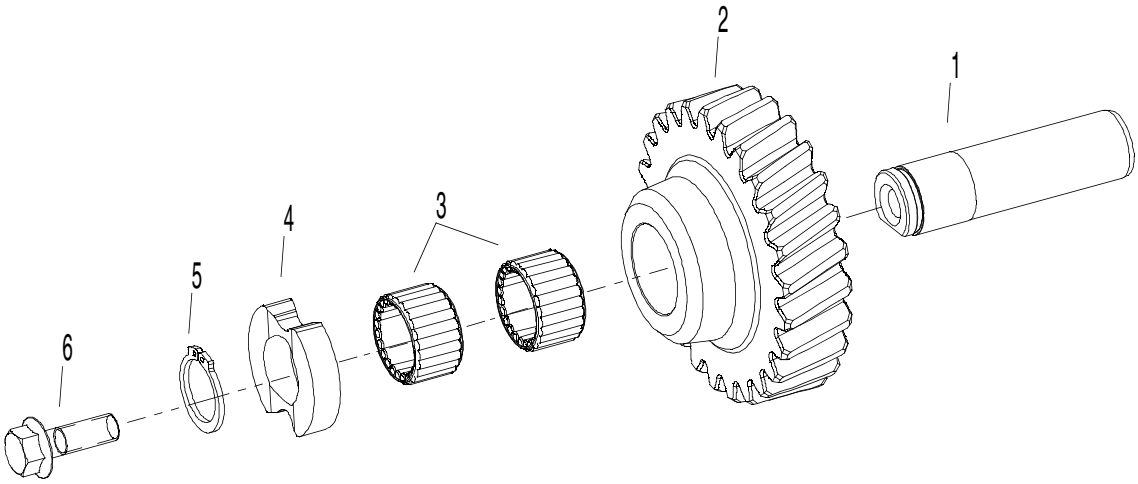
How to Remove and Disassemble Reverse Idler

Special Instructions

None

Special Tools

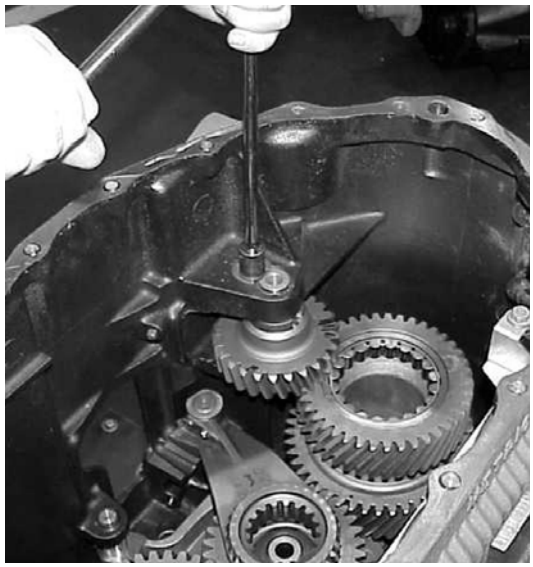
- Slide Hammer



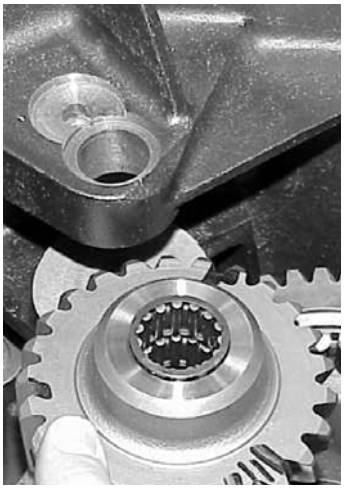
1. Reverse Idler Shaft
2. Reverse Idler Gear
3. Bearings
4. Washer
5. Snap Ring
6. Capscrew

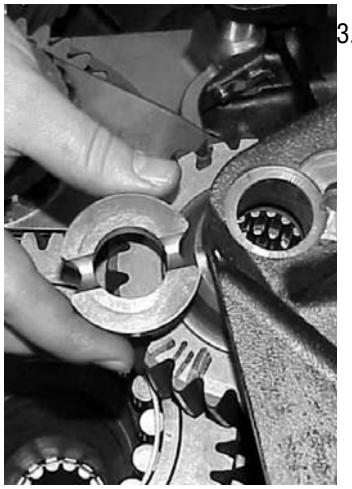
Procedure -

1. Remove the idler shaft retainer capscew.



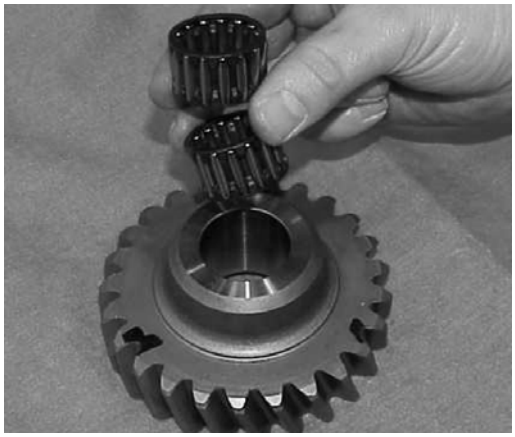
2. Install a threaded slide hammer in the end of the idler shafts (m12 x 1.75) and remove the shafts.





3. Remove the idler gears and grooved spacer washers.

   Note: Mark the idler gear assemblies as right and left or upper and lower for future reassembly.



4. Remove the two (2) caged needle bearings from each reverse idler gear.

5. Remove the snap ring from the reverse idler shafts.

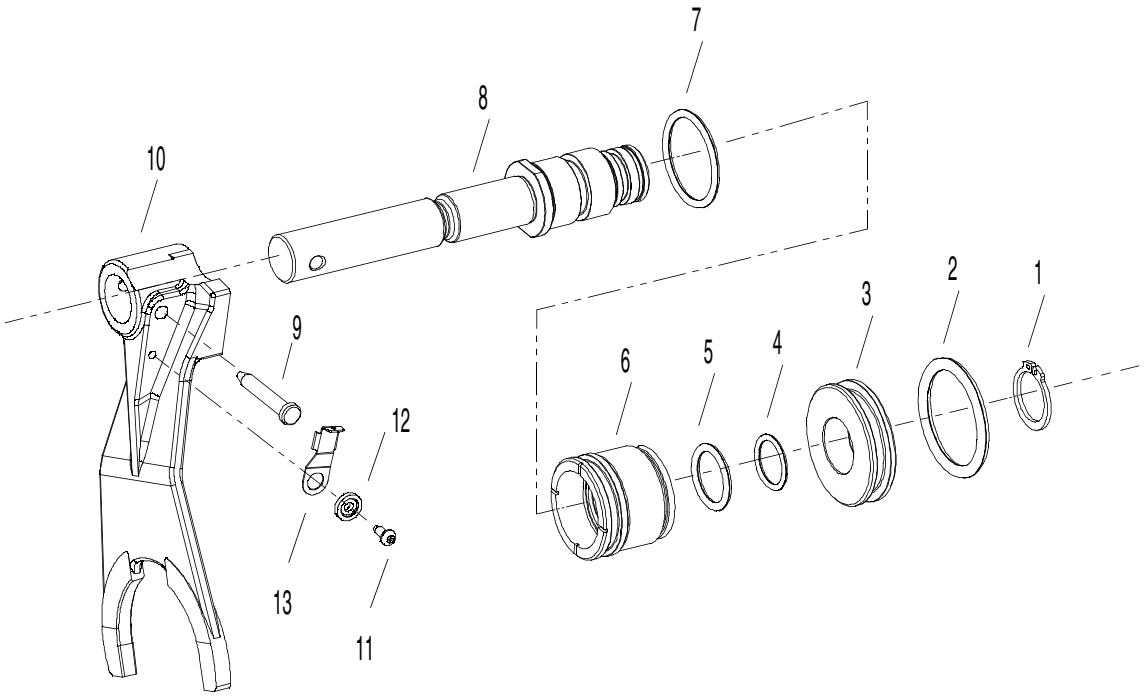
How to Disassemble Splitter System

Special Instructions

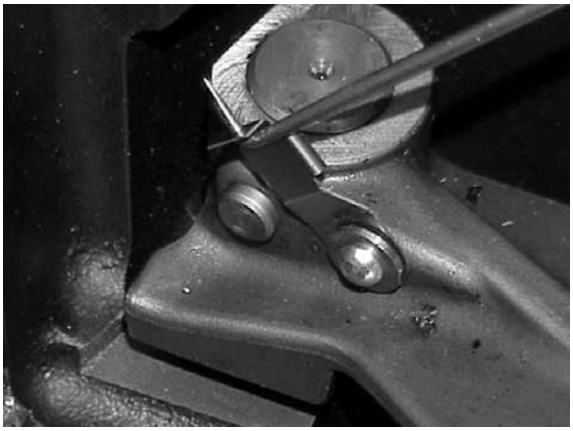
None

Special Tools

- Typical Service Tools

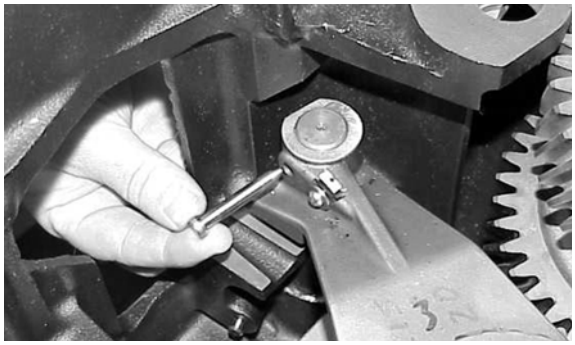


1. Snap Ring
2. O- Ring
3. Piston
4. O- Ring
5. O- Ring
6. Piston
7. O- Ring
8. Yoke Bar
9. Pin
10. Splitter Yoke Assy
11. Screw
12. Step Washer
13. Retainer

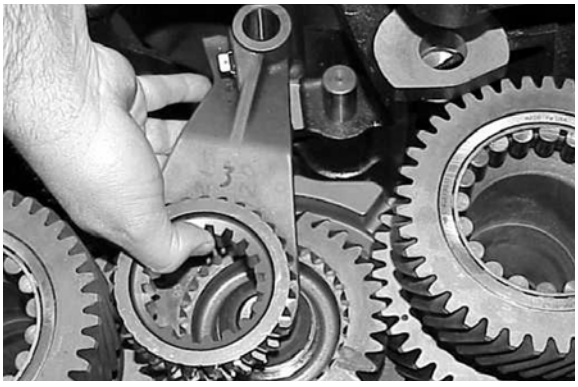


Procedure -

1. Disengage the yoke pin retainer clip.

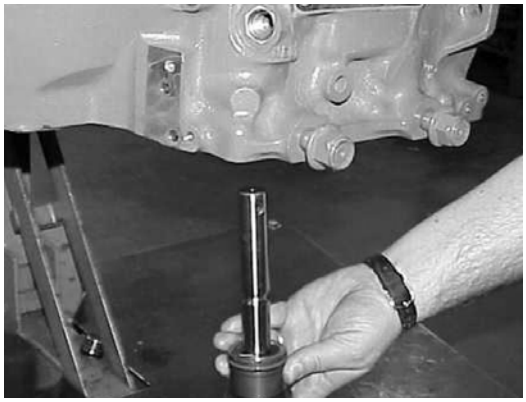


2. Remove the yoke pin.



3. Remove yoke and sliding clutch.

4. Remove the splitter bar assembly from the main case.



5. Remove the snap ring from the end of the splitter bar and remove the two pistons from the yoke bar.

6. Remove the four (4) O-rings from the splitter pistons and yoke bar.

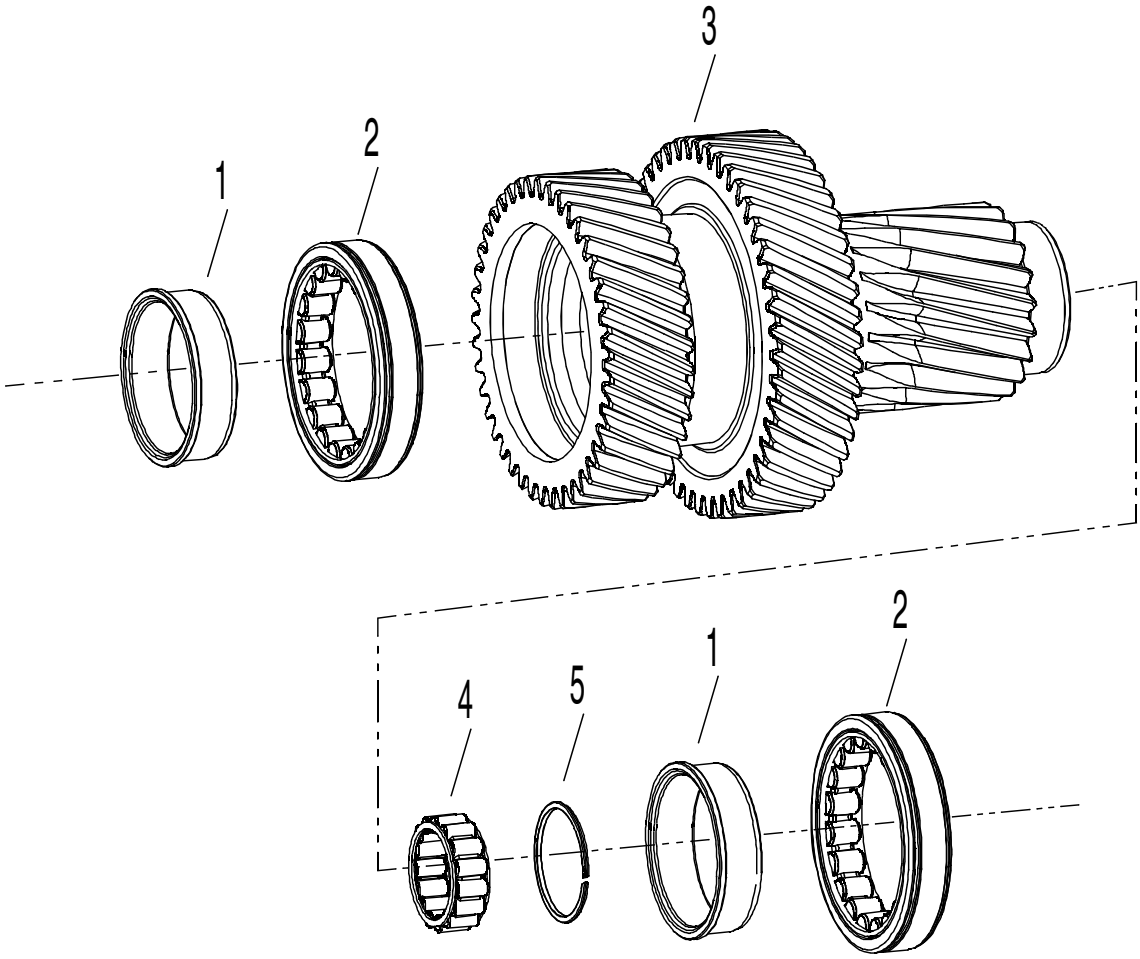
How to Remove and Disassemble Auxiliary Countershaft

Special Instructions

None

Special Tools

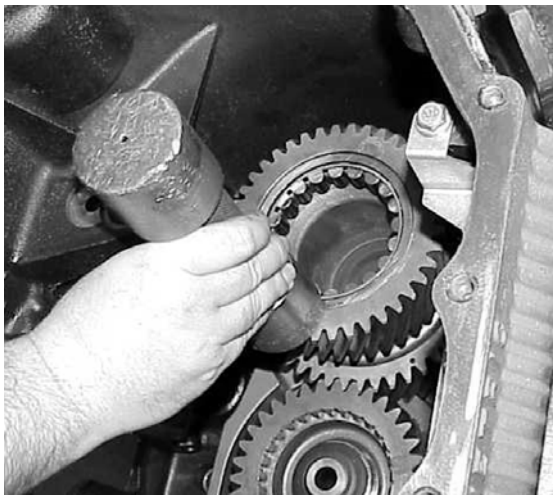
- Typical Service Tools
- Bearing Puller (Tool ref ID T8)



1. Bearing-Inner Race
2. Bearing-Outer Race
3. Welded Countershaft Assy
4. Bearing
5. Retaining Ring

Procedure -

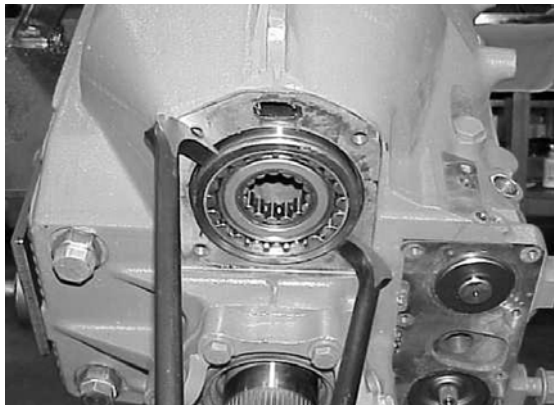
1. With the auxiliary countershaft bearing covers removed, tap the auxiliary countershafts to the rear of the transmission to partially unseat the auxiliary rear countershaft bearings.



