MERITOR®

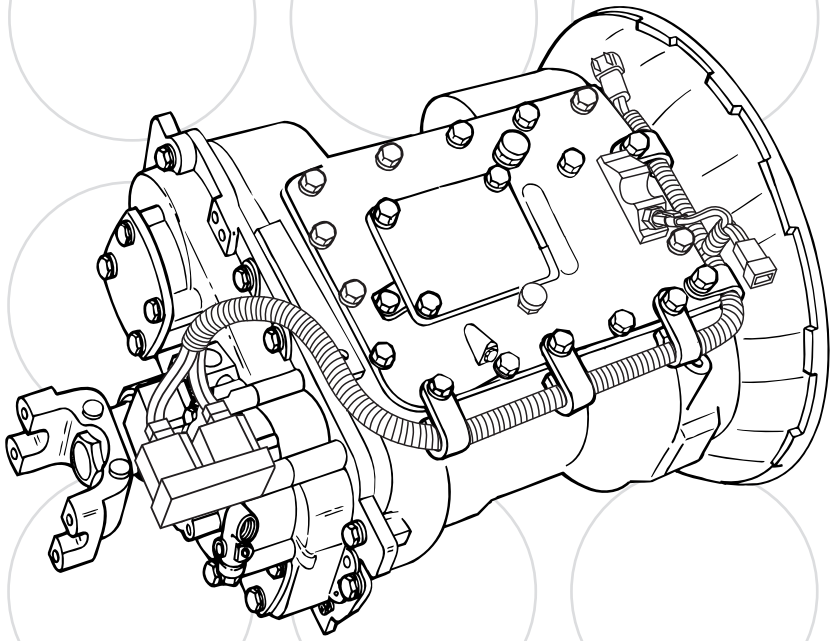
an *ArvinMeritor* brand

Maintenance Manual MM-99106

9- and 10-Speed Transmissions

Platform “G”

Revised 01-06



Service Notes

Before You Begin

This manual provides top cover and auxiliary case overhaul procedures for Meritor's Platform "G" 9- and 10-speed transmissions. Before you begin procedures:

1. Read and understand all instructions and procedures before you begin to service components.
2. Read and observe all Caution and Warning safety alerts that precede instructions or procedures you will perform. These alerts help to avoid damage to components, serious personal injury, or both.
3. Follow your company's maintenance and service, installation, and diagnostics guidelines.
4. Use special tools when required to help avoid serious personal injury and damage to components.

Safety Alerts, Torque Symbol and Notes

WARNING	A Warning alerts you to an instruction or procedure that you must follow exactly to avoid serious personal injury.
CAUTION	A Caution alerts you to an instruction or procedure that you must follow exactly to avoid damage to components.
	A torque symbol alerts you to tighten fasteners to a specified torque value.
NOTE	A Note provides information or suggestions that help you correctly service a component.

Access Product and Service Information on Our Website

Visit the DriveTrain Plus™ by ArvinMeritor Tech Library at arvinmeritor.com to access and order product and service information.

To Order Information by Phone

Call ArvinMeritor's Customer Service Center at 800-535-5560 to order the following publications.

- 9-, 10- and 13-Speed Transmissions (Maintenance Manual 26A)
- Electric Over Air (EOA) Range Shift System Wiring Diagram (Wiring Diagram TP-9964)
- 9- and 10-Speed Manual Transmissions (Operator Manual TP-8989)
- 9-, 10- and 13-Speed Transmissions (Parts Book PB-94134)
- Drivetrain Plus™ by ArvinMeritor Technical Electronic Library on CD. Features product and service information on most Meritor, and Meritor WABCO products. $20. Order TP-9853.

How to Order Tools and Supplies Specified in This Manual

Call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355 to order Meritor tools and supplies.

SPX Kent-Moore, 28635 Mound Road, Warren, Michigan, 48092. Call the company's customer service center at 800-345-2233, or visit their website at spxkentmoore.com.

For Owatonna Tools, contact OTC Tool and Equipment Division, 655 Eisenhower Drive, Owatonna, Minnesota, 55060.

Great Lakes Tool Specialties, 8530 M-89, Richland, Michigan, 49083. Call the company's customer service center at 800-877-9618 or 616-629-9628.

Platform “G” 9- and 10-Speed Transmissions
Maintenance Manual MM-99106

USING THIS MAINTENANCE MANUAL

This maintenance manual addresses maintenance, service and use issues that owners and users of Meritor’s Platform “G” 9- and 10-speed transmissions may encounter. It is not intended as a discussion of every issue that may arise in those contexts but is illustrative of certain information that might be considered in conjunction with installation, maintenance, repair and use of the subject transmissions.

Owners and users of Meritor’s Platform “G” 9- and 10-speed transmissions are responsible for familiarizing themselves with the content of this maintenance manual and using the information (and following the warnings) contained herein for any function or condition covered. They are also responsible for communicating the information contained in this maintenance manual to any persons performing installation, maintenance or repair services with respect to the subject transmissions. Correct maintenance, service and use of the subject transmissions, and observance of the suggestions and directives contained in this maintenance manual, are integral requirements of continued warranty coverage for the subject transmissions.

This maintenance manual is provided under the following limitations, restrictions and disclaimers, which are applicable to any person or entity using or relying on the same, as a condition to such usage or reliance:

THESE MATERIALS PROVIDE SUGGESTIONS, AS WELL AS CERTAIN REQUIREMENTS, WITH RESPECT TO THE INSTALLATION, MAINTENANCE, REPAIR AND USAGE OF MERITOR’S PLATFORM “G” 9- AND 10-SPEED TRANSMISSIONS.

INSTALLATION, MAINTENANCE, REPAIR AND USAGE OF THE SUBJECT TRANSMISSIONS IS SOLELY THE RESPONSIBILITY OF THE OWNERS AND USERS OF THE SUBJECT TRANSMISSIONS, AND IMPROPER OR INCORRECT ACTIONS OR OMISSIONS IN THAT REGARD ARE NOT THE RESPONSIBILITY OF MERITOR.

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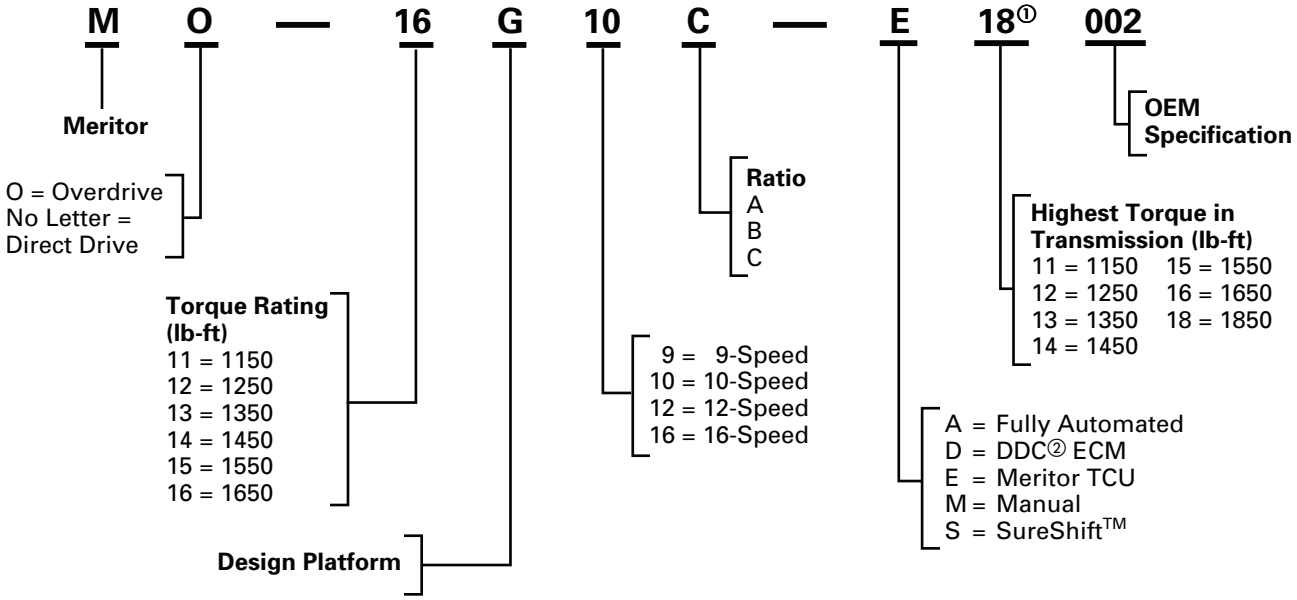
Transmission Model Numbers



① Progressive torque is an engine feature that requires a Torq-2™ transmission. In models not featuring progressive torque, this number will be the same as the torque rating.

② Detroit Diesel Corporation

Overview

This manual provides top cover and auxiliary case overhaul procedures for Meritor's Platform "G" 9- and 10-speed transmissions.

For complete maintenance and diagnostics procedures for Meritor's 9-, 10- and 13-speed transmissions, including models with the Electric Over Air range shift system, refer to the Service Notes page on the front inside cover of this manual.

Electric Over Air (EOA) Range Shift System Standard on Platform "G"

The Electric Over Air (EOA) range shift system, which is standard on Meritor's Platform "G" 9- and 10-speed transmissions, routes pressurized air past the filter regulator and into the range piston housing. Solenoids enable air to shift the transmission into high or low range.