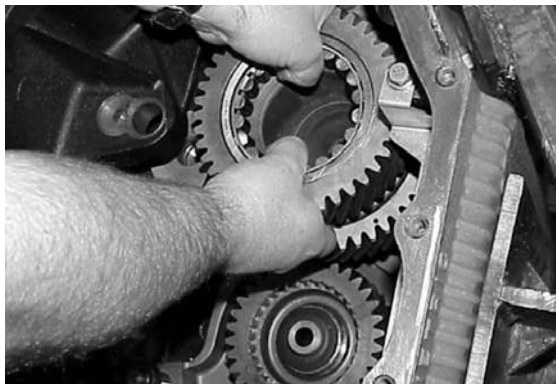
2. Use a pair of pry bars to finish removing the bearings.

   Note: When tapping the countershafts to the rear, the bearings may fall out of the bores.

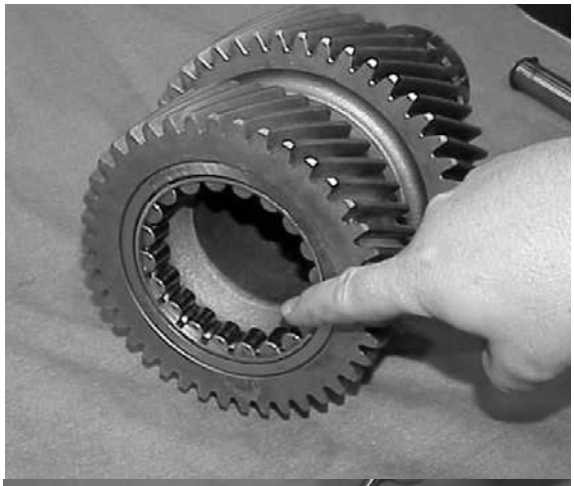
   WARNING: Do not reuse rear auxiliary countershaft bearining as they will be destoyed during removal.



3. Remove the auxiliary countershafts from the transmission and mark them as right and left for future re-assembly.

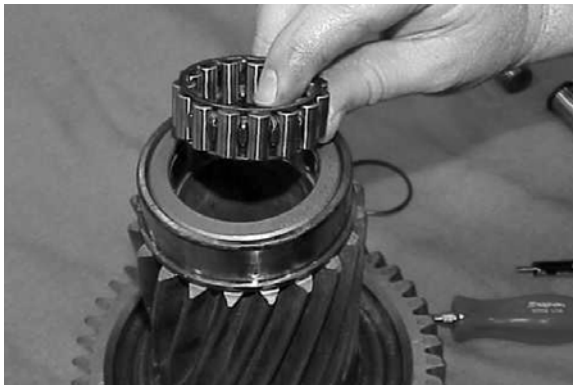


4. Install the roller bearing puller (Tool ref. ID T8) as shown.

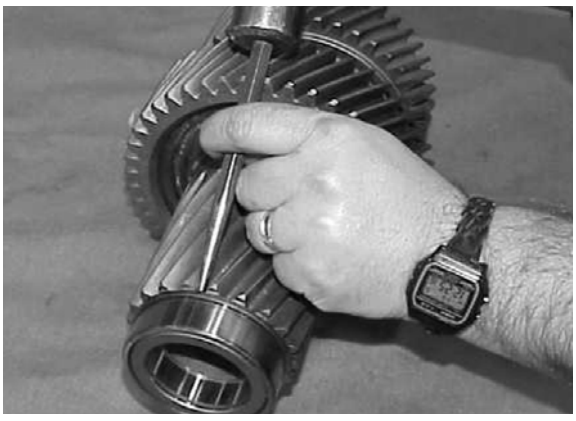


5. Remove the auxiliary countershaft front bearing.

6. Remove the stepped snap ring.



7. Remove the auxiliary countershaft rear inner bearing as shown.



8. Use a hammer and drift to remove the auxiliary countershaft rear inner bearing races.

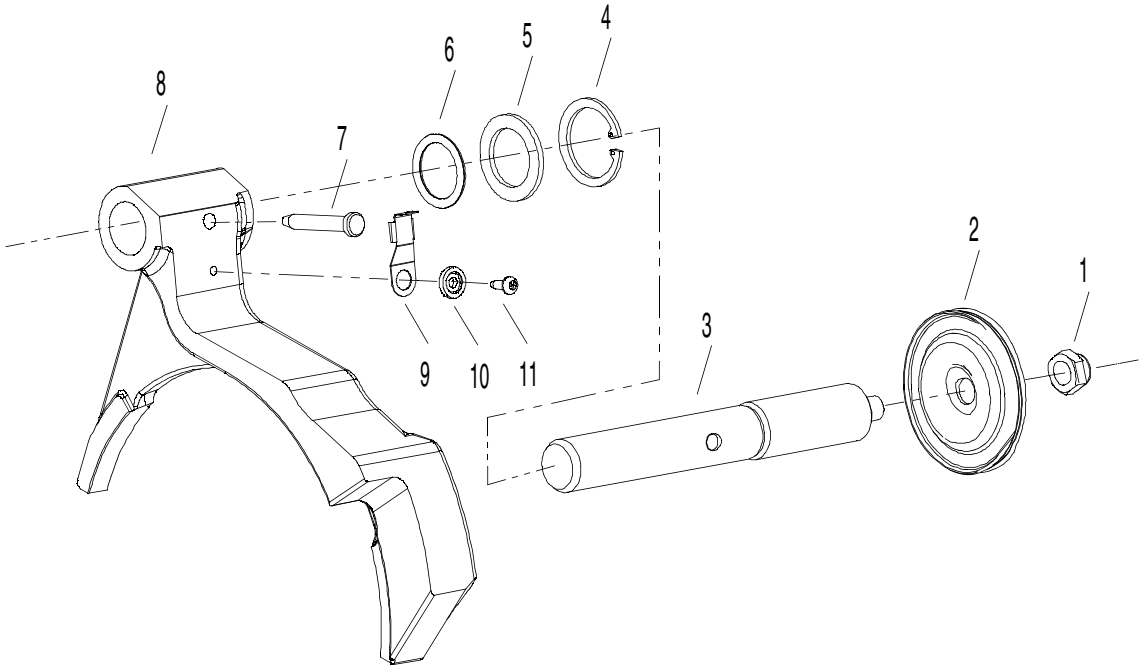
How to Remove and Disassemble Range System

Special Instructions

None

Special Tools

- Typical Serivce Tools

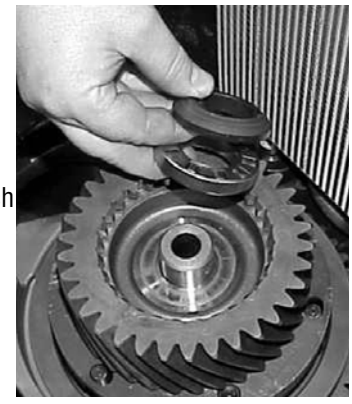


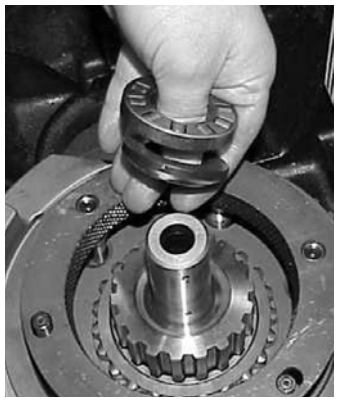
1. Nut
2. Piston
3. Yoke Bar
4. Snap Ring
5. Washer
6. O- Ring
7. Pin
8. Range Yoke Assy
9. Retainer
10. Step Washer
11. Screw

Procedure -

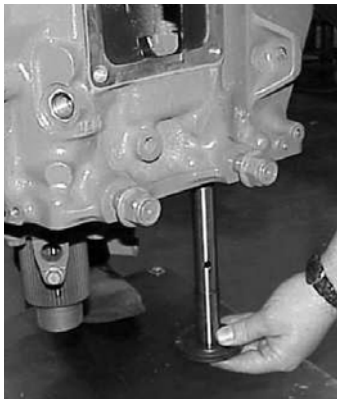
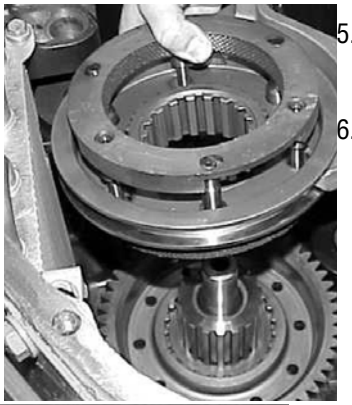
1. Remove the splitter gear.

2. Remove the conical washers and thrust bearings on each side of the splitter gear.

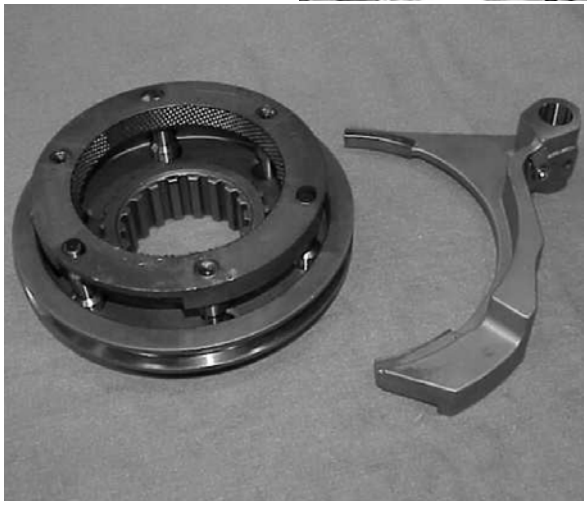




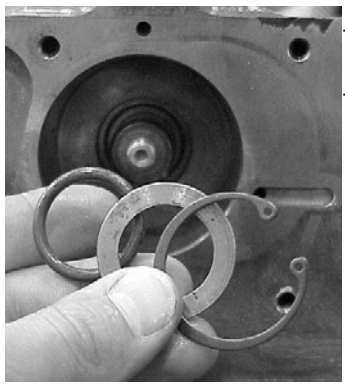

3. Disengage the yoke pin retaining clip.
4. Remove the pin holding the range yoke on the range bar.

5. Remove the range bar and piston by sliding it out of the rear of the main case.
6. Remove the range yoke and synchronizer assembly from the case.



7. Separate the synchronizer and yoke. Place the synchronizer assembly on a clean flat surface with the LOW range ring (larger ring) down.
8. Cover the synchronizer assembly with a shop rag to prevent losing the three (3) springs that are located in the HIGH range synchronizer ring.
9. Grasp both sides of the HIGH range synchronizer ring and pull up. The three springs should be free from the pins and should be contained by the shop rag. If not, locate all three springs or replace with new ones.
10. Remove the sliding clutch from the LOW range synchronizer pins.

11. Remove the nut and piston from the range bar.
12. Remove the snap ring, washer, and O-ring from inside the range bore at the rear of the transmission case.

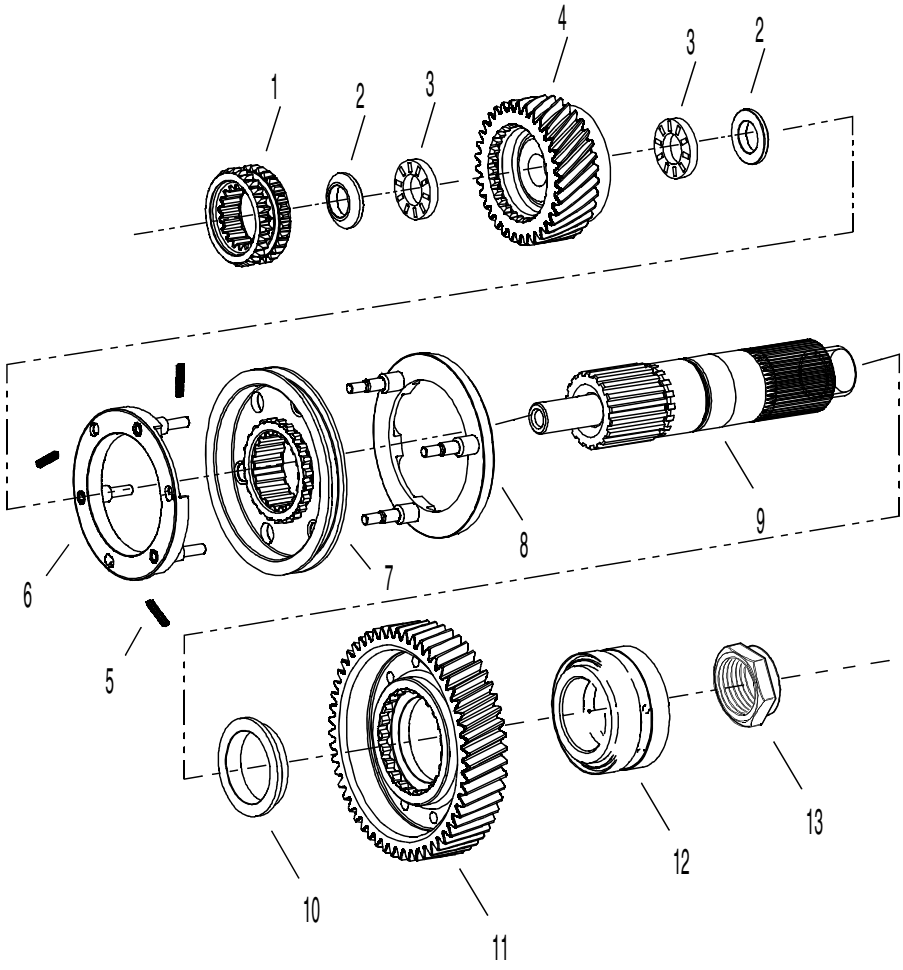
How to Remove and Disassemble Auxiliary Mainshaft Assembly

Special Instructions

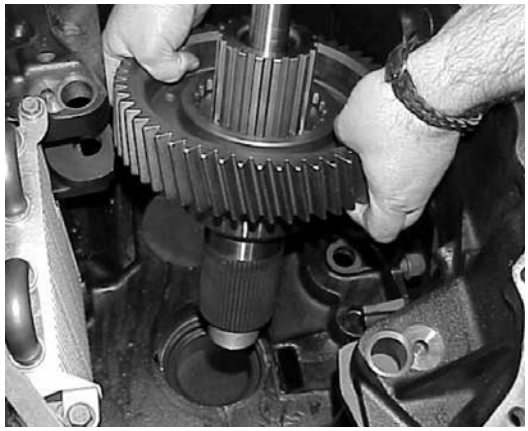
None

Special Tools

- Arbor Press
- Typical Service Tools

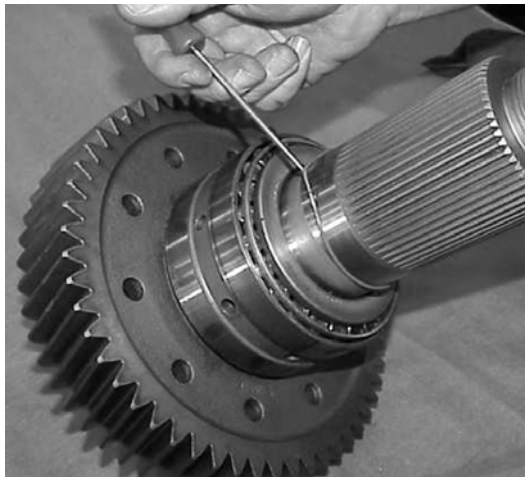


1. Sliding Clutch
2. Spherical Washer
3. Bearing
4. Aux Splitter Gear
5. Spring
6. Synchronizer Assy
7. Sliding Clutch
8. Synchronizer Assy
9. Mainshaft Assy
10. Spacer
11. Reduction Gear
12. Bearing
13. Nut

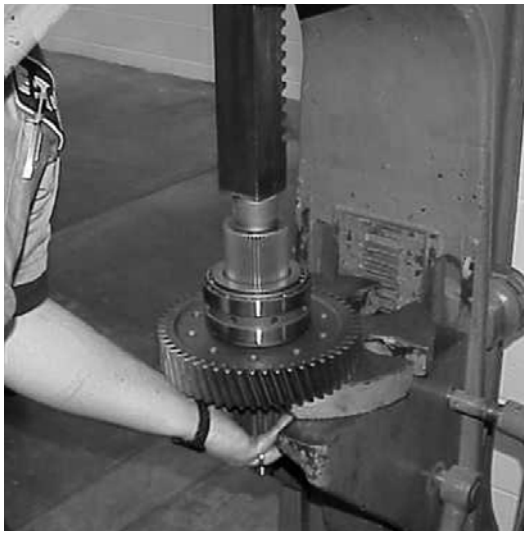


Procedure -

1. With the auxiliary countershafts, output nut and yoke removed, grasp the auxiliary mainshaft reduction gear on both sides and lift the gear and auxiliary mainshaft assembly out of the case.



2. Remove the O-ring seal to the rear of the output bearing. Then press the auxiliary mainshaft out of the output bearing, by supporting the shaft assembly with the front of the auxiliary mainshaft reduction gear, and pressing the shaft forward through the bearing as shown.



3. Once the shaft is removed from the bearing and gear, remove the stepped washer from the auxiliary mainshaft.

How to Remove Cooler and Fittings

Special Instructions

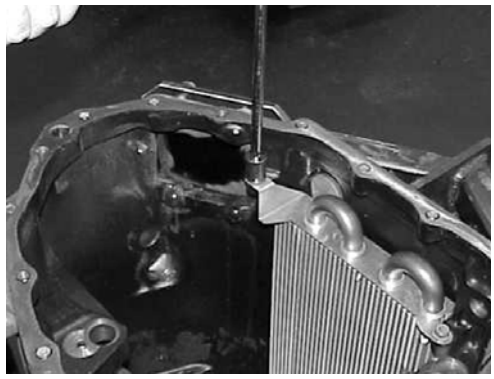
None

Special Tools

- Typical Service Tools

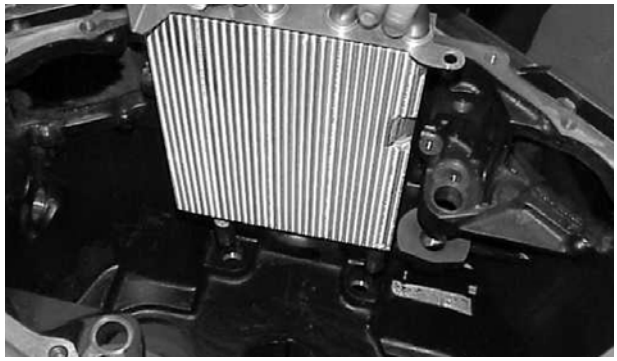
Procedure -

1. Remove the two (2) cooler retainer capscrews.

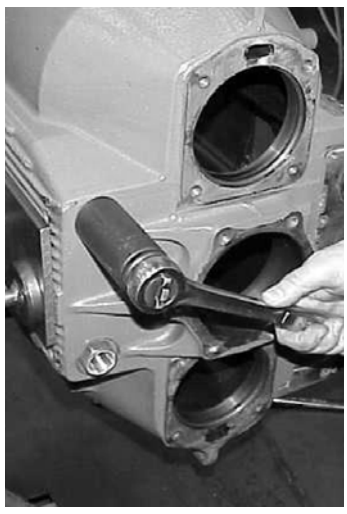


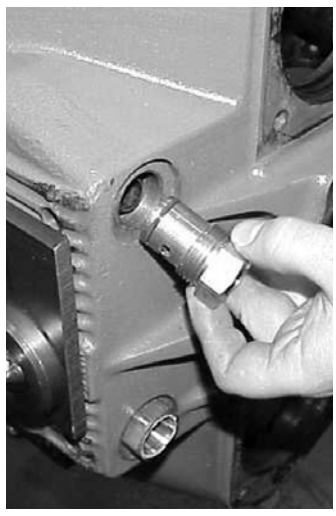
2. Grasp the two coils at the top of the cooler and pull the cooler up and out of the case.

   Note: The cooler will be held partially in place by the cooler inlet and outlet fittings. The cooler may have to be worked carefully side to side to remove.



3. Loosen the cooler inlet and outlet fittings.
4. Remove the cooler inlet and outlet fittings.





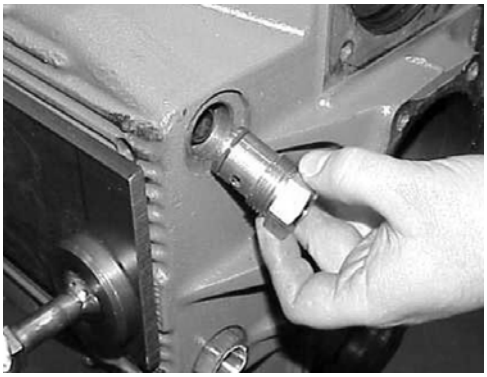
How to Install Cooler and Fittings

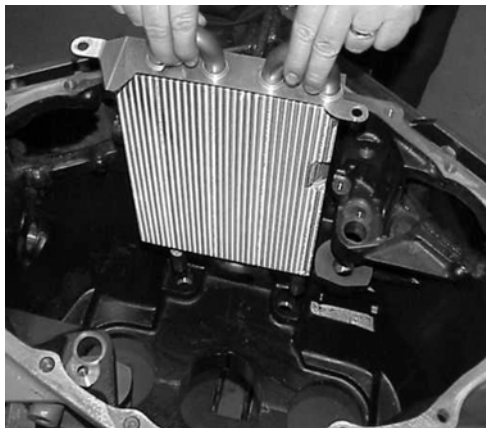
Special Instructions

None

Special Tools

- Typical Service Tools





Procedure -

1. Generously coat the internal and external O-rings on the cooler fittings with Eaton Fuller silicone lubricant #71206 or equivalent to prevent the O-rings from being damaged during fitting and cooler installation.

2. Install both fittings into the rear of the transmission case, tighten to 40-50 lb-ft (54-67 Nm).

3. If the original cooler is being reused, completely flush the internal cooler tubes and blow out all residual solvent from the external fins using a low-pressure blow gun.

4. Install the cooler into the case and carefully work the cooler tubes into the inlet and outlet fittings until fully seated against the retaining capscrew mounting surface.

5. Install the two (2) cooler retaining capscrews and tighten to 20-23 lb-ft (27-31 Nm).

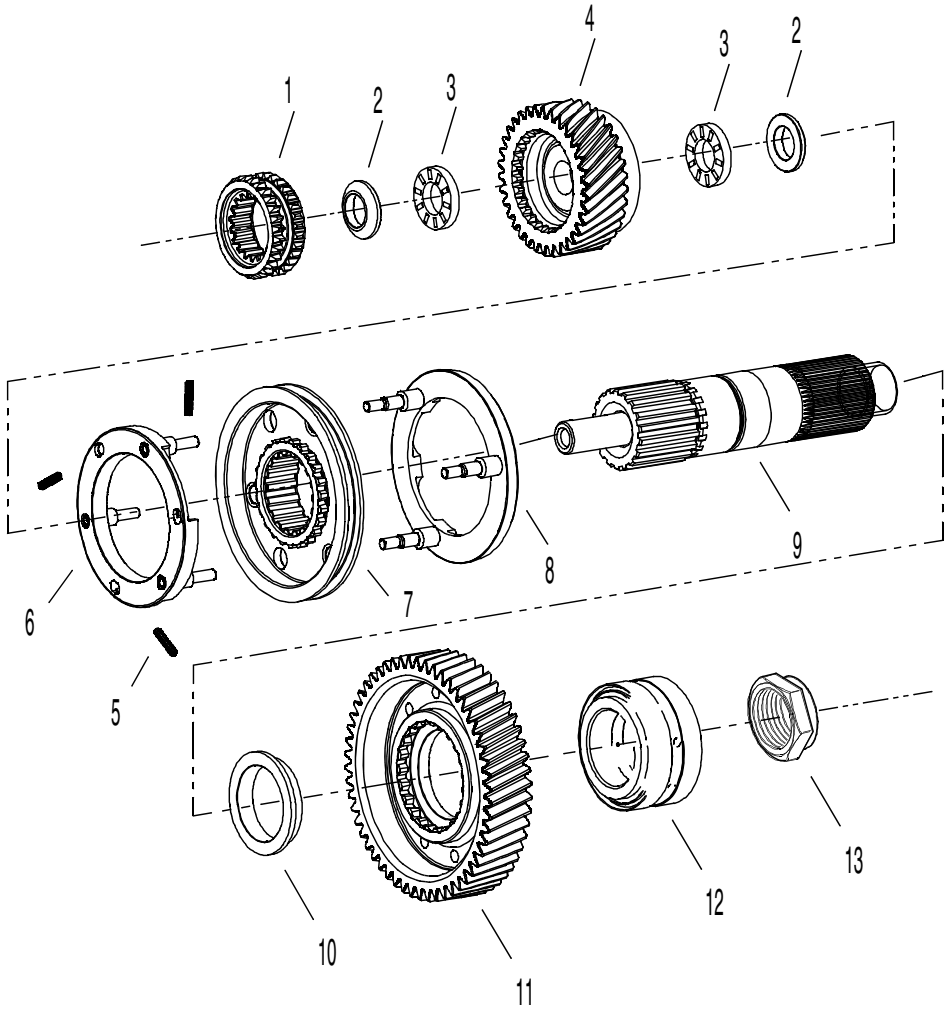
How to Assemble and Install Auxiliary Mainshaft Assembly

Special Instructions

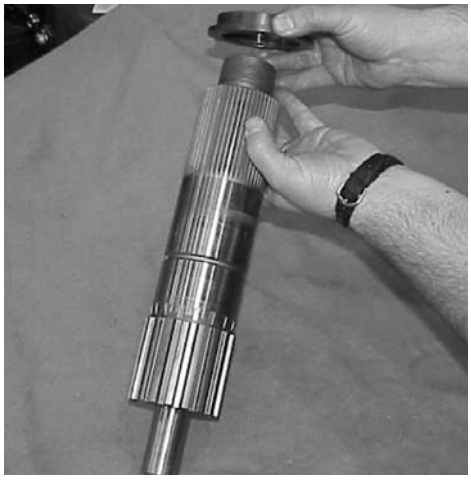
None

Special Tools

- None

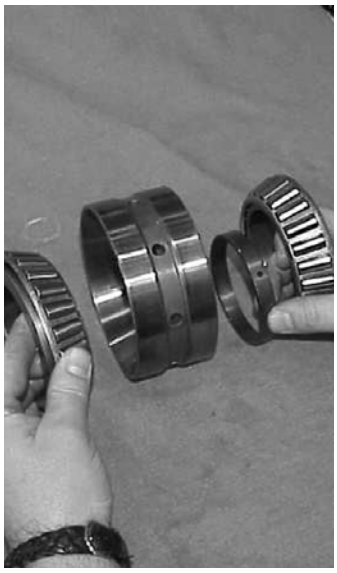


1. Sliding Clutch
2. Spherical Washer
3. Bearing
4. Aux Splitter Gear
5. Spring
6. Synchronizer Assy
7. Sliding Clutch
8. Synchronizer Assy
9. Mainshaft Assy
10. Spacer
11. Reduction Gear
12. Bearing
13. Nut



Procedure -

1. Install the stepped washer on the auxiliary mainshaft with the step to the rear of the shaft. With the small end of the shaft down, stand the shaft up on a flat bench or mount in a vise with brass jaw covers.

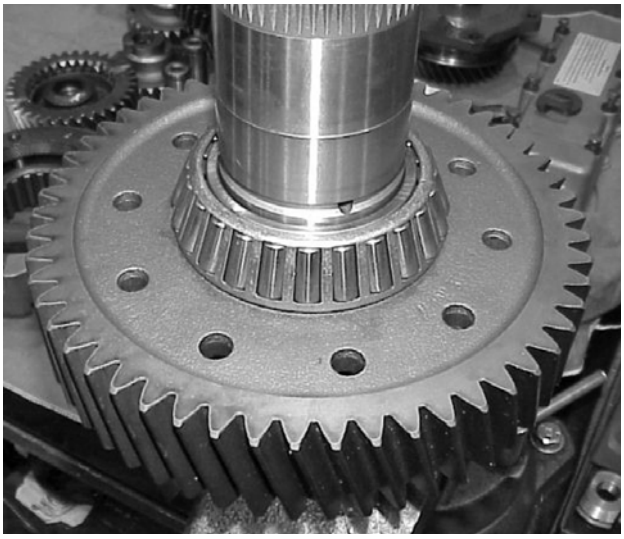


2. Coat the washer with transmission oil and install the auxiliary reduction gear with the internal clutching teeth down toward the washer.

   Note: The auxiliary mainshaft is hollow to provide an oil passage to the output bearing, prior to assembly inspect and clean the oil passage to insure there is no blockage or debris which could prevent oil supply to the bearing.

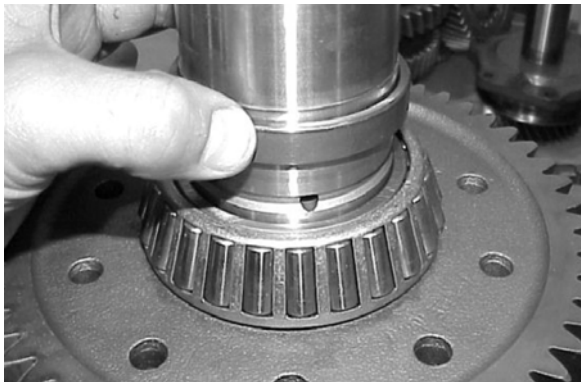
3. Inspect the bearing.

   CAUTION: The output bearing assembly is made up of a matched set of two tapered roller bearings, a center race for both bearings, and a spacer which controls the preload on the bearings. The bearing assembly should be installed exactly as it was removed if not being replaced or exactly as it came out of the packaging if new. DO NOT mix bearing parts from one bearing set to another as the bearings will be damaged.

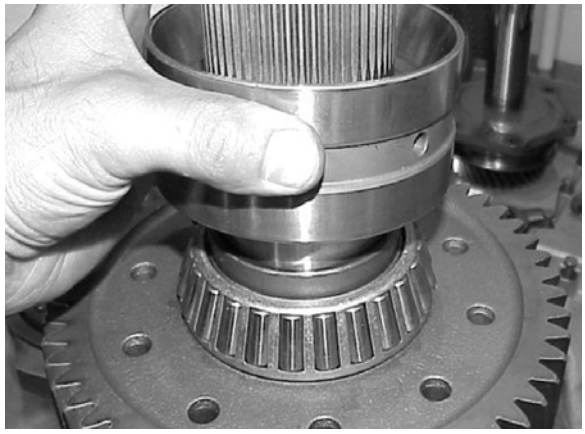


4. With the tapered side up, use a bearing heater or appropriate driver to install the inner output shaft bearing cone tightly against the stepped washer.