EOA System Features

- Eliminates the slave valve, air lines, range piston housing fittings and a pneumatic switch in the shift knob.
- Enables the auxiliary transmission to shift only when the main transmission is in Neutral, which protects the synchronizer.
- Uses a preselect switch and is available with Meritor s Shift-n-Cruise™ speed control feature.

EOA Components

Component	Function
Shift Knob	Transmission in Neutral: Activates the preselected range shift solenoid. Requires 12 VDC switched power. Preselect high range: Activates the high range solenoid and deactivates the low range solenoid. Preselect low range: Activates the low range solenoid and deactivates the high range solenoid.
High and Low Range Shift Solenoids	Perform as electronic valves that enable air to pass through only when activated by the shift knob. Require 12 VDC switched power.
Neutral/ In-Gear Switch	Selecting Neutral closes the switch and enables the shift knob to activate the preselected range shift solenoid and deactivate the other one.
Wiring Harnesses	Connect components that operate the system.

Preselect Switch

Status	Preselect Switch Function
Main Transmission in Gear	Prevents range shifts.
Transmission in Neutral	Activates the preselected range shift solenoid.
Preselect High Range	Activates the high range solenoid and deactivates the low range solenoid.
Preselect Low Range	Activates the low range solenoid and deactivates the high range solenoid.

Section 2
Operating Guidelines

⚠ WARNING

Use the information in this section to correctly operate the vehicle and prevent serious personal injury and damage to components.

How to Use the Clutch

Use the Clutch for Initial Gear Engagement When the Vehicle is Stationary

Use the clutch brake for initial gear engagement when the vehicle is stationary. If you use the clutch brake when the vehicle is moving, the clutch tabs can break and damage the input shaft, transmission, and low and reverse sliding collar.

Do Not Coast in Neutral with the Clutch Disengaged

If you coast in neutral with the clutch disengaged, lubricants will be unable to pass to the thrust washers. Damage to the washers and the mainshaft can occur.

Always Use the Clutch to Change Gears

Always use the clutch to change gears. The clutch enables the gear teeth to mesh correctly.

What Happens When You Do Not Use the Clutch

- The gear teeth grind instead of mesh and can damage the shift forks, sliding collars and gears.
- Metal particles from the damaged parts can fall into the lubricant and damage the bearings.
- The transmission becomes difficult to shift or slips out of gear.

Operating a Vehicle on a Hill or Grade

- Downshift to the next lower gear when descending a hill or grade.
- Upshift to the next higher gear when ascending a hill or grade.

Use the Correct Gear to Prevent Shock Load

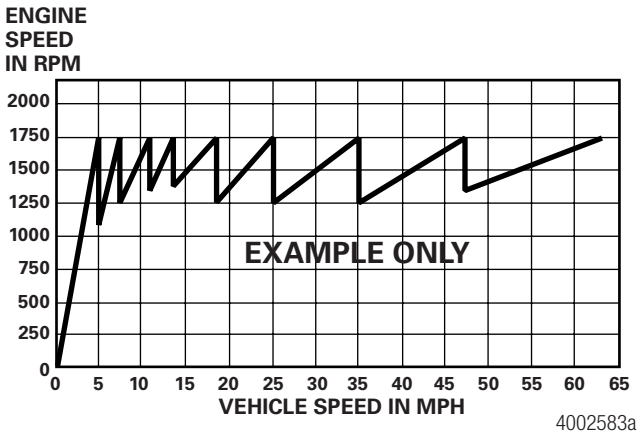
Using the correct gear can prevent shock load. Shock load can damage gear teeth immediately or cause damage that appears later.

Engine Torque Curves Define Correct RPM or MPH Speeds

Shifting at the correct rpm enables the transmission to operate economically. Engine torque curves vary by vehicle, because rpm and mph values are determined by engine specifications, the rear axle ratio and tire size.

If you changed the engine, rear axle or tires from the vehicle's original equipment, you must obtain a new Torque Split Chart to ensure that the transmission operates correctly.

Refer to the vehicle manufacturer's engine torque curves to determine a vehicle's correct rpm or mph. A typical chart is shown below.



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Shift the Range Selector When the Transmission is in Gear (Preselect)

Do not move the shift lever to Neutral and then move the range selector. This causes the gear change to occur BEFORE the range changes and can damage the synchronizer.

Drain Moisture From the Air Reservoir Every Day

Draining moisture from the air reservoir every day helps prevent moisture and contaminants from entering the system, which can affect operation and damage components.

Remove Axle Shafts When You Tow a Vehicle with the Rear Wheels on the Ground

If you do not remove the axle shafts when you tow a vehicle with the rear wheels on the ground, the towing angle will prevent lubricants from reaching the transmission mainshaft thrust washers and the axle pinion bearings. Damage to these components will result.

Optional Transmission Temperature Indicator Light or Temperature Gauge

CAUTION

Do not operate the transmission when the temperature indicator light comes ON, or when temperature indicator gauge is in the "WARNING" area. These are indications that the transmission is overheating. Stop the vehicle and service the transmission as necessary to prevent damage to components.

Some vehicles use an optional transmission temperature light or gauge that enables you to verify that the transmission is within normal temperatures during operation. Refer to the vehicle's operating instructions for more information.

The temperature indicator light will come ON, or the gauge indicator will be in the "WARNING" area, when the transmission is overheating.

- **If the transmission is overheating:** Stop the vehicle. Service the transmission as required.

Parking a Vehicle

WARNING

You must place the transmission into Neutral and follow the vehicle manufacturer's procedures when you park a vehicle. If the transmission is in gear when you start the vehicle, the vehicle can move forward suddenly. Serious personal injury and damage to components can result.

1. Place the transmission into Neutral.
2. Apply the parking brake. Refer to the vehicle manufacturer's instructions for the correct procedures.

Shift-n-Cruise™ Speed Control Feature

WARNING

Only use the Shift-n-Cruise speed control feature when you operate a vehicle under normal operating conditions. Do not use this feature in heavy traffic or on winding, wet or slippery roads. These conditions can affect cruise control performance, which can result in loss of vehicle control, serious personal injury and damage to components.

CAUTION

Only use your finger to press the Shift-n-Cruise™ speed control PAUSE, RESUME or SET buttons located on the shift knob. If you use a screwdriver, ballpoint pen or any sharp item, a button can stick in the switch assembly and affect speed control operation. Damage to components can result.

The Shift-n-Cruise™ speed control feature integrates cruise control functions into the transmission shift knob, so that you can reactivate the cruise feature after a shift without removing your hand from the shift knob.

The PAUSE, RESUME and SET buttons are located on the TOP of the shift knob. The ON/OFF controls are located on the instrument panel.

How to Use the Shift-n-Cruise Speed Control Feature

- Use the SET button to select cruise control speed.
- Use the PAUSE button to temporarily deactivate cruise control operation.
- Use the RESUME button to reactivate cruise control to a selected speed after you press the PAUSE button.

When to Shift the Transmission

Shift the transmission at the correct engine speed (rpm) to prevent gears from grinding and at the manufacturer's recommended vehicle speed.

Cab Shift Labels Identify a Transmission

⚠ CAUTION

Shift patterns vary by vehicle. You must use the correct shift pattern for the vehicle you operate to avoid damage to the transmission.

1. Refer to the shift pattern decal affixed to the sun visor or instrument panel when you shift the transmission.
2. If the decal is missing or unreadable, call ArvinMeritor's Commercial Vehicle Aftermarket at 888-725-9355/Option #5 to order a new decal.
3. Install the new decal in the vehicle.

Shift Patterns

- Nine-speed standard direct drive and overdrive manual transmissions with **A** and **B** ratios. **Figure 2.1**.
- Nine-speed RMO manual transmissions with **A** and **B** ratios. **Figure 2.2**.
- Nine-speed manual transmissions with **R** ratios. **Figure 2.3**.
- Ten-speed manual transmissions. **Figure 2.4**.