5. Coat the bearing cone with transmission lube and install the center spacer.

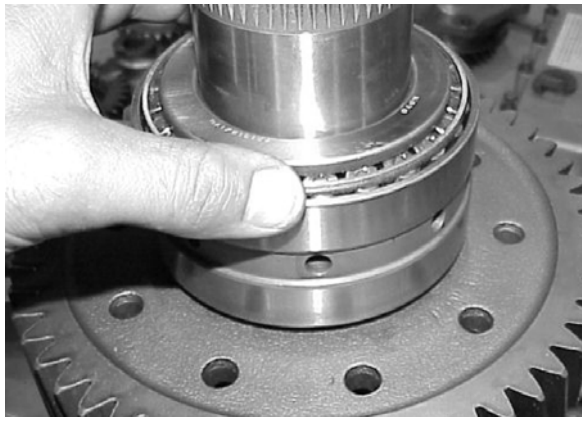


6. Install the bearing race assembly over the inner bearing cone.

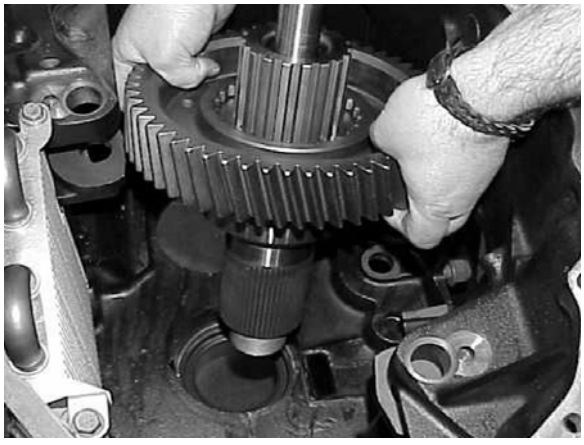


7. Coat the outer bearing cone with transmission lube and with the tapered side down, use a bearing heater or appropriate driver to install the outer output shaft bearing cone tightly against the center spacer.

   Note: The output bearing assembly must be fully seated against the stepped washer to insure proper mainshaft endplay clearance.



8. Install the assembled auxiliary mainshaft assembly into the transmission case by holding the auxiliary reduction gear and lowering the output end of the shaft through the rear of the case as shown.



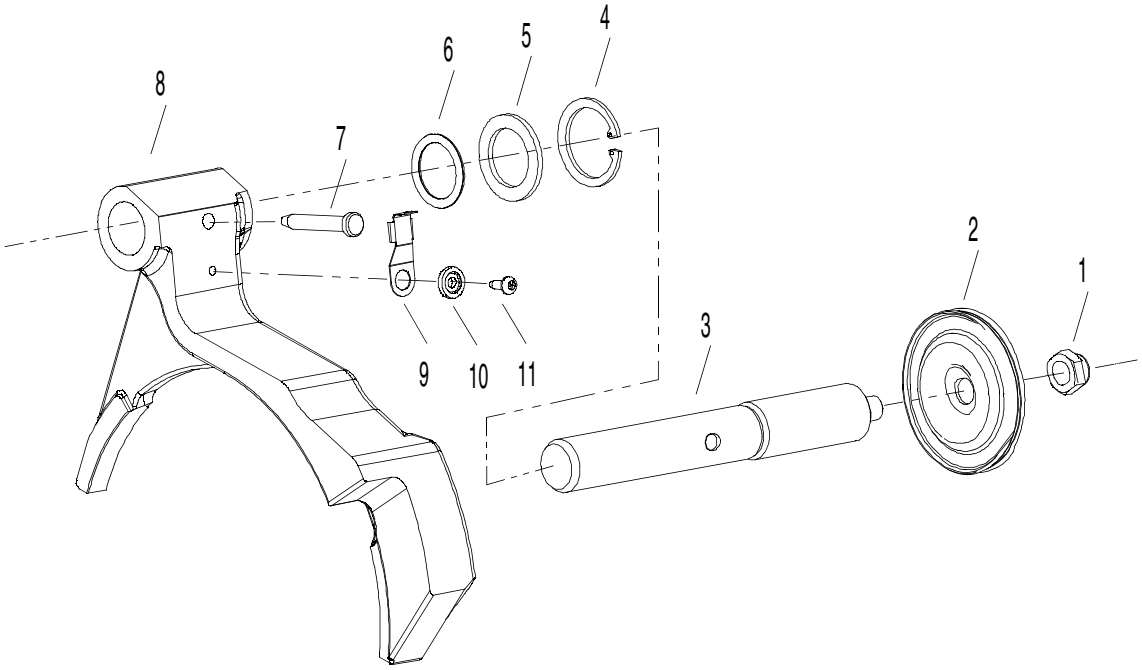
How to Assemble and Install Range System

Special Instructions

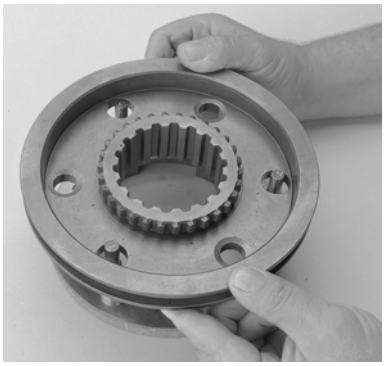
None

Special Tools

- Typical Service Tools



1. Nut
2. Piston
3. Yoke Bar
4. Snap Ring
5. Washer
6. O- Ring
7. Pin
8. Range Yoke Assy
9. Retainer
10. Step Washer
11. Screw

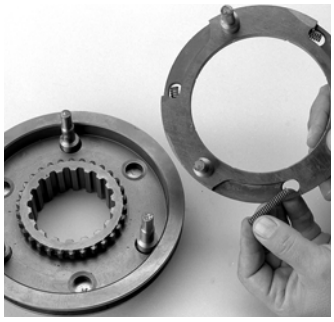


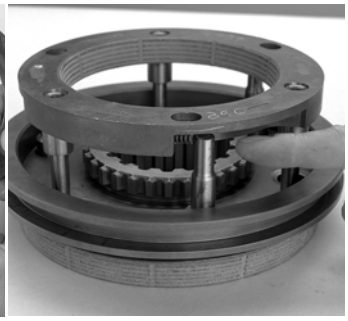
Procedure -

1. To assemble the range synchronizer assembly, place the larger LOW range synchronizer ring on the bench with the pins facing up.

   TIP: Assembly should be done on a clean, flat surface slightly lower than your waist.

2. With the recessed side up, place the sliding clutch over the LOW range synchronizer pins. Make sure the pins on the low range synchronizer are inserted through the chamfered holes on the bottom of the sliding clutch.

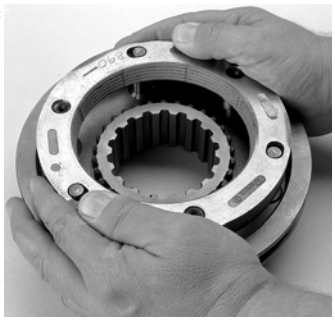


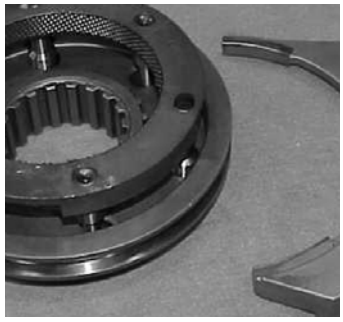


3. Install a spring in each of the three (3) holes in the HIGH range synchronizer. The holes are horizontal to the pins.

4. Place the HIGH range synchronizer ring over the three (3) pins on the LOW range synchronizer ring. With the whole assembly covered with a shop rag, rotate the HIGH range synchronizer counterclockwise until the springs are seated against the pins. The shop rag will contain the springs if they come loose from the synchronizer during compression.

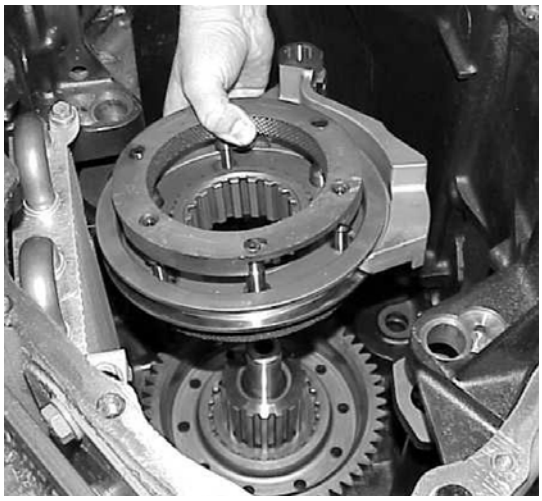
5. To achieve spring compression, place hands on each side of the synchronizer assembly and apply downward pressure while twisting the HIGH range synchronizer counterclockwise. As the springs compress, the HIGH range synchronizer will drop down over the LOW range synchronizer pins.



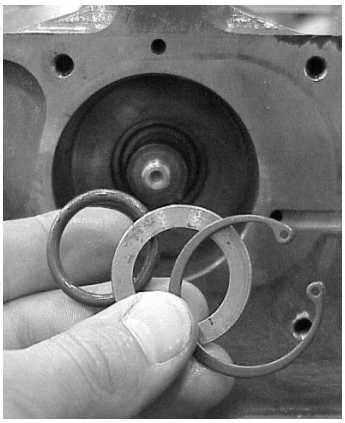


6. Assemble the range yoke into the sliding clutch groove so that the yoke offset is facing up and the smaller HIGH range synchronizer ring is on top.

7. Install the range synchronizer and yoke over the auxiliary mainshaft so that the LOW range synchronizer seats into the reduction gear cup. Line up the range yoke with the holes for the range bar.

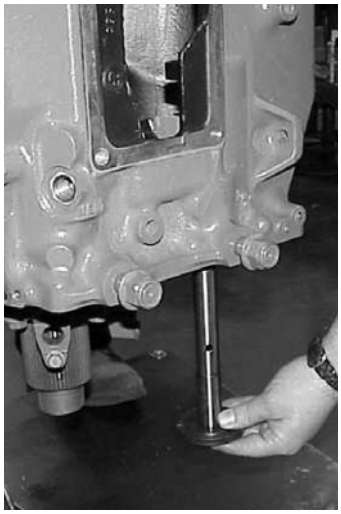


8. Apply a thin coating of silicon lube to the new range bar O-ring and install the O-ring over the range bar. Make sure the range bar is fully seated in the bore.



9. Install the washer and snap ring into the bore. Make sure that the snap ring fully expands and seats into the snap ring groove.

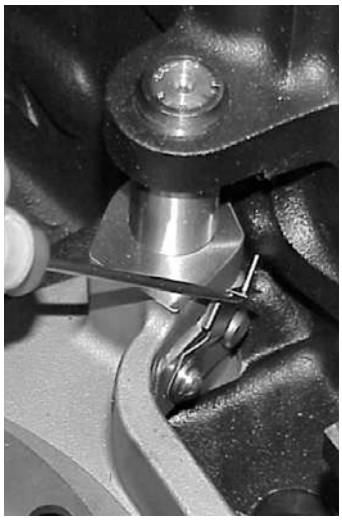
10. Install the range piston on the end of the range bar with the rubberized sealing surface toward the range bar.

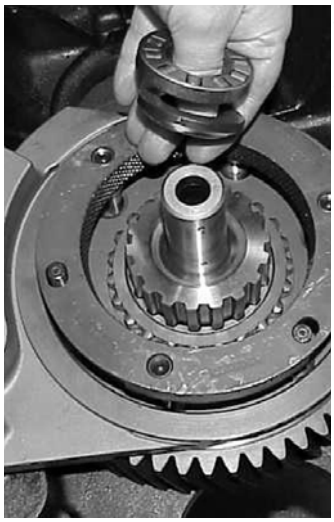


11. Apply a thin coating of silicon lube to the outside diameter of the new range piston and push the range bar and piston forward into the bore at the rear of the main case.

12. Install the new range piston retaining nut and tighten to 25-35 lb-ft (34-47 Nm).

13. Line up the yoke retainer pin hole in the range bar with the hole on the range yoke. Install the pin with the head of the pin next to the pin retaining clip.





14. Engage the clip over the head of the retainer pin.

15. Install the conical splitter gear washer and thrust bearing with the flat side of the washer facing up against the bearing.

16. Install the splitter gear with the HIGH range synchronizer hub inserted into the HIGH range synchronizer.

    Note: Reference auxiliary countershaft assembly instructions and timing of gearing section for information on marking the splitter gear for timing purposes.

17. Install the splitter gear thrust bearing and conical washer with the bearing against the gear and the flat side of the washer against the bearing.

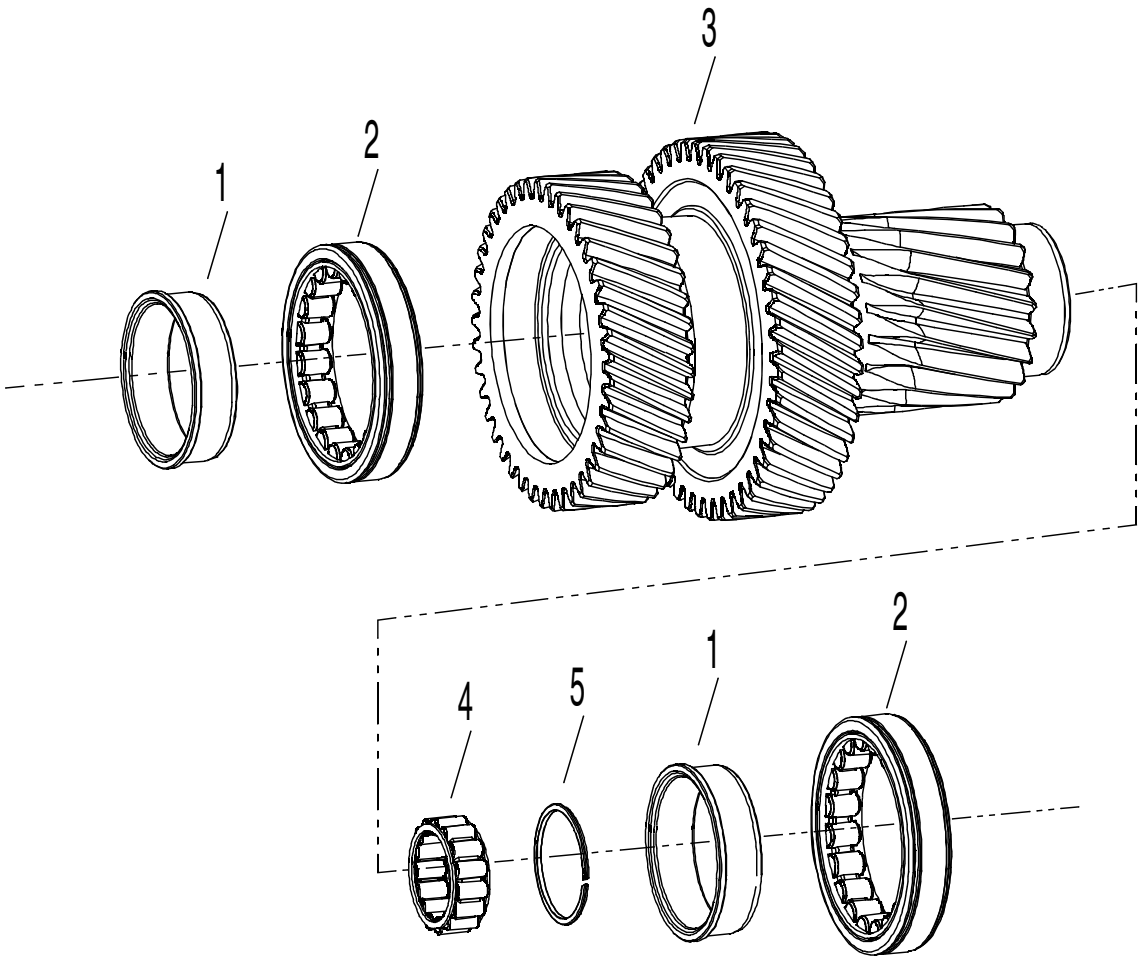
How to Assemble and Install Auxiliary Countershaft

Special Instructions

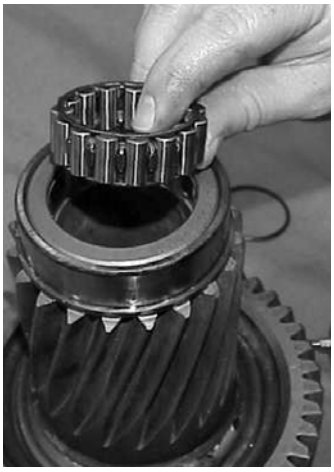
None

Special Tools

- Typical Service Tools
- Bearing Driver (Tool ref. ID T 10)
- Arbor Press



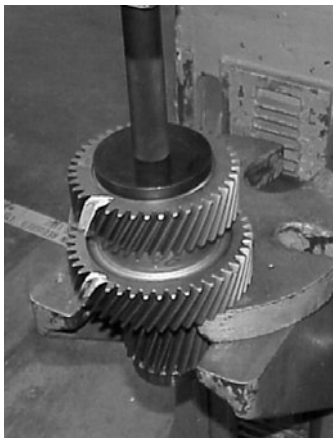
1. Bearing-Inner Race
2. Bearing-Outer Race
3. Welded Countershaft Assy
4. Bearing
5. Retaining Ring



Procedure -

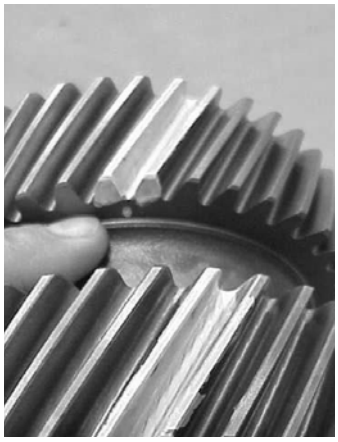
1. Use a bearing race heater or bearing driver to install the auxiliary countershaft rear inner bearing races.