Figure 2.1

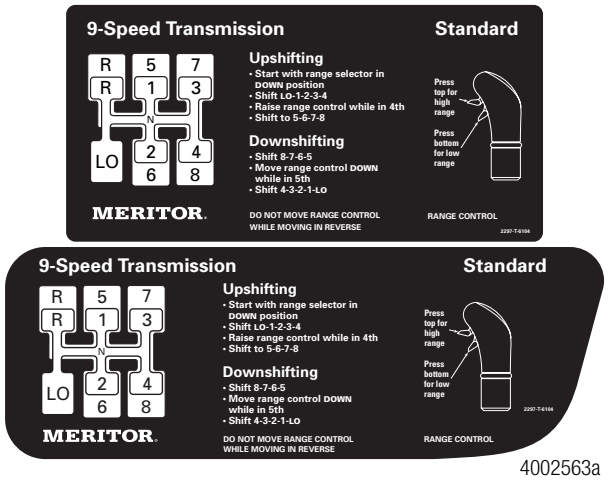

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Figure 2.2

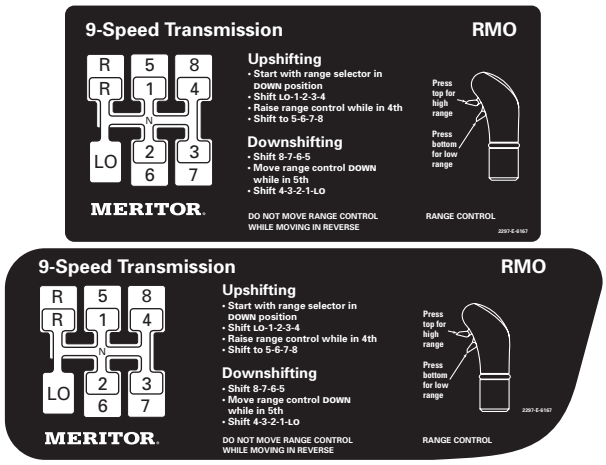

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Figure 2.3

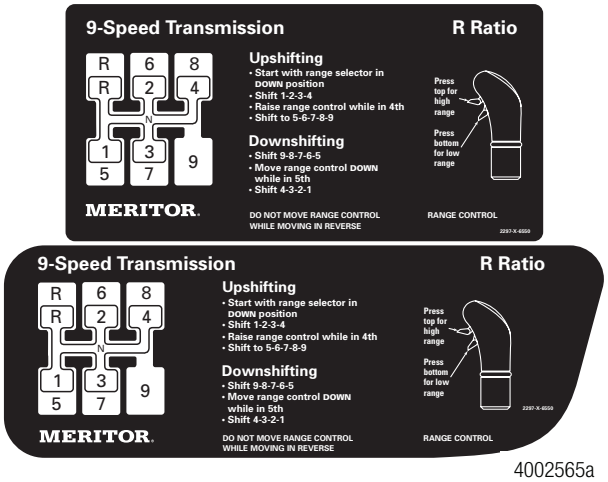

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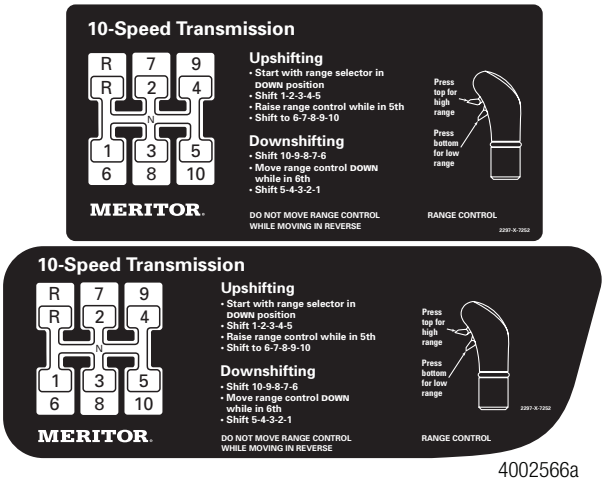
Figure 2.4



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How to Shift Nine-Speed "A" and "B" Ratio Manual Transmissions

CAUTION

Always use the correct starting gear when you operate the transmission. Do not shift into Neutral and coast. Damage to the transmission can result.

Use the clutch brake only for initial gear engagement when the vehicle is stationary to prevent damage to the input shaft and the clutch brake.

Before You Start the Vehicle

1. Check that transmission fluid is at the specified level.
2. Check that the transmission is in Neutral.

Start the Vehicle

WARNING

The transmission must be in Neutral when you start the vehicle. If the transmission is in gear, the vehicle can move forward suddenly. Serious personal injury and damage to components can result.

1. The shift lever must be in Neutral.
2. Push the clutch pedal to the end of travel.
3. Start the engine. Allow system pressure to reach the specified range on the gauge.
4. Release the clutch pedal.
5. Release the parking brakes.

Shift Into a Starting Gear

CAUTION

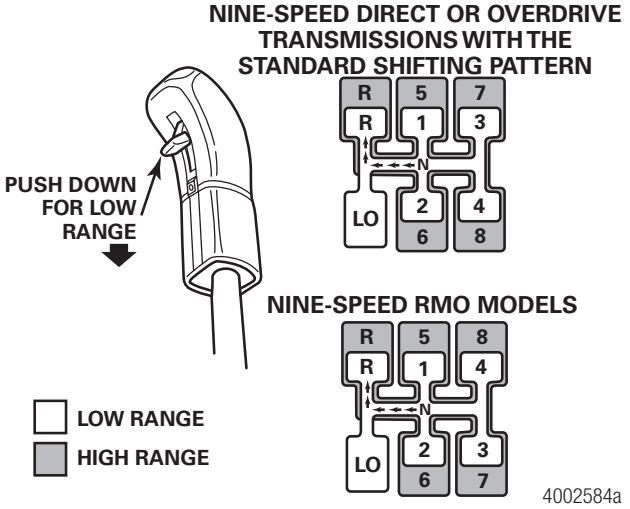
Only use the clutch brake for initial gear engagement when the vehicle is stationary. If you use the clutch brake when the vehicle is moving, the clutch tabs can break. Damage to the input shaft, transmission, and low and reverse sliding collar can result.

Reverse

NOTE: Use low range whenever you shift into Reverse.

1. Move the range lever DOWN into low range. **Figure 3.1**.

Figure 3.1



NOTE: Disengaging the clutch stops the transmission for initial gear engagement.

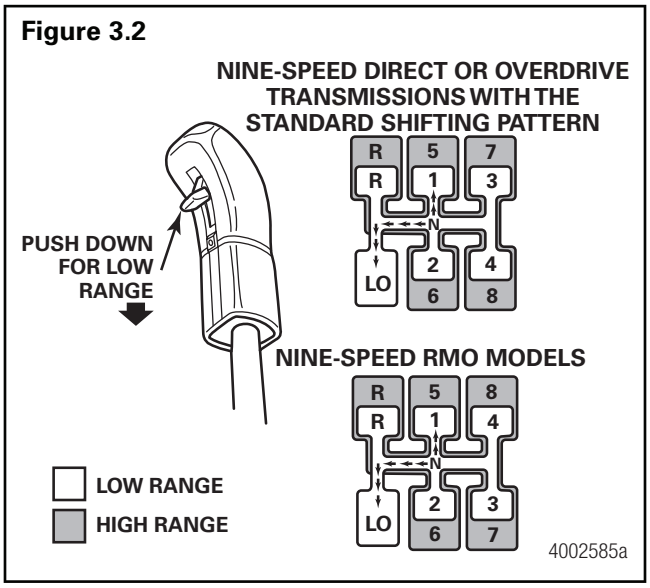
2. Disengage the clutch: Push the clutch pedal to the end of travel. The clutch brake will touch the clutch release bearing.
3. With the clutch pedal at the end of travel, move the shift lever into Reverse. **Figure 3.1**.
4. Slowly release the clutch pedal to move the vehicle in the reverse direction.

Low Gear

NOTE: Use low gear when moving a loaded vehicle up a grade from a stationary position.

1. Push the range lever DOWN into low range. **Figure 3.2**.
2. Disengage the clutch: Push the clutch pedal to the end of travel. The clutch brake will touch the clutch release bearing.
3. With the clutch pedal at the end of travel, move the shift lever into low gear. **Figure 3.2**.
4. Slowly release the clutch pedal.

Figure 3.2



Upshifting

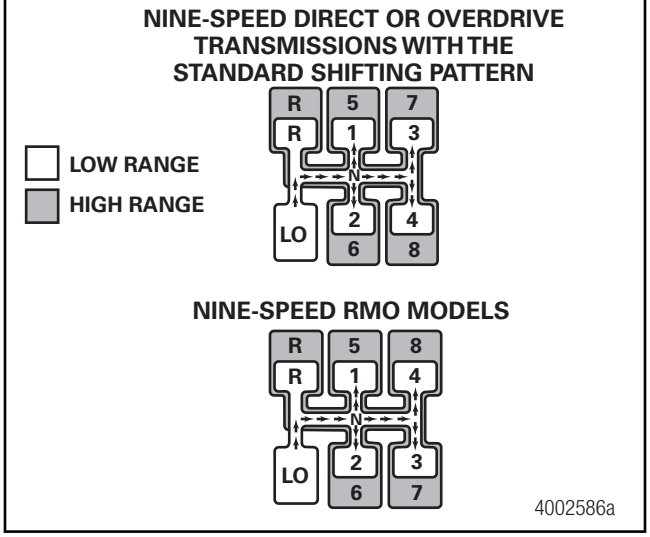
First Gear

1. Release the accelerator.
2. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
3. Move the shift lever into Neutral.
4. Release the clutch pedal.
5. Allow the engine to slow to the correct rpm.
6. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
7. Move the shift lever into first gear. **Figure 3.3**.
8. Release the clutch pedal. Apply the accelerator.

Second, Third and Fourth Gears

To upshift into second, third and fourth gears, repeat Steps 1-8 above, but move the shift lever into the correct second, third and fourth gears. **Figure 3.3**.

Figure 3.3



Fifth Gear

CAUTION

Move the range lever only when the transmission is in gear to prevent damage to the transmission.

1. While in fourth gear, move the range lever UP to shift the range selector valve into high range. **Figure 3.4**.

Figure 3.4

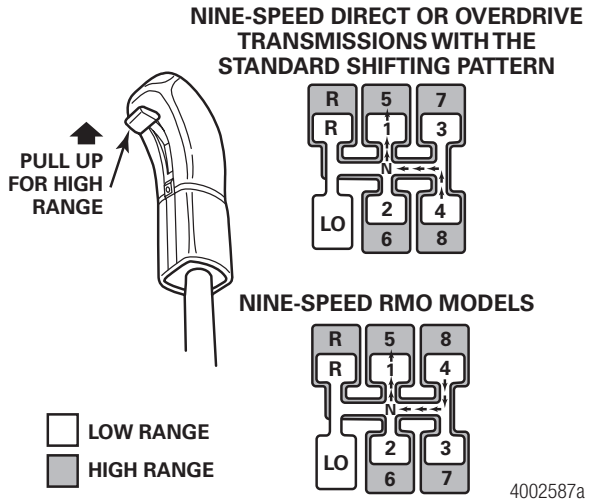
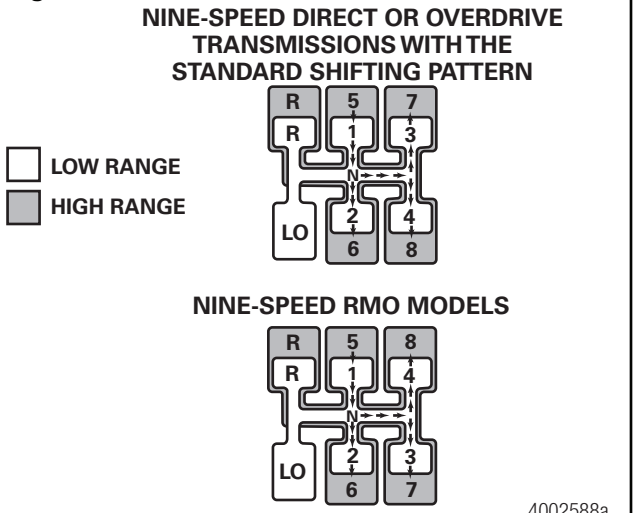


Figure 3.5



2. Release the accelerator.
3. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.

NOTE: The range cylinder will automatically shift into high range when the shift lever is in Neutral.

4. Move the shift lever into Neutral.
5. Release the clutch pedal.
6. Allow the engine to slow to the correct rpm.
7. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
8. Move the shift lever into fifth gear. **Figure 3.4**.
9. Release the clutch pedal. Apply the accelerator.

Sixth, Seventh, and Eighth Gears

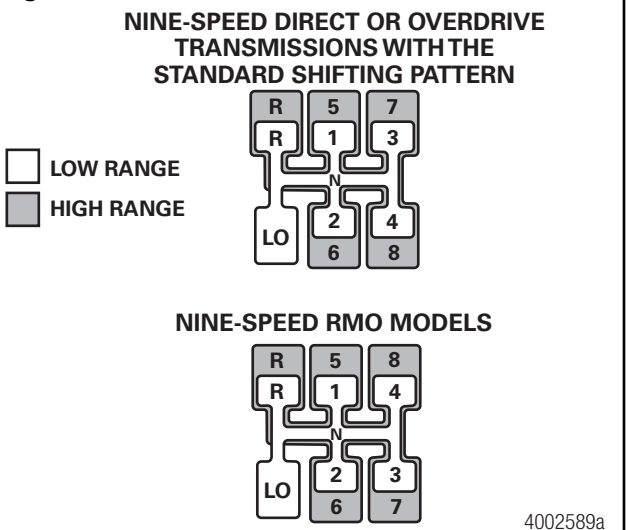
To upshift into sixth, seventh and eighth gears, repeat Steps 2-9 above, but move the shift lever into the correct sixth, seventh and eighth gears. **Figure 3.5**.

Downshifting

Eighth, Seventh and Sixth Gears

1. Release the accelerator.
2. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
3. Move the shift lever into Neutral.
4. Release the clutch pedal.
5. Apply the accelerator to increase the engine speed to the correct rpm.
6. Release the accelerator and immediately push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
7. Move the shift lever into the correct gear. **Figure 3.6**.
8. Release the clutch pedal.

Figure 3.6



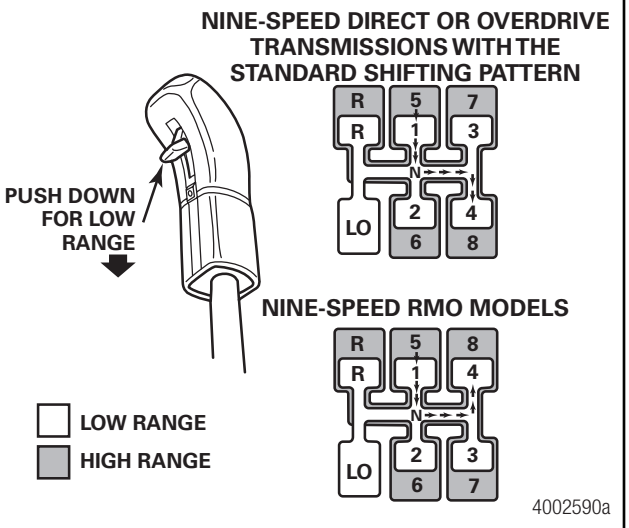
Fifth Into Fourth Gear

⚠ CAUTION

Move the range lever only when the transmission is in gear to prevent damage to the transmission.

1. While in fifth gear, move the range lever DOWN to shift the range selector valve into low range. **Figure 3.7**.

Figure 3.7



2. Release the accelerator.
3. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.

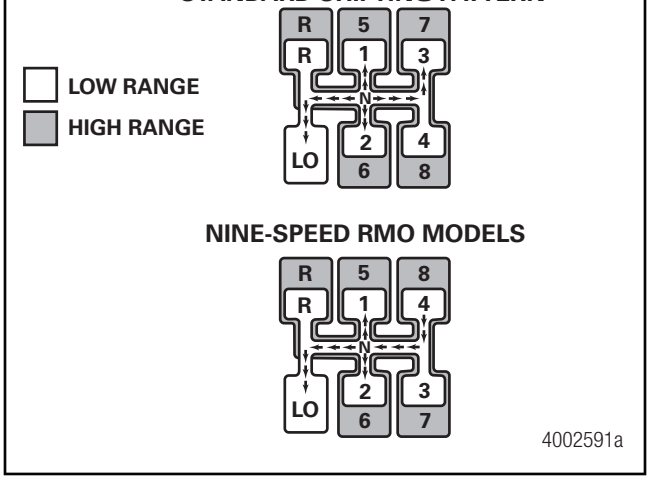
NOTE: The range cylinder will automatically shift into low range when the shift lever is in Neutral.

4. Move the shift lever to Neutral.
5. Release the clutch pedal.
6. Apply the accelerator to increase engine speed to the correct rpm.
7. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
8. Move the shift lever into fourth gear.
9. Release the clutch pedal. Apply the accelerator.

From Third, Second, First and Low Gears

To downshift into third, second, first and low gears, repeat Steps 2-9 above, but move the shift lever into the third, second, first and low gears. **Figure 3.8**.

Figure 3.8



How to Shift Nine-Speed "R" Ratio Manual Transmissions

CAUTION

Always use the correct starting gear when you operate the transmission. Do not shift into Neutral and coast. Damage to the transmission can result.

Before You Start the Vehicle

1. Check that engine oil is at the specified level.
2. Check that the transmission is in Neutral.

Start the Vehicle

WARNING

The transmission must be in Neutral when you start the vehicle. If the transmission is in gear, the vehicle can move forward suddenly. Serious personal injury and damage to components can result.

1. The shift lever must be in Neutral.
2. Push the clutch pedal to the end of travel.
3. Start the engine. Allow system pressure to reach the specified range on the gauge.
4. Release the clutch pedal.
5. Release the parking brakes.

Shift Into a Starting Gear

CAUTION

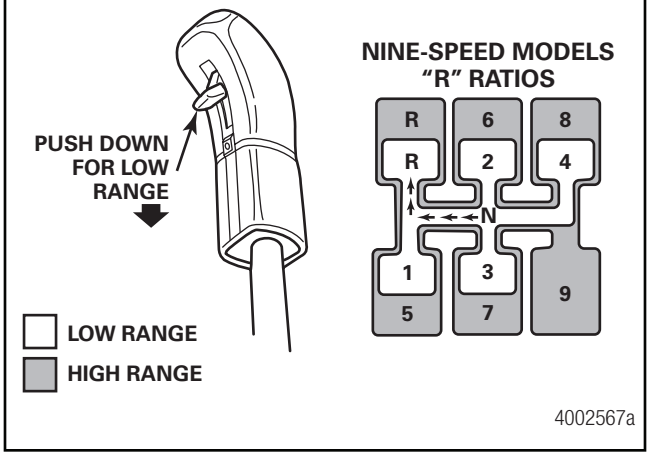
Only use the clutch brake for initial gear engagement when the vehicle is stationary. If you use the clutch brake when the vehicle is moving, the clutch tabs can break. Damage to the input shaft, transmission, and low and reverse sliding collar can result.

Reverse

NOTE: Use low range whenever you shift into Reverse.

1. Move the range lever DOWN into low range. **Figure 3.9**.

Figure 3.9



NOTE: Disengaging the clutch stops the transmission for initial gear engagement.

2. Disengage the clutch: Push the clutch pedal to the end of travel. The clutch brake will touch the clutch release bearing.
3. With the clutch pedal at the end of travel, move the shift lever into Reverse. **Figure 3.9**.
4. Slowly release the clutch pedal to move the vehicle in the reverse direction.

Upshifting

First Gear

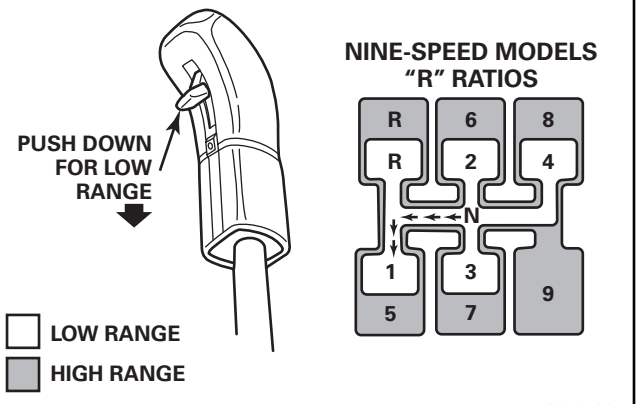
NOTE: Use low gear when moving a loaded vehicle up a grade from a stationary position.