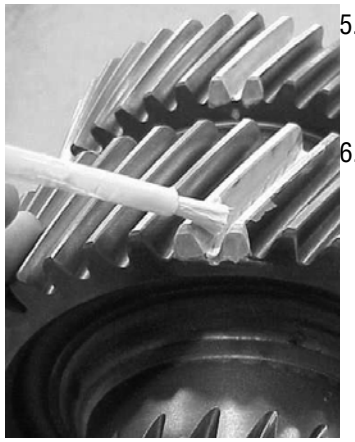
2. Install the auxiliary countershaft rear inner roller bearing and snap ring. Make sure the snap ring is installed with the flat side against the bearing as shown.



3. Use a bearing driver (Tool ref. ID T10) to install the auxiliary countershaft front roller bearing.

4. Use a highly visible toolmakers dye to mark the splitter gear and auxiliary countershaft gears for timing purposes. To mark the splitter gear, paint the toolmakers dye on any tooth on the gear then paint the tooth directly opposite the first tooth.





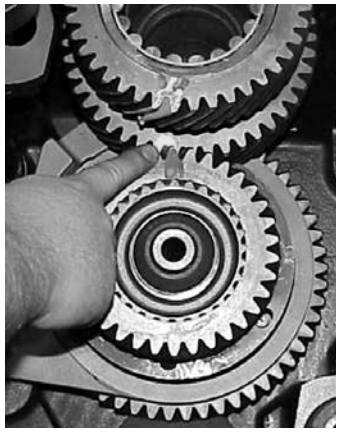
5. To mark the auxiliary countershaft gears locate the timing mark on the flat section of the shaft next to the smallest gear (usually a ’0’).

6. Locate and paint the two adjacent teeth on both larger gears that line up with the timing mark. Reference the ”Timing of Gearing” section for the complete procedure.

7. With the splitter gear installed on the end of the auxiliary mainshaft and the transmission tilted at a 45 degree angle. Install the upper auxiliary countershaft into the case.

   Note: Tilting the transmission will allow the countershaft to be aligned with the bearing bore for easier bearing installation.

8. The two painted teeth on the countershaft line up with the painted tooth on the splitter gear.



9. Install the rear auxiliary countershaft bearing over the end of the shaft by tapping it into the bearing bore until seated.

10. Assemble the countershaft rear bearing cover per installation instructions.

11. Repeat steps for the other auxiliary countershaft.

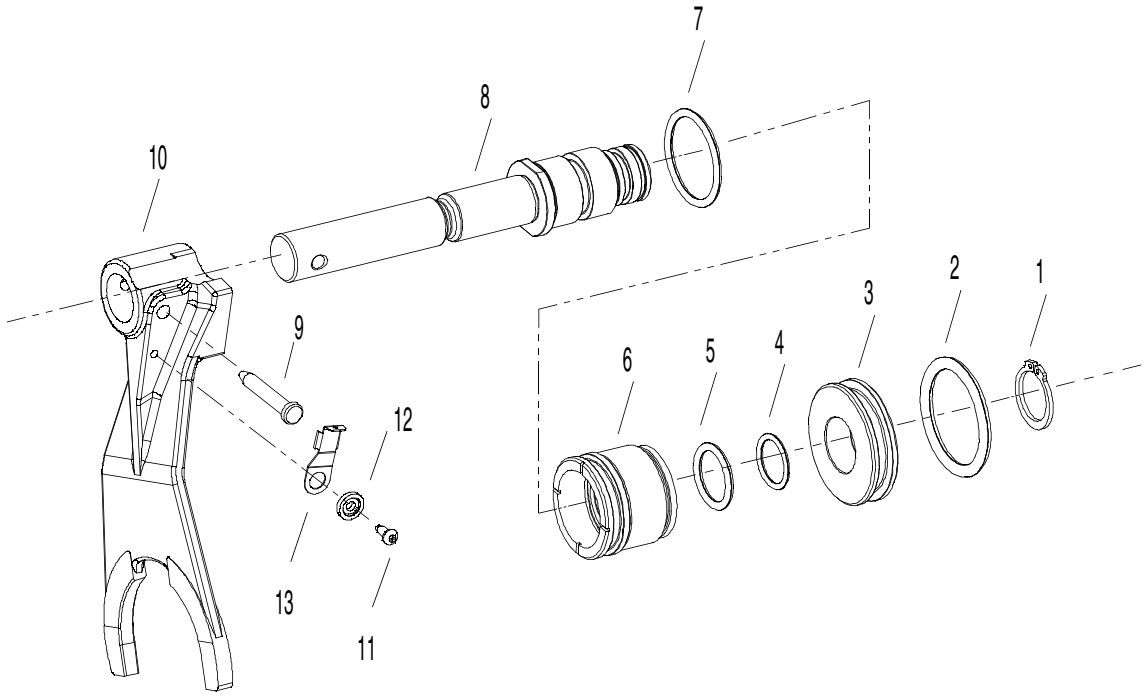
How to Assemble Splitter System

Special Instructions

None

Special Tools

- Typical Service Tools

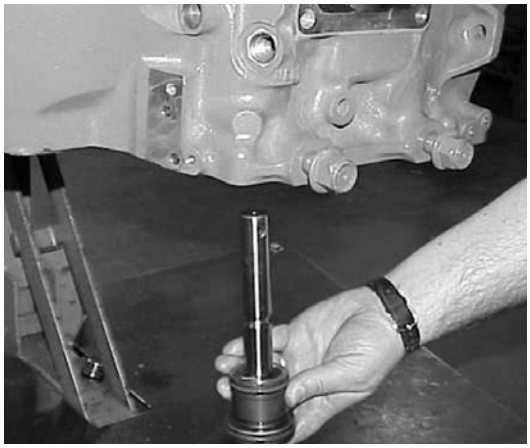


1. Snap Ring
2. O- Ring
3. Piston
4. O- Ring
5. O- Ring
6. Piston
7. O- Ring
8. Yoke Bar
9. Pin
10. Splitter Yoke Assy
11. Screw
12. Step Washer
13. Retainer

Procedure -

1. Apply a thin coating of Eaton Fuller silicone lubricant to the four (4) splitter O-rings and install the O-rings on the yoke bar and splitter pistons.

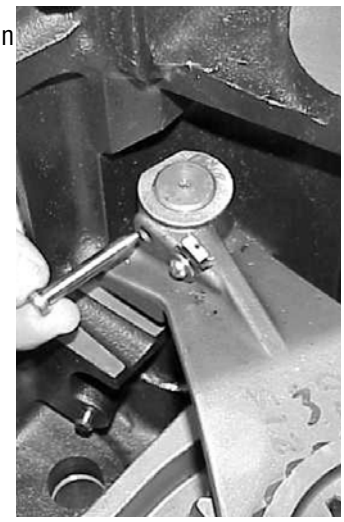
2. Insert the splitter bar assembly into the splitter bore.



3. Position the splitter clutch into the splitter yoke and install the yoke and clutch on the splitter bar. Make sure the yoke is offset toward the splitter gear and the hole for the yoke retainer pin visible on top.

4. Line up the hole in the end of the splitter bar with the hole in the splitter yoke.

5. Install the retaining pin and locking clip.



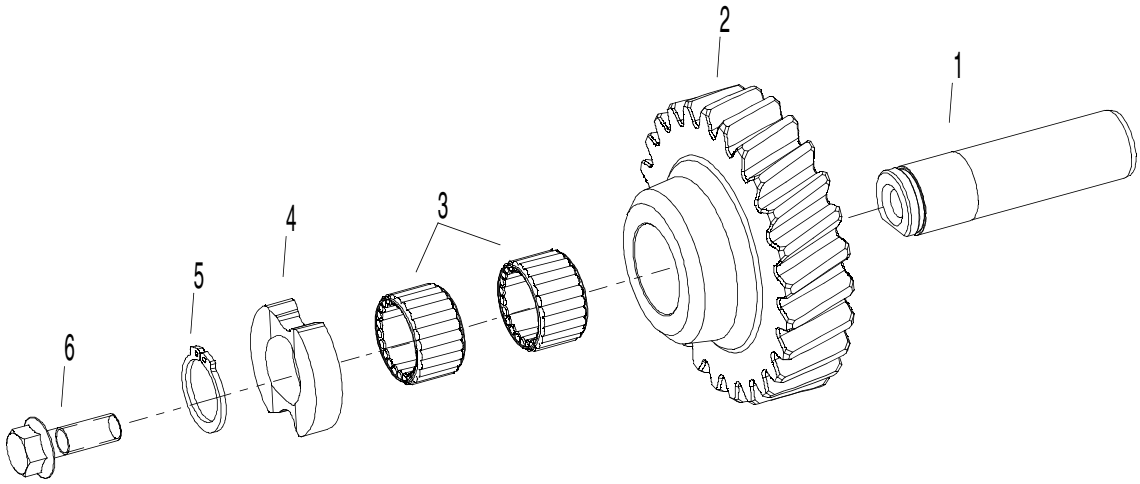
How to Assemble and Install Reverse Idler

Special Instructions

None

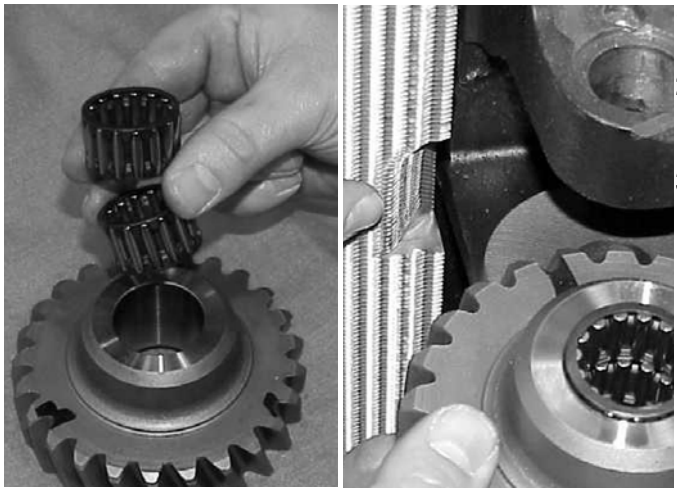
Special Tools

- Typical Service Tools



1. Reverse Idler Shaft
2. Reverse Idler Gear
3. Bearing
4. Washer
5. Snap Ring
6. Capscrew

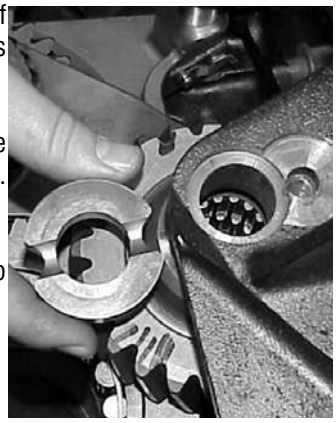
Procedure -



1. Install the snap rings on the reverse idler shafts.
2. Install two (2) caged needle bearings in each reverse idler gear.
3. Install the reverse idler gears between the mounting forks with the large end of the gear facing up as shown.

   Note: The internal cooler is made with a clearance slot for the lower (right side) idler gear.

4. Install the grooved washers on top of the gear with one of the notches lined up with the retaining capscrew hole as shown.



5. Align the gears and shafts with the shaft bores and insert the idler shafts into the bores with the threaded hole facing up. Tap the shafts into the bores until fully seated.

   Note: Make sure the notch in the end of the shaft is lined up with the retainer capscrew hole.

6. Install the idler shaft retainer capscrews. Tighten capscrews to 47-52 lb-ft (63-70 Nm). Make sure the gears spin freely on the shafts.

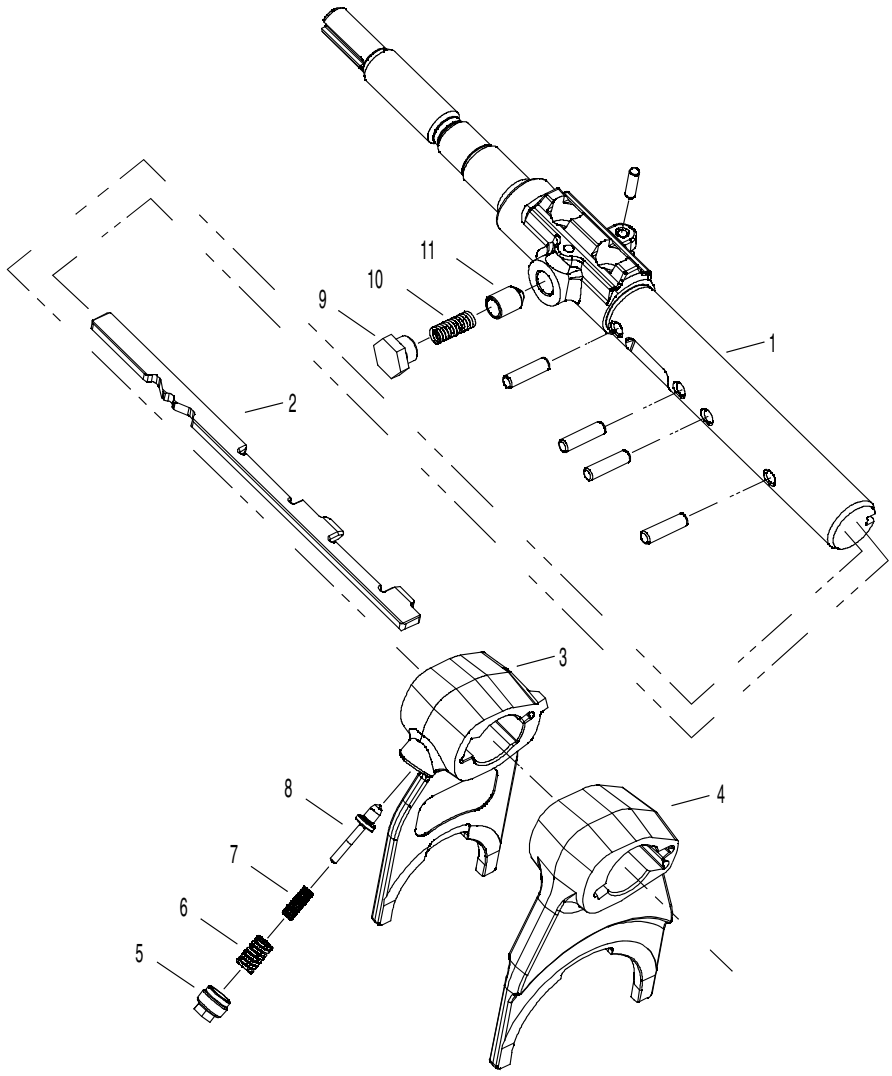
How to Assemble and Install the Shift Shaft

Special Instructions

None

Special Tools

- Typical Service Tools



1. Shift Shaft Assy
2. Key
3. Shift Yoke
4. Shift Yoke
5. Plug
6. Spring
7. Spring
8. Plunger
9. Plug
10. Compression Spring
11. Plunger

Procedure -

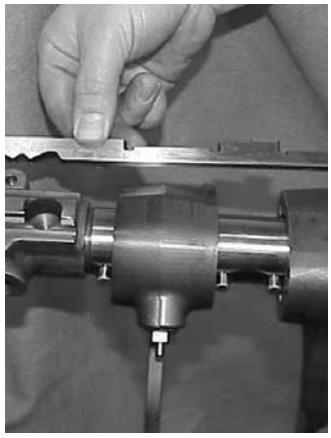
1. Clamp the small end of the shiftshaft in a vise with brass jaw protectors. Position the shiftshaft horizontally with the solid pins facing to the left.