1. Push the range lever DOWN into low range. **Figure 3.10**.

NOTE: Disengaging the clutch stops the transmission for initial gear engagement.

2. Disengage the clutch: Push the clutch pedal to the end of travel. The clutch brake will touch the clutch release bearing.
3. With the clutch pedal at the end of travel, move the shift lever into first gear. **Figure 3.10**.
4. Slowly release the clutch pedal.

Figure 3.10



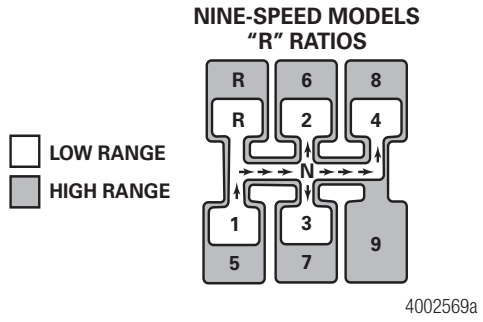
Second Gear

1. Release the accelerator.
2. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
3. Move the shift lever to Neutral.
4. Release the clutch pedal.
5. Allow the engine to slow to the correct rpm.
6. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
7. Move the shift lever into second gear. **Figure 3.11**.
8. Release the clutch pedal. Apply the accelerator.

Third and Fourth Gears

To upshift into third and fourth gears, repeat Steps 1-8 above, but move the shift lever into the third and fourth gears. **Figure 3.11**.

Figure 3.11



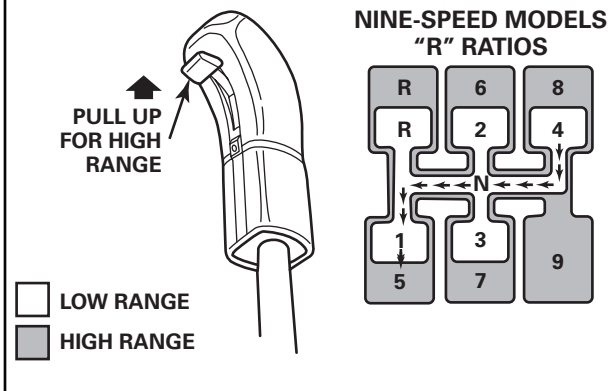
Fifth Gear

CAUTION

Move the range lever only when the transmission is in gear to prevent damage to the transmission.

1. While in fourth gear, move the range lever UP to shift the range selector valve into high range. **Figure 3.12**.

Figure 3.12



2. Release the accelerator.
3. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.

NOTE: The range cylinder will automatically shift into high range when the shift lever is in Neutral.

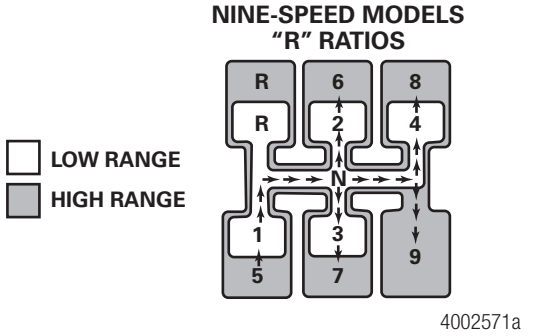
4. Move the shift lever into Neutral.
5. Release the clutch pedal.

6. Allow the engine to slow to the correct rpm.
7. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
8. Move the shift lever into fifth gear. **Figure 3.12**.
9. Release the clutch pedal. Apply the accelerator.

Sixth, Seventh, Eighth and Ninth Gears

To upshift into sixth, seventh, eighth and ninth gears, repeat Steps 2-9 above, but move the shift lever into the correct sixth, seventh, eighth and ninth gears. **Figure 3.13**.

Figure 3.13

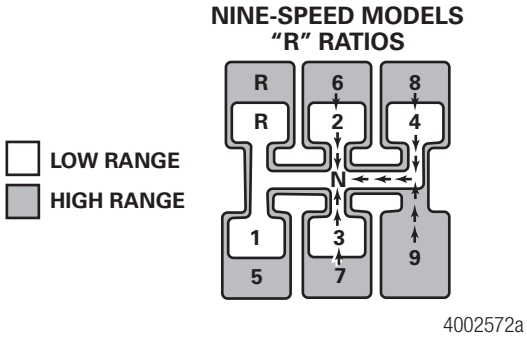


Downshifting

Ninth, Eighth, Seventh and Sixth Gears

1. Release the accelerator.
2. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
3. Move the shift lever to Neutral.
4. Release the clutch pedal.
5. Apply the accelerator to increase the engine speed to the correct rpm.
6. Release the accelerator and immediately push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
7. Move the shift lever into the correct gear. **Figure 3.14**.
8. Release the clutch pedal.

Figure 3.14



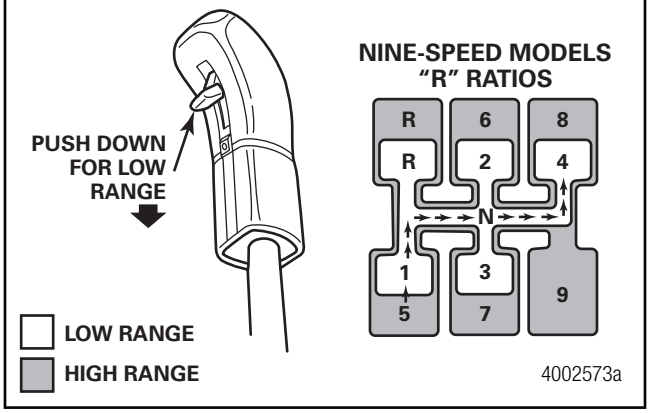
From Fifth Gear Into Fourth Gear

CAUTION

Move the range lever only when the transmission is in gear to prevent damage to the transmission.

1. While in fifth gear, move the range lever DOWN to shift the range selector valve into low range. **Figure 3.15**.

Figure 3.15



2. Release the accelerator.
3. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.

NOTE: The range cylinder will automatically shift into low range when the shift lever is in Neutral.

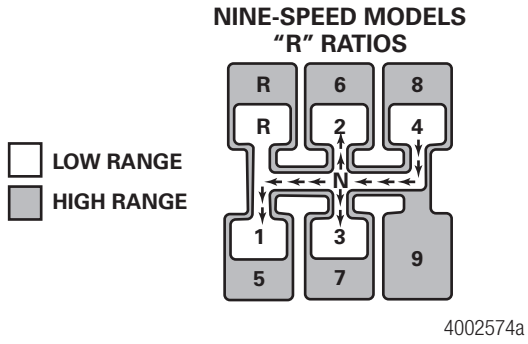
4. Move the shift lever to Neutral.
5. Release the clutch pedal.

6. Apply the accelerator to increase engine speed to the correct rpm.
7. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
8. Move the shift lever into fourth gear.
9. Release the clutch pedal. Apply the accelerator.

Third, Second and First Gears

To downshift into third, second and first gears, repeat Steps 2-9 above, but move the shift lever into third, second and first. **Figure 3.16**.

Figure 3.16



How to Shift Ten-Speed Manual Transmissions

CAUTION

Always use the correct starting gear when you operate the transmission. Do not shift into Neutral and coast. Damage to the transmission can result.

Before You Start the Vehicle

1. Check that engine oil is at the specified level.
2. Check that the transmission is in Neutral.

Start the Vehicle

WARNING

The transmission must be in Neutral when you start the vehicle. If the transmission is in gear, the vehicle can move forward suddenly. Serious personal injury and damage to components can result.

1. The shift lever must be in Neutral.
2. Push the clutch pedal to the end of travel.
3. Start the engine. Allow system pressure to reach the specified range on the gauge.
4. Release the clutch pedal.
5. Release the parking brakes.

Shift Into a Starting Gear

CAUTION

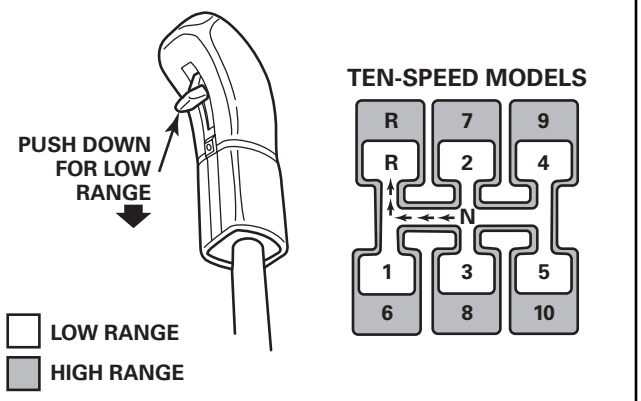
Only use the clutch brake for initial gear engagement when the vehicle is stationary. If you use the clutch brake when the vehicle is moving, the clutch tabs can break. Damage to the input shaft, transmission, and low and reverse sliding collar can result.

Reverse

NOTE: Use low range whenever you shift into Reverse.

1. Move the range lever DOWN into low range. **Figure 4.1**.

Figure 4.1



NOTE: Disengaging the clutch stops the transmission for initial gear engagement.

2. Disengage the clutch: Push the clutch pedal to the end of travel. The clutch brake will touch the clutch release bearing.
3. With the clutch pedal at the end of travel, move the shift lever into Reverse. **Figure 4.1**.
4. Slowly release the clutch pedal to move the vehicle.

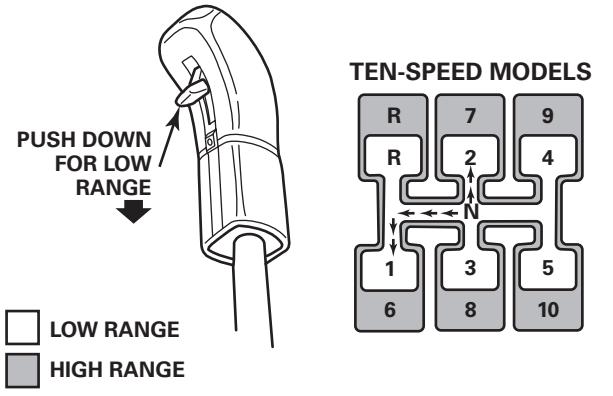
Upshifting

First Gear

NOTE: Use first gear when moving a loaded vehicle up a grade from a stationary position.

1. Push the range lever DOWN into low range. **Figure 4.2**.
2. Disengage the clutch: Push the clutch pedal to the end of travel. The clutch brake will touch the clutch release bearing.
3. With the clutch pedal at the end of travel, move the shift lever into first gear. **Figure 4.2**.
4. Slowly release the clutch pedal.

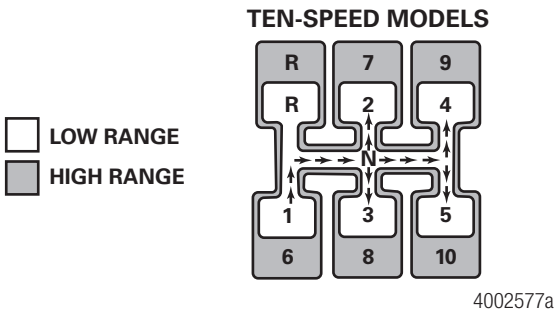
Figure 4.2



Second Gear

1. Release the accelerator.
2. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
3. Move the shift lever to Neutral.
4. Release the clutch pedal.
5. Allow the engine to slow to the correct rpm.
6. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
7. Move the shift lever into second gear. **Figure 4.3**.
8. Release the clutch pedal. Apply the accelerator.

Figure 4.3



Third, Fourth and Fifth Gears

To upshift into third, fourth and fifth gears, repeat Steps 1-8, but move the shift lever into the third, fourth and fifth gears. **Figure 4.3**.

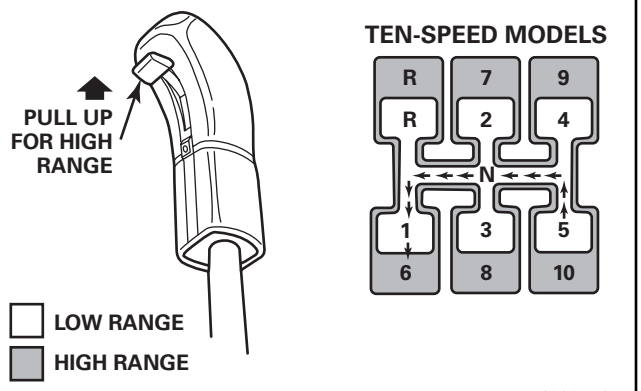
Sixth Gear

CAUTION

Move the range lever only when the transmission is in gear to prevent damage to the transmission.

1. While in fifth gear, move the range lever UP to shift the range selector valve into high range. **Figure 4.4**.

Figure 4.4



2. Release the accelerator.
3. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.

NOTE: The range cylinder will automatically shift into high range when the shift lever is in Neutral.

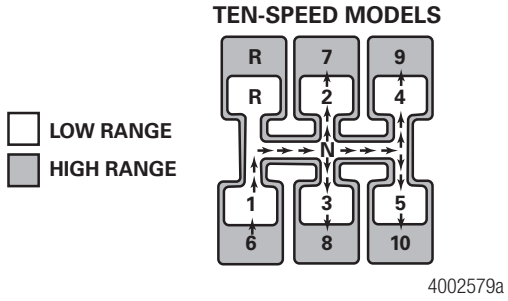
4. Move the shift lever into Neutral.
5. Release the clutch pedal.
6. Allow the engine to slow to the correct rpm.
7. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
8. Move the shift lever into sixth gear. **Figure 4.4**.

9. Release the clutch pedal. Apply the accelerator.

Seventh, Eighth, Ninth and Tenth Gears

To upshift into the seventh, eighth, ninth and tenth gears, repeat Steps 2-9 above, but move the shift lever into the correct seventh, eighth, ninth and tenth gears. **Figure 4.5**.

Figure 4.5

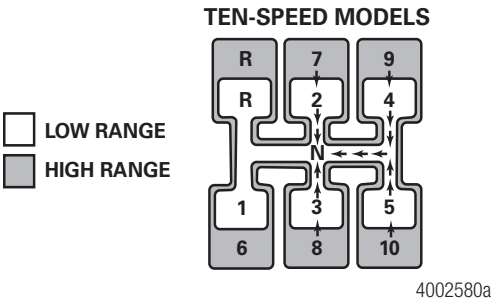


Downshifting

Tenth, Ninth, Eighth and Seventh Gears

1. Release the accelerator.
2. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
3. Move the shift lever to Neutral.
4. Release the clutch pedal.
5. Apply the accelerator to increase the engine speed to the correct rpm.
6. Release the accelerator and immediately push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
7. Move the shift lever into the correct gear. **Figure 4.6**.
8. Release the clutch pedal.

Figure 4.6



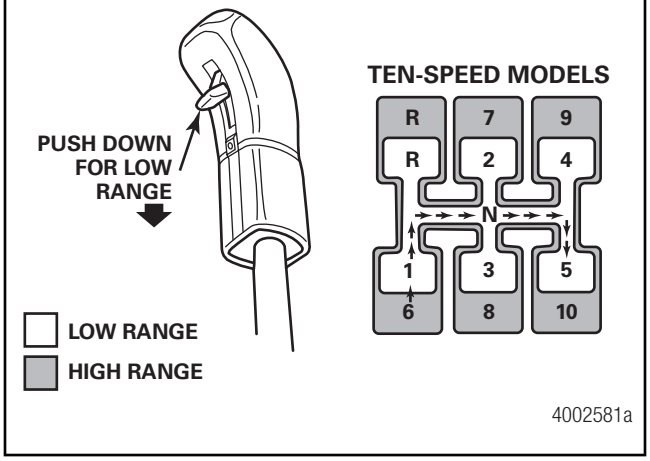
Sixth Gear Into Fifth Gear

CAUTION

Move the range lever only when the transmission is in gear to prevent damage to the transmission.

1. While in sixth gear, move the range lever DOWN to shift the range selector valve into low range. **Figure 4.7**.

Figure 4.7



2. Release the accelerator.
3. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.

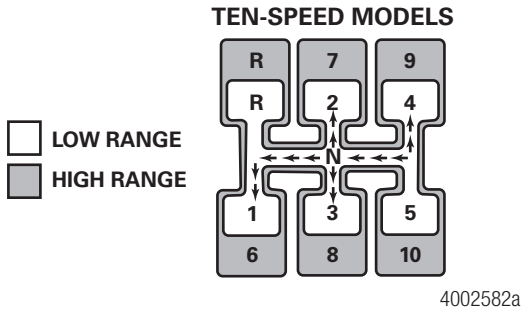
NOTE: The range cylinder will automatically shift into low range when the shift lever is in Neutral.

4. Move the shift lever to Neutral.
5. Release the clutch pedal.
6. Apply the accelerator to increase engine speed to the correct rpm.
7. Push the clutch pedal until the clutch disengages. Do not push the clutch pedal to the end of travel.
8. Move the shift lever into fifth gear.
9. Release the clutch pedal. Apply the accelerator.

Fourth, Third, Second and First Gears

To downshift into fourth, third, second and first gears, repeat Steps 2-9 above, but move the shift lever into the fourth, third, second and first gears. **Figure 4.8**.

Figure 4.8



What to Check

When troubleshooting a manual transmission, the first thing to check is the service condition. Talk to the driver, mechanic or service manager. If possible, road test the vehicle and check for the following conditions:

- Oil leaks
- Noise and vibration
- Operating conditions

Oil Leaks

Check the transmission for transmission oil leaks. If you find oil on or under the transmission, verify that the leak is transmission oil and not engine oil, coolant or other lubricants. Note that under normal conditions, the area around the oil seal, yoke and rear bearing retainer is moist. This moist condition is not a transmission leak or an oil seal leak.

New Transmissions

The following conditions can be found on new transmissions and are not considered oil leaks:

- Lubricants applied to the yoke during assembly can make the seal area appear moist or leaking.
- All output seals are prelubed with grease that melts at low temperatures. When the grease melts, it comes out of the seals, and the seals only appear to be leaking.

Vibration

When checking a noise or a vibration, determine when the condition occurs.

- In Neutral or in gear
- During upshifts or downshifts
- In all gears or specific gears
- In the high range or the low range
- During coast or acceleration
- With the vehicle loaded or unloaded

Noise

If a noise is the problem, find out the sound of the noise.

- Growling, humming or grinding
- Hissing, thumping or bumping
- Rattles
- Squealing
- Whining

Operating Concerns

When the transmission is not operating correctly, find out when the problem occurs and what the transmission does during the problem.