2. With the detent boss facing to the left, line up the 1st & reverse shift fork slot with the shiftshaft pins and slide over the shaft to the set of pins closest to the shift block.

3. Install the reverse bias plunger, spring, and plug into the 1st & reverse shift fork as shown. Tighten plug to 15-20 lb-ft (20-27 Nm).

4. With the single internal slot facing to the left, line up the 3rd & direct shift fork slot with the shiftshaft pins. Slide the fork over the shiftshaft to the first set of pins.

5. Position the two shift forks on the shiftshaft as shown.



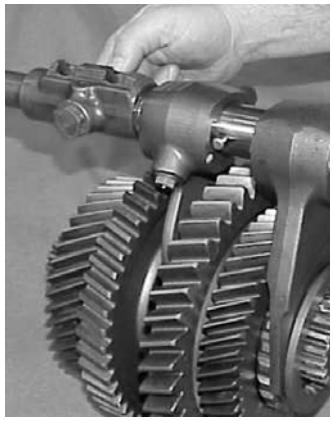
6. Line up the shift fork slots with the shiftshaft key slots. Install the shiftshaft key with the two wide notches facing out from the shaft as shown.

7. Install the neutral detent plunger with the cup facing out.

8. Install the spring and threaded detent plug. Tighten plug to 15-20 lb-ft (20-27 Nm).

9. Install the shiftshaft assembly on the mainshaft with the two shift forks inserted into the mainshaft sliding clutches and the long section of the shift shaft facing toward the rear of the mainshaft.

10. Refer to the mainshaft installation section for installing the shiftshaft and mainshaft into the maincase.



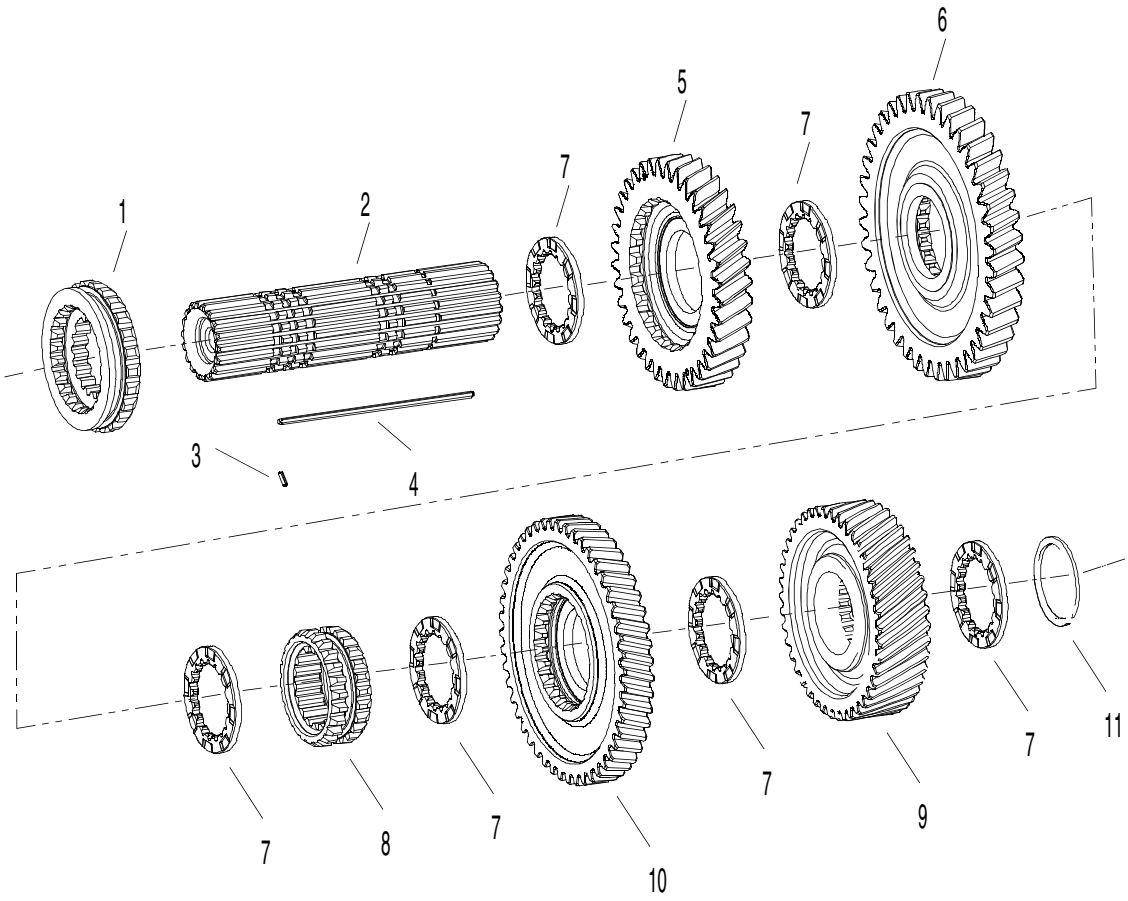
How to Assemble and Install the Mainshaft

Special Instructions

None

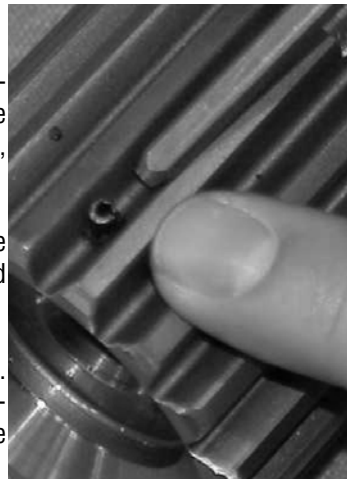
Special Tools

- Typical Service Tools
- Tool Makers Dye



1. Sliding Clutch
2. Mainshaft Key
3. Roll Pin
4. Key
5. 4th Gear-Mainshaft
6. 1st Gear-Mainshaft
7. Washer
8. Sliding Clutch
9. Auxiliary Drive Gear
10. Reverse Gear-Mainshaft
11. Snap Ring

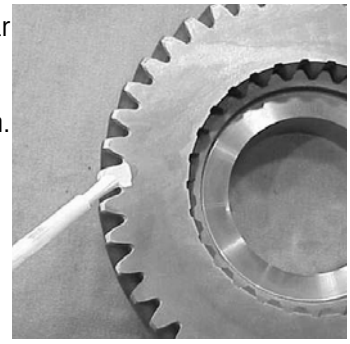
Procedure -

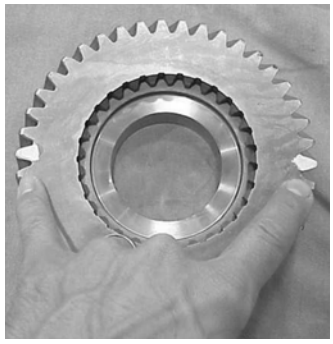


1. Start with the mainshaft sitting on the bench in a vertical position with the three washer grooves at the bottom. The spline for the mainshaft key can be identified by the roll pin, this spline should be facing toward you.

2. Slide the first splined washer over the mainshaft into the lowest groove. Rotate the washer to offset the splines and hold the washer in place.

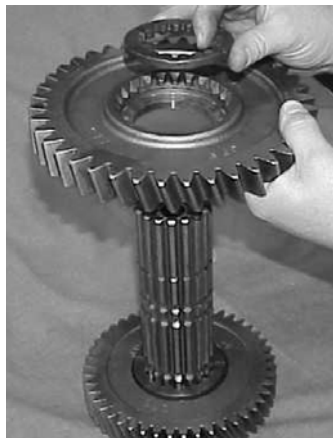
   Note: The six (6) mainshaft washers are the same thickness. Unlike previous Eaton Fuller transmissions, this model does not require gear endplays to be set while building the mainshaft.





3. Use a highly visible toolmakers dye to mark the 3rd/4th gear for timing purposes.

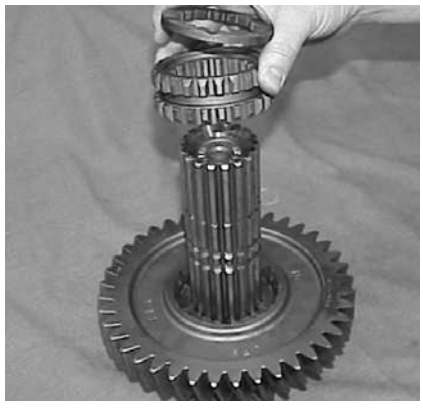
4. To mark the gear, paint the toolmakers dye on any tooth. Then paint the tooth directly opposite the first tooth.



5. With the clutching teeth down, install the 3rd/4th gear on the mainshaft against the first washer. Then install the second washer into the second groove. Rotate the washer to offset the splines and hold the washer in its groove.

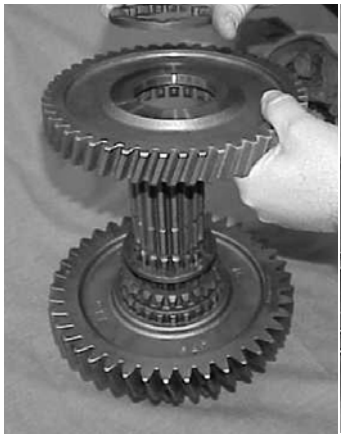
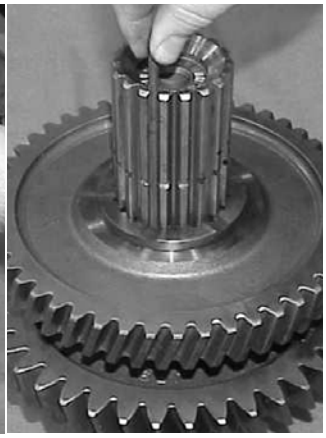
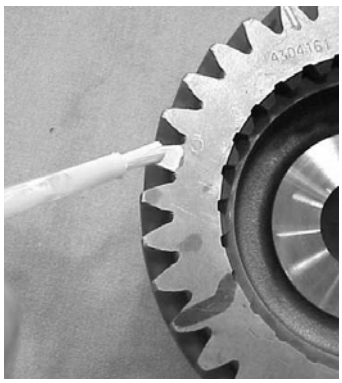
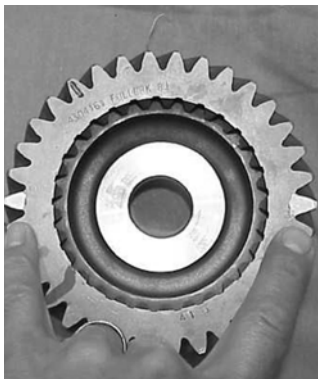
   TIP: A spare piece of 12" long 5/32" air line can be used as a temporary key to assist in assembly. From the bottom, feed the air line up the keyway through the splined washers and gears to hold the components in place. After the mainshaft is fully assembled, the key can be inserted from the top as the air line is withdrawn from the bottom.

   Note: The spline in the mainshaft with the roll pin must be used as the keyway.

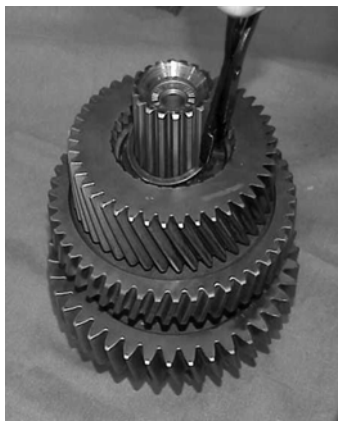


6. Install the 1st/2nd gear against the second washer with the clutching teeth up. Install the third splined washer and rotate the splines to hold it in the groove.

7. Locate the missing internal spline on the middle position sliding clutch. Install the clutch on the mainshaft with the missing internal spline aligned with the keyway.

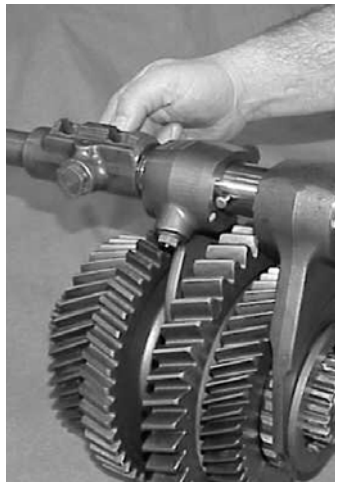





8. Install the fourth splined washer in the next available groove.
9. With the clutching teeth down, install the reverse gear on the mainshaft against the washer.
10. Install the fifth splined washer next to the gear and rotate the splines to hold it in the groove.
11. Insert the key into the keyway spline against the roll pin. Make sure the rounded edge of the three-way key is installed against the mainshaft.
12. Use a highly visible toolmakers dye to mark the auxiliary drive gear for timing purposes.
13. To mark the gear, paint the toolmakers dye on any tooth. Then paint the tooth directly opposite the first tooth.
14. Install the auxiliary drive gear on the mainshaft with the clutching teeth up.
15. Install the sixth splined washer against the gear.
16. Install the snap ring into the snap ring groove.



17. Locate the missing internal spline on the front sliding clutch. Install the clutch on the front of the mainshaft with the missing spline aligned with the keyway and the external clutching teeth toward the gear.

18. Install the shift shaft assembly onto the mainshaft with the two shift forks inserted into the mainshaft sliding clutches. The long section of the shift shaft should face toward the rear of the mainshaft.



19. While holding the mainshaft and shiftshaft together, lower them into the maincase with the shiftshaft lined up with the rear shiftshaft bore in the case.

20. Make sure the auxiliary drive gear timing marks are lined up on each side with the timing marks of the auxiliary countershaft driven gear and seated against the auxiliary mainshaft. Reference the “Timing of Gearing” section for more information.