- In Neutral or in gear
- During upshifts or downshifts
- In the high range or the low range
- Does not stay in the selected gear
- Does not stay in the selected range
- Does not select all gears
- Does not select all ranges
- Overheats
- Does not operate

Troubleshooting Other Systems

Refer to the following chart to verify that the transmission is the potential cause of the problem.

System	Check For	Possible Repairs
Engine Systems	1. Loose or missing fasteners	1. Replace missing fasteners. Tighten to specified torque.
	2. Engine idle speed out-of-specifications	2. Adjust idle speed to the specified range.
	3. Loose or damaged engine mounts	3. Tighten the fasteners to the specified torque. Replace damaged mounts.
	4. Out-of-balance fan	4. Replace fan.
	5. Damaged engine fan	5. Repair or replace as required.
Clutch Systems	1. Loose or missing fasteners	1. Replace missing fasteners. Tighten to specified torque.
	2. Clutch out-of-adjustment	2. Adjust clutch.
	3. Clutch assembly out-of-balance	3. Replace clutch assembly.
	4. Worn or damaged pilot bearing	4. Replace pilot bearing.
Driveshaft Systems	1. Driveshaft system requires lubrication	1. Lubricate driveshaft system.
	2. Worn or damaged U-joints and/or yokes	2. Replace U-joints and/or yokes.
	3. Driveshaft out-of-balance	3. Balance driveshaft correctly or replace driveshaft.
	4. Center bearings not installed correctly or damaged	4. Install center bearings correctly or replace.
	5. Driveline angles not correct	5. Adjust driveline angles to manufacturer's specifications.
Suspension Systems	1. Loose or missing fasteners	1. Replace missing fasteners. Tighten to specified torque.
	2. Damaged suspension components	2. Repair or replace damaged suspension components.
	3. Driveline touching frame	3. Adjust so that driveline does not touch frame.
	4. Loose or damaged cab mounts	4. Tighten loose fasteners to the specified torque. Replace damaged mounts.
	5. Leaks in air suspension system	5. Repair leaks. Check all valves for correct operation.
Power Take-Off (PTO) Systems	1. PTO does not engage or disengage correctly	1. Repair or replace PTO assembly.
Wheels and Tires	1. Wheels and tires out-of-balance	1. Balance or replace wheels and tires.
	2. Tires do not match on each side of the vehicle	2. Install tires of the same size on all sides of the vehicle.
Remote Shift Systems	1. Low lubricant level	1. Fill to specified level.
	2. Linkage out-of-adjustment	2. Adjust linkage.
	3. Linkage binding or unable to move	3. Lubricate, repair or replace linkage.

Leaks

Before troubleshooting a leak:

1. Clean the outside of the transmission to remove all dirt.
2. Operate the vehicle to verify that the leak is coming from the transmission.
3. Verify that the fluid is transmission oil.
4. Verify that the transmission housings are not cracked or broken.

Condition	Possible Causes	Possible Repairs
Leaks: In-Vehicle Repair	1. Missing fasteners	1. Replace missing fasteners. Tighten to specified torque.
	2. Loose fasteners	2. Tighten to specified torque.
	3. High oil level	3. Drain to specified level. Refer to Transmission Overheats in the Operating Conditions chart.
	4. Unspecified oil in transmission	4. Drain oil. Install specified oil.
	5. Clogged or dirty breather vent	5. Clean the breather vent.
	6. Damaged yoke	6. Replace the yoke. ①
	7. Damaged output shaft seal	7. Replace the output shaft seal. ①
	8. Worn or damaged sealing tape on electronic speed sensor	8. Install new sealing tape on the electronic speed sensor.
Leaks: Remove and Disassemble Transmission	1. Damaged gaskets or sealing material	1. Replace gaskets or sealing material.
	2. Cracked or broken housing	2. Replace the housing.
	3. Oil leaking from breather vent ②	3. Replace the O-ring in the piston housing.

① If the transmission continues to leak and the output shaft seal and the yoke have been replaced, remove and replace the output shaft assembly.

② Place the transmission in the low range and operate the vehicle. If air leaks from the breather vent, the O-ring in the housing of the range cylinder is damaged.

Vibrations

Before troubleshooting a vibration:

1. The engine idle speed is within the specified range.
2. The engine is operating correctly.
3. The U-joints, yokes and driveshaft are in good condition. Check the driveline angles. Correct as necessary.
4. The U-joints, the yokes and the driveshafts are correctly aligned and balanced. Correct as necessary.
5. Check air bag height. Correct as necessary.

Condition	Possible Causes	Possible Repairs
Vibration: In-Vehicle Repair	Fasteners do not remain tight	Tighten fasteners. If fasteners do not remain tight, replace fasteners or housing.
Vibration: Remove and Disassemble Transmission	Damaged bearings	Replace bearings.
	Broken or loose synchronizer pins ①	Replace the synchronizer.

① If the transmission does not shift correctly into the selected range, broken or loose synchronizer pins can be a result of vibration.

Noises

For noise conditions, check the following before disassembling the transmission:

1. The oil level is even with the bottom of the fill plug hole on a level surface.
2. The correct oil is used.
3. The driveline angles of the transmission are correct.
4. The transmission is correctly installed.
5. Remove the drain plug. Check for metal shavings, gasket material or any other material in the oil.

Condition	Possible Causes	Possible Repairs
Growling, Humming or Grinding ①	1. Worn or damaged gears 2. Worn bearings (humming only) 3. End play out-of-specifications	1. Replace gears. 2. Replace bearings. 3. Check and adjust end play.
Hissing, Thumping or Bumping ②	1. Damaged bearings (hissing only) 2. Damaged gear teeth (thumping or bumping only)	1. Replace bearings. 2. Replace gears.
Rattles: In-Vehicle Repair	1. Engine idle speed not within specifications 2. Engine does not operate on all cylinders 3. Clutch intermediate or center plate binding in housing ③ 4. Other systems 5. Incorrect shim installation on the PTO unit	1. Adjust idle speed to specified RPM. 2. Adjust or repair engine. 3. Repair or replace intermediate or center plate. 4. Verify that the transmission is the source of the rattle condition. 5. Install correct shims on PTO unit.
Rattles: Remove and Disassemble Transmission	1. Damaged washers between mainshaft gears	1. Replace washers between mainshaft gears.
Squealing or Whining: In-Vehicle Repair ④	1. Incorrect shim installation on PTO unit	1. Install correct shims on PTO unit.
Squealing or Whining: Remove and Disassemble Transmission ④	1. Damaged bearings 2. End play of countershafts not within specifications	1. Replace bearings. 2. Adjust countershaft end play within specifications.

① Growling and humming are associated with the first stages of the condition. Grinding is associated with the severe stages of the condition.

② Hissing is associated with the first stages of the condition. Thumping and bumping are associated with the severe stages of the condition.

③ If the noise occurs when the clutch is engaged and stops when the clutch is disengaged, then the intermediate or center plate can be the cause of the rattle.

④ Whining is a medium-pitched noise. Squealing is a high-pitched noise.

Section 5
Troubleshooting

Operating Conditions

Condition	Possible Causes	Possible Repairs
Transmission Slips Out of the Selected Range: In-Vehicle Repair	1. Loose air lines and fittings	1. Tighten air lines and fittings.
	2. Obstructions in the air lines	2. Change routing or replace air lines.
	3. Check operation of filter regulator assembly	3. Replace the filter regulator assembly if pressure at the delivery port is not within 55-75 psi (379.2-517.1 kPa).
	4. Damaged O-ring on piston in range shift cylinder ①	4. Replace the O-ring on the piston.
	5. Loose or missing nut that fastens piston to shift shaft in range shift cylinder ②	5. Tighten or replace the nut.
Transmission Slips Out of the Selected Range: Remove and Disassemble Transmission	1. Worn teeth in sliding clutch	1. Replace the sliding clutch.
	2. Bent or worn shift fork	2. Replace the shift fork.
	3. Worn collar on range shift fork	3. Replace the collar on the range shift fork.
Transmission is Slow to Shift or Unable to Shift into the Selected Range: In-Vehicle Repair	1. Loose or leaking air lines and fittings	1. Tighten or replace the air lines or fittings.
	2. Obstructions in the air lines	2. Change the routing or replace the air lines.
	3. Filter regulator assembly does not operate correctly	3. Replace the filter regulator assembly if pressure at the delivery port is not 55-75 psi (379.2-517.1 kPa).
	4. Damaged piston or O-rings in piston housing ③	4. Replace the O-rings or piston in piston housing.
	5. Damaged shift knob or selector valve	5. Replace the shift knob or selector valve.
	6. Range solenoid does not operate correctly.	6. Replace the range solenoid.
	7. Neutral switch does not operate correctly.	7. Replace the neutral switch.
Transmission is Slow to Shift or Unable to Shift into the Selected Range: Remove and Disassemble Transmission	1. Damaged output shaft	1. Replace the output shaft.
	2. Broken or missing synchronizer springs or pins	2. Replace the synchronizer springs or synchronizer.
	3. Damaged synchronizer	3. Replace the synchronizer.
	4. Bent or broken shift shaft in range cylinder	4. Replace the shift shaft.
	5. Bent or broken shift fork in range cylinder	5. Replace the shift fork.
	6. Dirt between splines and gears	6. Drain the oil. Flush the inside of the housing. Fill to the specified level with new fluid.
	7. Missing high-low fork pin and nut	7. Replace the high-low fork pin and nut.

① To check leakage at the range cylinder, first place the selector valve in the low range. Operate the vehicle to charge the air system. Listen for air exhaust at the base of the solenoid. If air leaks are heard, the O-ring or the piston must be replaced.