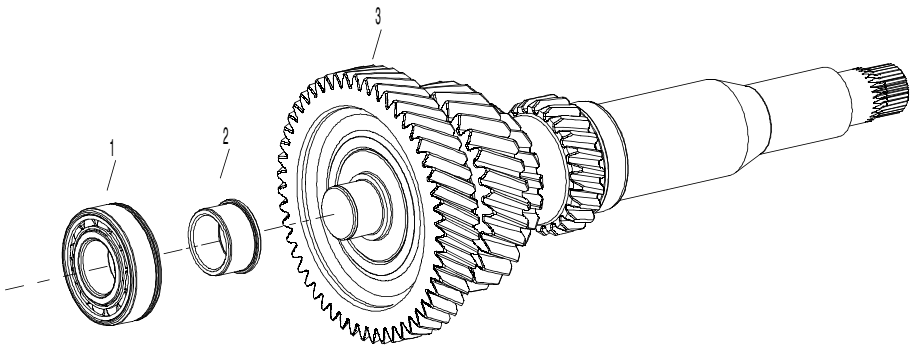
How to Assemble and Install Front Countershaft Assembly

Special Instructions

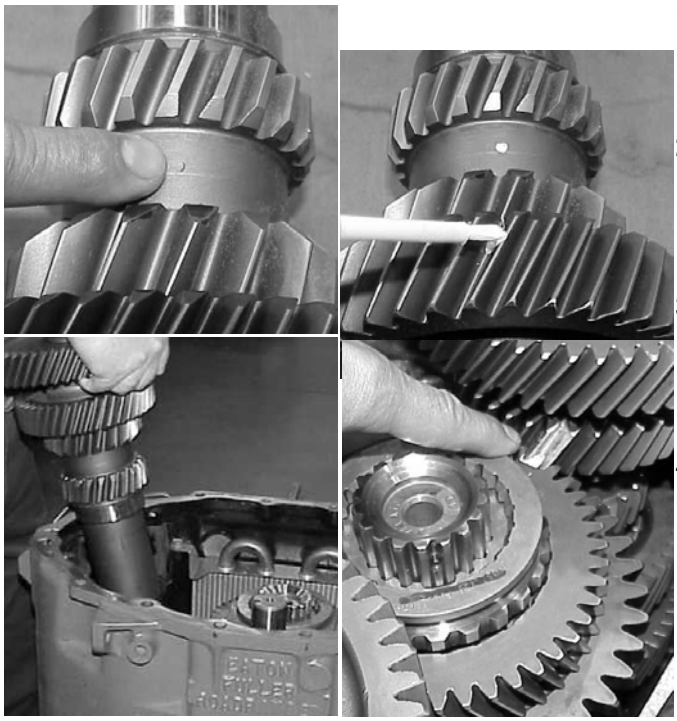
None

Special Tools

- Bearing Heater



1. Bearing — Outer Roller
2. Bearing — Inner Race
3. Welded Countershaft Assy



Procedure -

1. Install the countershaft front bearing races by heating them with a bearing race heater, and pressing them on with an arbor press or appropriate race driver.

2. Install the auxiliary countershaft front bearing races on the front countershafts by heating them with a bearing race heater, and pressing them on with an arbor press or appropriate race driver.

3. For timing purposes, use a highly visible toolmakers die to mark the 4th gear teeth on each front countershaft. Locate and paint the two adjacent teeth that line up with the timing mark on each shaft (usually a '0').

4. Slide each front countershaft into the auxiliary countershafts while lining up the marked teeth on the countershaft gears with the marked teeth on the mainshaft gear as shown.

   Note: Reference the "Timing of Gearing" procedure for complete information.

How to Install Output Bearing Cover

Special Instructions

None

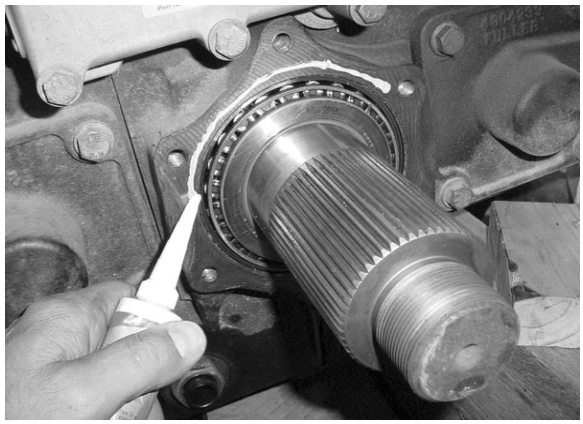
Special Tools

- Typical Service Tools

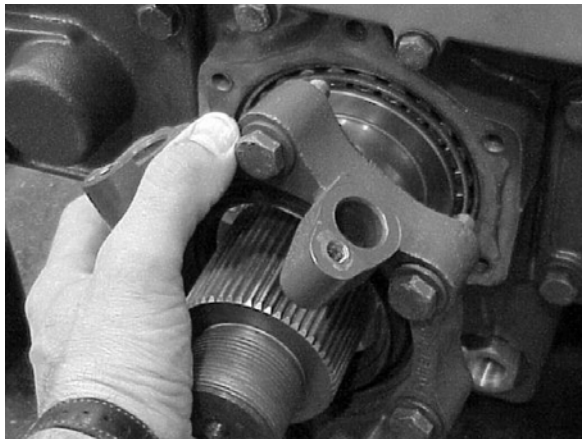
Procedure -

1. Thoroughly clean and inspect the sealing surfaces on the transmission case and the output bearing cover for gouges or distortion. Replace if necessary.

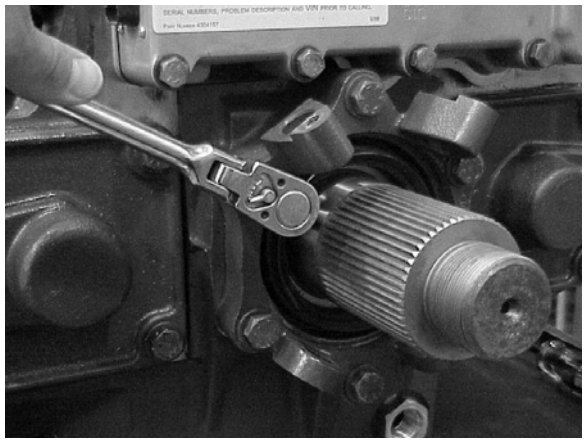
2. Apply RTV sealant per application guidelines to the transmission case.



3. Place the bearing cover on the case in the same orientation as removed.



4. Install the six bearing cover retaining capscrews. Tighten capscrews to 47-52 lb-ft (63-70 Nm).



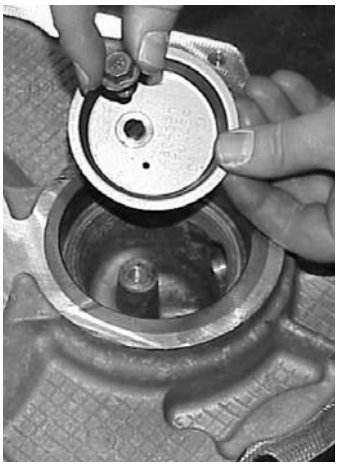
How to Assemble Clutch Housing / Front Cover

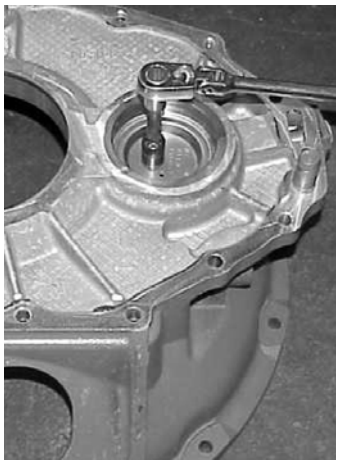
Special Instructions

None

Special Tools

- Typical Service Tools
- Bearing Driver (Tool ref. ID T10)

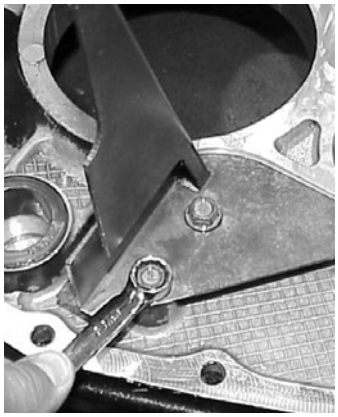




Procedure -

1. Thoroughly clean and remove all traces of old hardened sealant and debris from the front cover, main transmission sealing surfaces and oil passages, prior to beginning the re-assembly process.

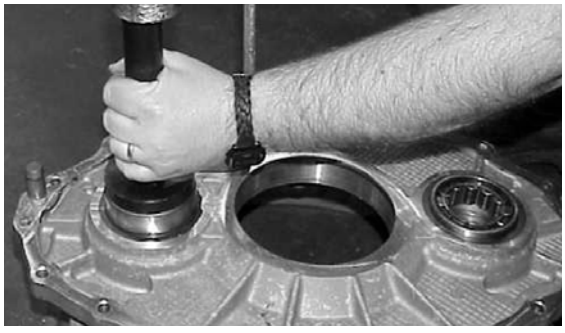
2. Install the oil dam plate and retaining capscrew inside the bearing bores, tighten capscrew to 20-23 lb-ft (27-31 Nm).



3. Install the oil trough and two retaining capscrews. Tighten to 20-23 lb-ft (27-31 Nm).

4. Coat the bearing rollers with transmission lube.

Note: The orientation of the snap ring groove should be facing downward.

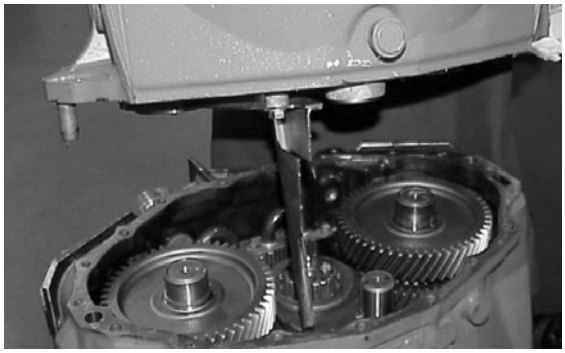


5. Install the front countershaft bearings into the bearing bores using bearing driver (Tool Ref. ID T10).

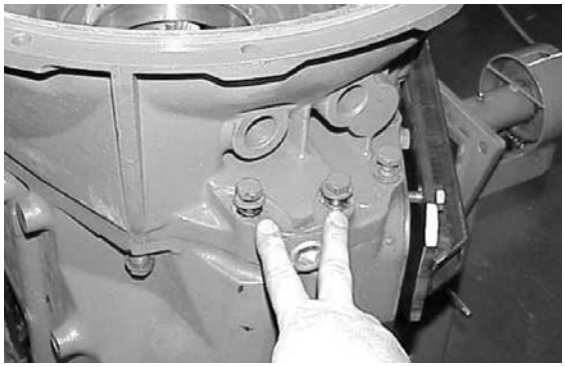
6. Apply sealant to the transmission main case front mounting surface as shown.

   Note: RTV sealant must be applied around the inside of the capscrew holes, the outside of the lube hole and around the circumfrence of both alignment pins.

7. Line up the dowel pins and install the front cover onto the main transmission case. Make sure the front cover is fully seated against the main case.

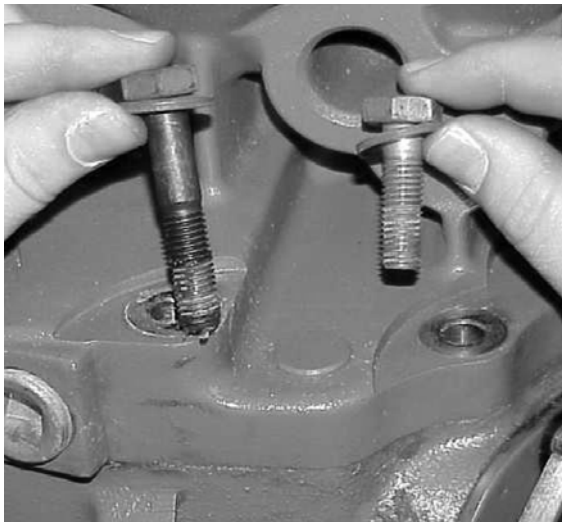


8. Install sixteen (16) capscrews and tighten to 47-52 lb-ft (63-70 Nm).



9. Note location of bolts on right side of case.

   Note: One (1) of the capscrews at the right side of the front cover is longer than the other and must be installed in the proper location.



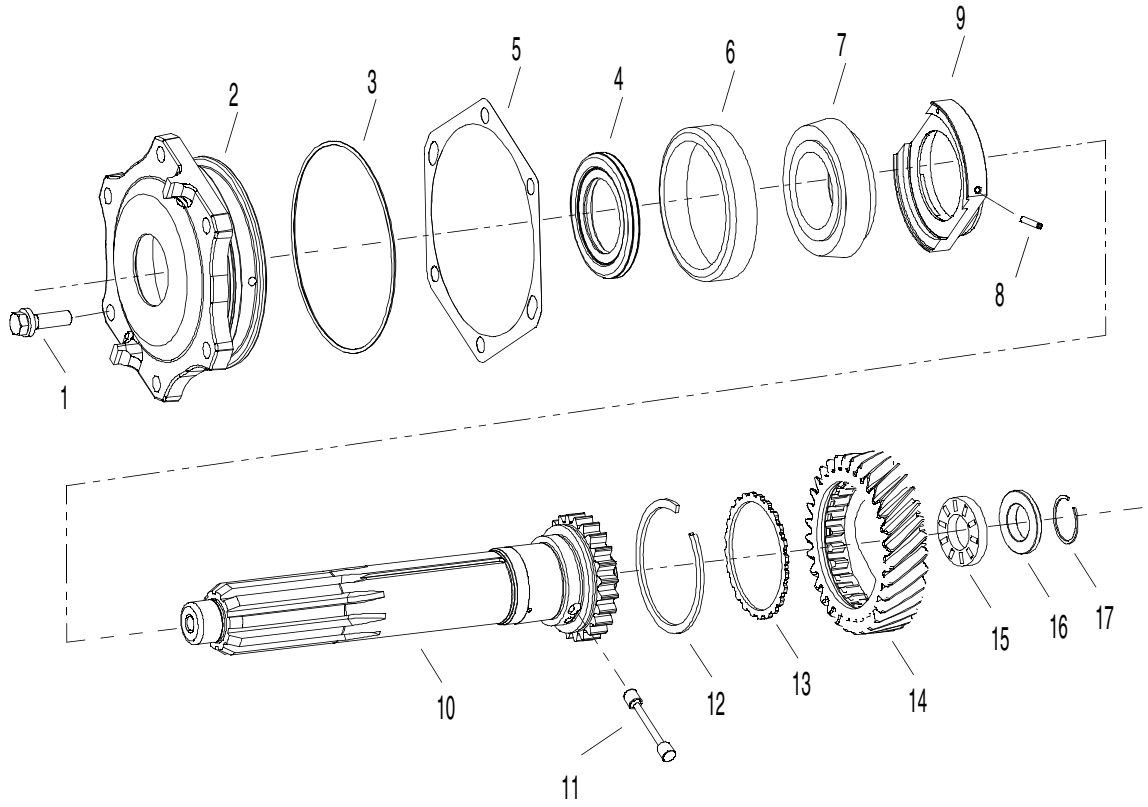
How to Assemble Input Shaft and Oil Pump

Special Instructions

None

Special Tools

- Arbor Press
- Typical Service Tools



1. Capscrew & Washer
2. Front Brg Cover Assy
3. O- Ring
4. Oil Seal
5. Shim Kit
6. Bearing Cup
7. Bearing Cone
8. Screw
9. Eccentric Pump Assy
10. Input Shaft
11. Piston Pump
12. Snap Ring
13. Washer
14. Main Drive Gear
15. Bearing
16. Spherical Washer
17. Snap Ring

Procedure -

1. Coat the thrust bearing with transmission lube and install the thrust bearing, beveled washer (flat side toward bearing), and snap ring on the input shaft.

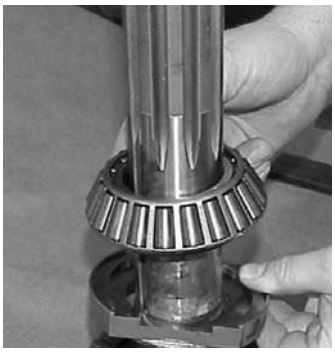
2. Assemble pump piston into input shaft with light coating of transmission lube.

3. Install the input shaft into the main drive gear and install the splined washer.

4. Install the snap ring.

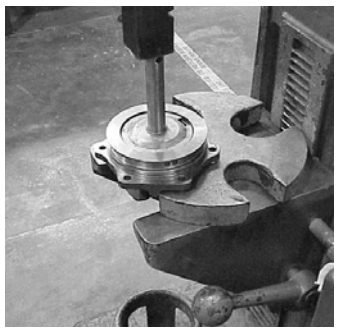
   Note: Old style splined washers have two different sides. The flat side must face the snap ring.

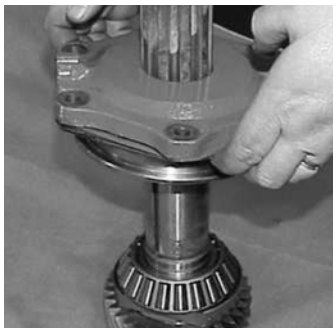
5. Install the concentric pump over the pump piston and install the input bearing using a bearing heater or arbor press.

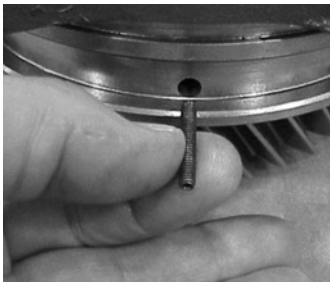


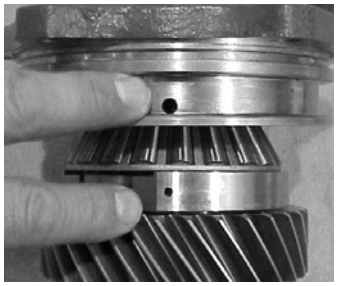
6. Install a new input shaft seal and bearing race in the front bearing cover (Tool ref. ID T10) using an arbor press as shown.

7. Apply transmission lube to the input bearing and install the front bearing cover.









8. Line the hole in the bearing cover up with the threaded hole in the eccentric pump.

9. Install the set screw into the bearing cover using a 5/64" allen wrench and tighten to 3 lb-ft (4 Nm). This will retain the bearing cover on the input shaft assembly.

10. Proceed to the mainshaft shimming procedure to complete the installation of the input shaft and bearing cover assembly.

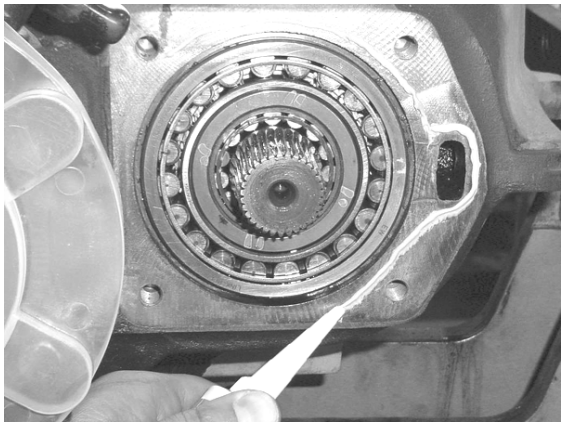
How to Install the Auxiliary Countershaft Bearing Cover

Special Instructions

None

Special Tools

- Typical Service Tools

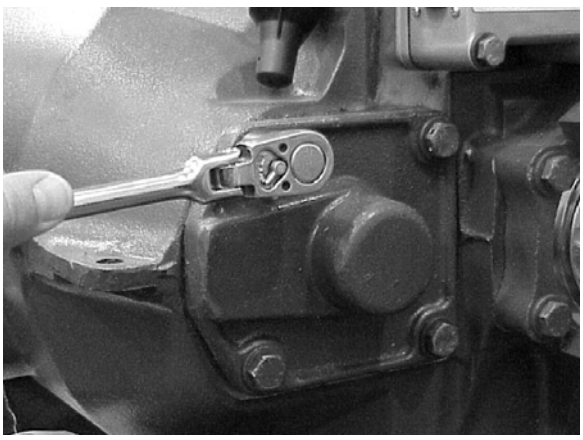


Procedure -

1. Thoroughly clean and inspect the sealing surfaces on the transmission case and the output bearing cover for gouges or distortion. Replace if necessary.

2. Apply RTV sealant per application guidelines to the transmission case.

3. Install the bearing cover on the case with the lube slot in the cover lined up with the lube hole in the case.



4. Install the four bearing cover capscrews. Torque to 47-52 lb-ft (63-70 Nm).

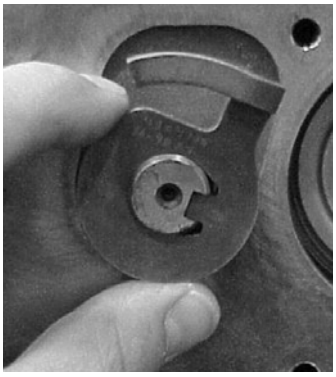
How to Install the ECU

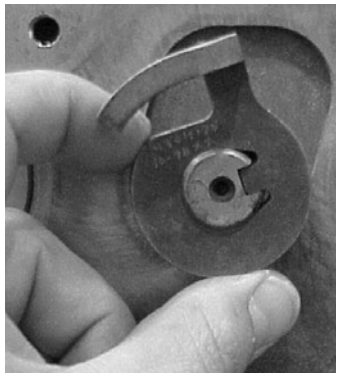
Special Instructions

None

Special Tools

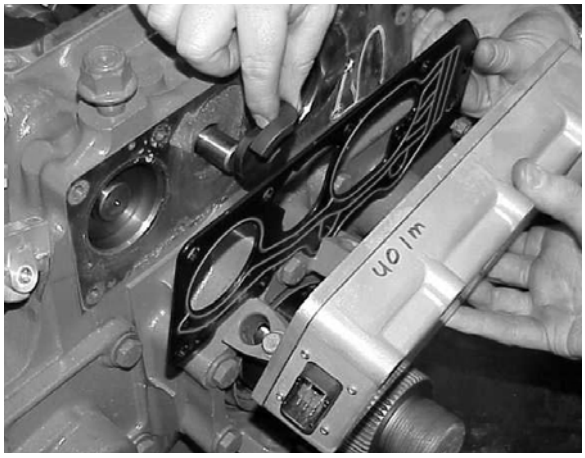
- Typical Service Tools



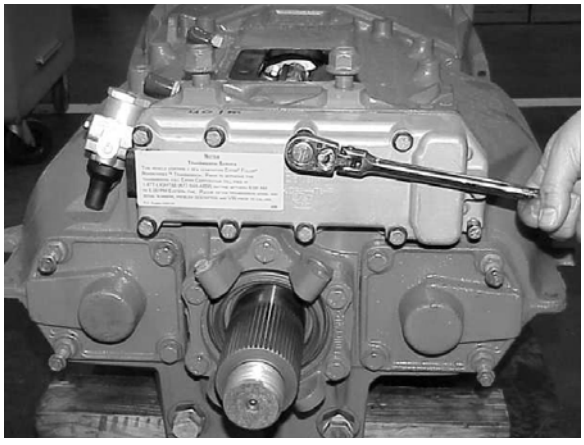


Procedure -

1. Place the transmission in the reverse gear position.
2. Position the actuating washer onto the end of the shift shaft and make sure it is rotated fully clockwise.



3. Assemble the ECU, spacer plate, and sealing plate.
4. Position the ECU assembly over the actuating washer so the finger lines up with the range position sensor.



5. Make sure the ECU is fully seated against the case and install the nine ECU capscrews.
6. Torque the ECU capscrews to 20-23 lb-ft (27-31 Nm).
7. Attach the vehicle interface harness to the ECU. Tighten the connector screw to 7–13 lb-in (.8–1.5 Nm).

How to Install Output Yoke

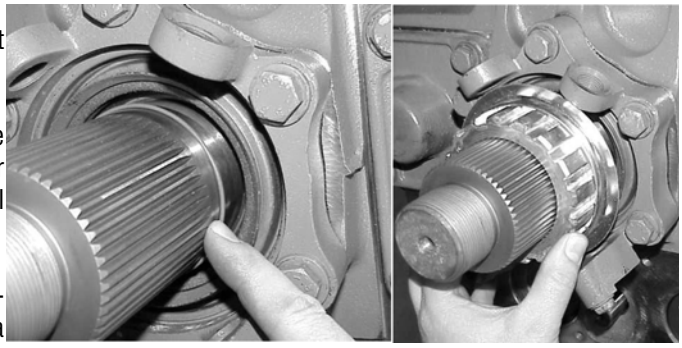
Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -

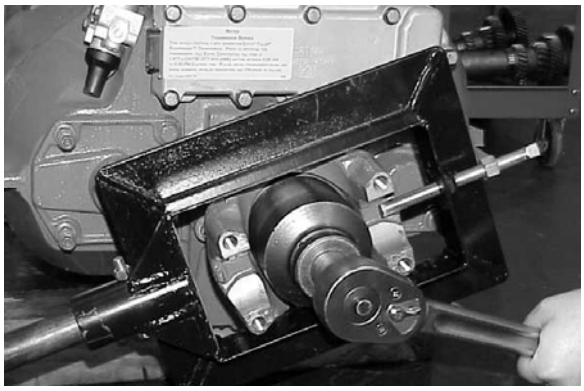


1. Install the O-ring and speedometer rotor on the output shaft ,until the rotor is fully seated against the output bearing.

2. Install the output yoke over the output shaft. The yoke should slide on and stop before contacting the speedometer rotor. As the output shaft nut is installed, the output yoke will contact the speedometer rotor.

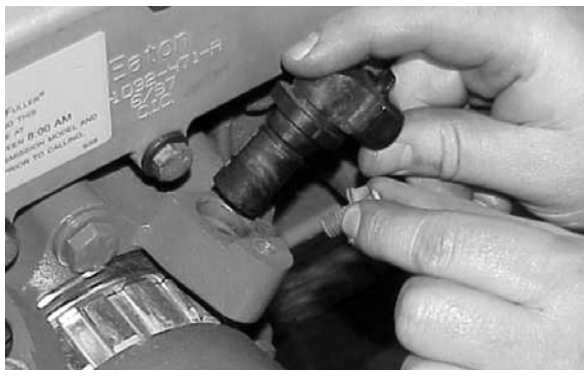
3. Inspect the output shaft nut for damage and wear. If the nylon locking material is damaged or excessively worn, use a new output nut.

   Note: The nylon locking material must be in good condition so that the nut doesn't loosen when the vehicle is in use.



4. Lightly oil the output shaft threads and the output nut threads and install the nut. Torque the nut to 450-500 lb-ft (610-677Nm).

   TIP: To prevent the output shaft and yoke from rotating while installing the nut, use a fixture to hold the yoke.



5. Install the speedometer sensor and retaining capscrew. Tighten to 20-23 lb·ft (27-31 Nm).

M/S Endplay Shimming Procedure

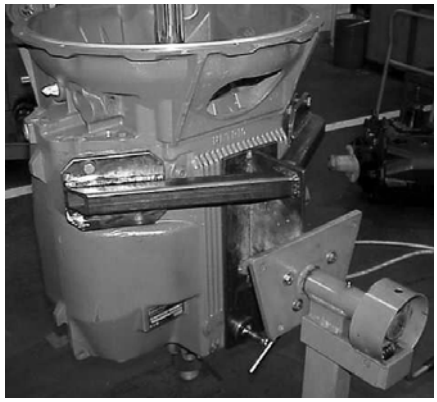
Special Instructions

None

Special Tools

- Dial Indicator

Procedure -



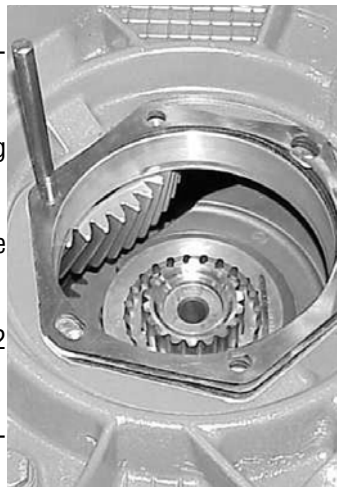
1. The output bearing must be fully seated on the auxiliary mainshaft before starting the shimming procedure. To insure this, install the speedometer rotor, output yoke, and nut. Torque the output nut to 450-500 lb-ft (610–677 Nm).

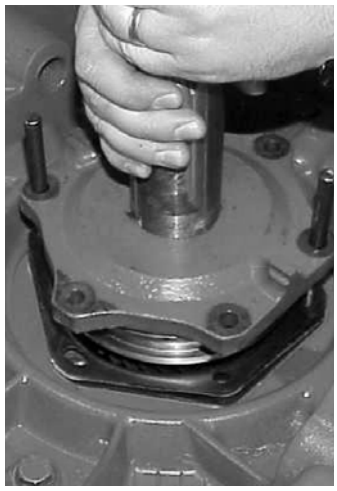
2. The input shaft bearing race must be fully seated in the front bearing cover to insure proper clearance. The use of an arbor press is recommended to insure the race is fully seated.

3. Transmission must be supported by the main case in a suitable stand that allows for the clutch housing to face upward and allow the output shaft to rotate freely.

4. The transmission should be fully assembled minus the input shaft front bearing cover assembly and shift tower.

   Note: All bearings should be pre-lubed with transmission lube during assembly.





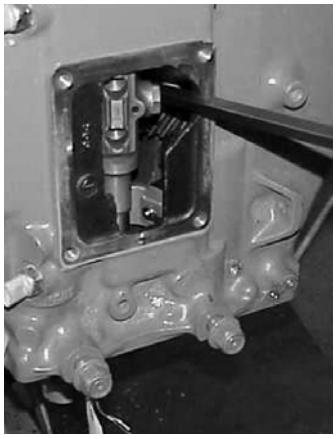
5. Start with (3) .020" shims (p/n 4304193) and use the threaded alignment pins if available.

6. Install the front bearing cover assembly minus O-ring (5568540) to prevent damage to the O-ring.

   Note: Bearing cover capscrew holes will only line up one way.

7. Install the (6) bearing cover capscrews and tighten to 47-52 lb-ft (63-70 Nm).

8. Rotate the input shaft to insure no binding has occurred during assembly, and to insure the bearings are seated.



9. Mount a dial indicator to the front bearing cover so that the endplay can be measured at the end of the input shaft.

10. Insert an 18" pry bar through the shift tower opening to the right of the shift bar.

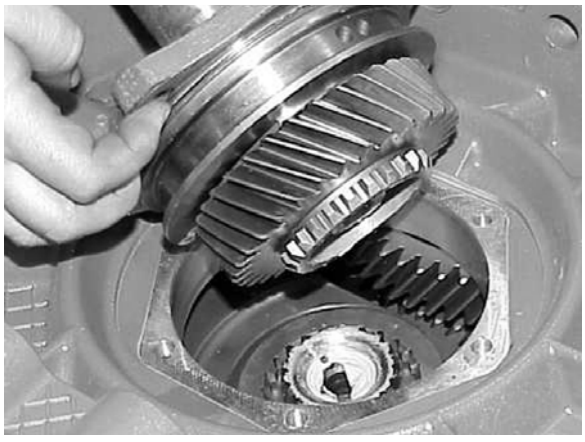
11. Apply leverage between the splitter clutch and auxiliary drive gear to separate the mainshafts while watching the dial indicator.

12. Take a minimum of three endplay readings on the input shaft to get a good sample.

13. Subtract the average of the three readings from .064". This will be the final shim pack thickness required ± .002". Example: if the average reading is .025", (.064 - .025 = .039). Your exact shim pack thickness would have to fall between .037" and .041". In this case, you could use (2) .020" shims to achieve the required .002"-.006" mainshaft endplay clearance.

    Note: If no endplay reading can be obtained with (3) .020 shims one of the mainshaft bearing races must not be seated - inspect the input and output bearing races and re-test.

    Mainshaft endplay clearance must be .002"-.006".



14. Remove the front bearing cover assembly and install the required number of shims on the bearing cover using the assortment included in the kit.

15. Apply assembly lubricant to the O-ring and install the O-ring onto the bearing cover.

16. Carefully install the front bearing cover assembly into the clutch housing to prevent damaging the O-ring.

17. Install the (6) capscrews and tighten to 47-52 lb-ft (63-70 Nm).

18. Recheck the endplay by repeating steps 8 through 11.

    Mainshaft endplay clearance must be .002"-.006".

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