② When the nut is loose or missing at the end of the shift shaft, the transmission could possibly shift into the high range but not into the low range.

③ To check for leaks at the piston housing, disconnect the air lines at the piston housing. Apply air pressure to each port, one port at a time. If air leaks past the piston, the O-ring or the piston must be replaced. If the piston does not move, the shift shaft or the shift assembly is damaged.

Operating Conditions

Condition	Possible Causes	Possible Repairs
Transmission Slips Out of the Selected Gear: In-Vehicle Repair	1. Incorrect clutch use	1. Verify that the driver uses clutch correctly.
	2. Linkage binding or does not move freely	2. Lubricate, repair or replace linkage.
	3. Clutch out-of-adjustment	3. Adjust the clutch. Check that the clutch engages and releases correctly.
	4. Remote shift linkage out-of-adjustment	4. Adjust remote shift linkage.
	5. Loose or damaged engine or cab mounts	5. Tighten fasteners of loose mounts to the specified torque. Replace damaged mounts.
	6. Incorrect driveline angles	6. Adjust driveline angles.
	7. Weak or broken detent spring in top cover assembly	7. Replace detent spring in top cover assembly.
Transmission Slips Out of the Selected Gear: Remove and Disassemble Transmission	1. Worn pads on shift fork	1. Replace the shift fork.
	2. Worn teeth in sliding clutch	2. Replace the sliding clutch.
	3. Worn fork slot on sliding clutch	3. Replace the sliding clutch.
	4. Broken key on mainshaft	4. Replace the key or mainshaft.
	5. Twisted mainshaft	5. Replace the mainshaft.
Transmission Is Hard to Shift or Unable to Shift Into the Selected Gear: In-Vehicle Repair	1. Incorrect vehicle operation	1. Verify that the driver operates vehicle correctly.
	2. Clutch out-of-adjustment	2. Adjust the clutch. Check that the clutch engages and releases correctly.
	3. Remote shift linkage binding or unable to move	3. Lubricate, repair or replace remote shift linkage.
	4. Loose or damaged cab or engine mounts	4. Tighten fasteners of loose mounts to the specified torque. Replace damaged mounts.
	5. Detent spring too strong or broken	5. Replace the detent spring.
Transmission Is Hard to Shift or Unable to Shift into the Selected Gear: Remove and Disassemble Transmission	1. Bent shift shaft in top cover assembly	1. Replace the shift shaft.
	2. Burr on shift shaft in top cover assembly	2. Replace the shift shaft.
	3. Cracked top cover assembly	3. Replace the top cover assembly.
	4. Twisted mainshaft	4. Replace the mainshaft.
	5. Broken key on mainshaft	5. Replace the key or mainshaft.
	6. Broken or bent shift fork on sliding clutch	6. Replace the fork.
Transmission Grinds on Initial Engagement: In-Vehicle Repair	1. Driver does not operate vehicle correctly	1. Verify that the driver operates vehicle correctly.
	2. Clutch out-of-adjustment	2. Adjust the clutch. Check that the clutch engages and releases correctly.
	3. Worn, damaged or missing clutch brake	3. Replace clutch brake. Check that the clutch engages and releases correctly.
	4. Clutch or remote shift housing linkage binding or unable to move	4. Lubricate, repair or replace linkage.
	5. Worn bushings in side of clutch housing	5. Replace the clutch housing bushings.
Shift Lever Locks or Sticks In Gear: In-Vehicle Repair	1. Remote shift linkage out-of-adjustment	1. Adjust the remote shift linkage.
	2. Clutch linkage needs adjustment	2. Adjust the clutch linkage.
	3. Linkage binding or unable to move	3. Lubricate, repair or replace the linkage.
	4. Loose or damaged cab and/or engine mounts	4. Tighten fasteners of loose mounts to the specified torque. Replace damaged mounts.
	5. Damaged detent pin or rail in top cover assembly	5. Replace the detent pin or rail.

Section 5
Troubleshooting

Operating Conditions

Condition	Possible Causes	Possible Repairs
Shift Lever Locks or Sticks In Gear: Remove and Disassemble Transmission	1. Bent shift fork in top cover 2. Damaged shift shaft in top cover 3. Damaged mainshaft	1. Replace the shift fork. 2. Replace the shift shaft. 3. Replace the mainshaft.
Transmission Overheats: In-Vehicle ④ ⑤	1. Incorrect oil level 2. Incorrect oil	1. Fill to the specified level. 2. Drain oil. Use the specified oil.
Transmission Does Not Operate: Remove and Disassemble Transmission	1. Missing or damaged interlock detent pin in top cover 2. Free-running gears are locked 3. Mismatched gear sets 4. Timing marks on gears not aligned 5. Broken shafts	1. Replace the interlock detent pin in top cover. 2. Replace the gears. 3. Install the correct gear sets. 4. Align the timing marks on the gears. 5. Replace the shafts.

④ If a noise is present along with the overheating condition, refer to the Noises chart in this section to identify and service the noise.

⑤ If the oil is at the specified level and the specified oil is used, but the transmission overheats and the oil smells burnt, the transmission must be disassembled and inspected.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

CAUTION

To avoid damage to the transmission, use only the specified oil. Do not use multi-viscosity engine oils or Extreme Pressure (EP) GL-5 gear oils. Use the same oil that is in the transmission. Do not mix oils. Check for low oil. The oil level must be even with the bottom of the fill plug for the oil to completely lubricate the transmission.

Lubrication

Transmission Oil Capacities ①

Transmission Model	U.S. Pints	Liters
RM9-115A	20.0	9.5
RM9-125A	20.0	9.5
RM9-135A	20.5	9.7
RM9-145A	20.5	9.7
RM9-155A	20.5	9.7
RMO9-125A	20.0	9.5
RMO9-135A	20.5	9.7
RMO9-145A	20.5	9.7
RMX9-125A	20.0	9.5
RMX9-135A	20.5	9.7
RMX9-145A	20.5	9.7
RMO9-115B	20.0	9.5
RMO9-125B	20.0	9.5
RMO9-135B	20.5	9.7
RMO9-145B	20.5	9.7
RMX9-115B	20.0	9.5
RMX9-125B	20.0	9.5
RMX9-135B	20.5	9.7
RMX9-145B	20.5	9.7
RMX9-155B	20.5	9.7
RMX9-115R	20.0	9.5
RMX9-125R	20.0	9.5
RMX9-135R	20.5	9.7
RMX9-145R	20.5	9.7
RM10-115A	20.0	9.5
RM10-125A	20.0	9.5
RM10-135A	20.5	9.7
RM10-145A	20.5	9.7
RMX10-115A	20.0	9.5
RMX10-125A	20.0	9.5
RMX10-135A	20.5	9.7
RMX10-145A	20.5	9.7
RMX10-155A	20.5	9.7
RMX10-165A	20.5	9.7
RMO-13-145A	22.0	10.4

① Oil capacities are approximate. Fill the transmission to the bottom of the fill plug hole. The vehicle should be on a level surface. On transmissions equipped with an oil pump and/or oil cooler, operate the engine with the transmission in Neutral and the clutch engaged for five minutes after the initial fill and check the oil level again.

Transmission Oil Specifications

NOTE: Do not mix oils in the transmission.

Use the specified type of single-weight oil when you add or replace oil in the transmission. Use the correct type of oil for outside temperatures. Use engine oil, mineral oil, or fully synthetic oil.

Transmission Oil Specifications

Lubricant Type	Grade (SAE)	Outside Temperature
Full-Synthetic Oil Meritor Specification O-81 ①	50	All
Heavy-Duty Engine Oil, A.P.I.-CD, -CE, -SF or -SG (Current A.P.I. Designations Acceptable) ① MIL-2104B, C, D or E①	50 40 30	Above 10°F (–12°C) Above 10°F (–12°C) Above –15°F (–26°C)
Mineral Oil with Rust and Oxidation Inhibitor, A.P.I.-GL-1 ①	90 80	Above 10°F (–12°C) Above –15°F (–26°C)

① Use only the specified type of single weight oils. Do not use multi-viscosity and EP (Extreme Pressure) GL-5 gear oils. Multi-viscosity and EP gear oils may damage components. The use of multi-viscosity or EP gear oils voids the warranty.

Check and Adjust the Oil Level

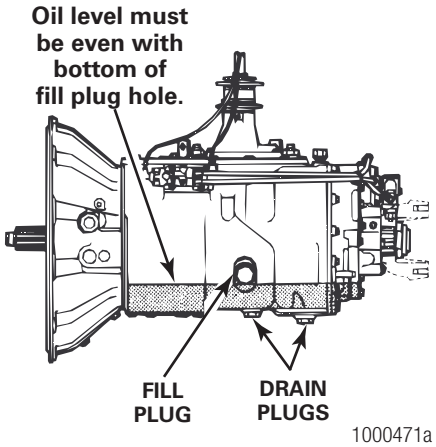
1. Follow this procedure before you check the oil.
   A. Check that the vehicle is parked on a level surface.
   B. Wait 10 minutes after the vehicle is parked before you check the oil level.
   C. Check that the oil you will use is at room temperature.
2. Clean the area around the fill plug. Remove the fill plug from the side of the transmission.
3. Check the oil level, which must be even with the bottom of the fill plug hole.
   - **If foam appears when you remove the fill plug:** The oil is too hot to be checked. Install the plug and allow the oil to cool.
   - **If oil flows from the fill plug hole when you remove the fill plug:** The oil level is high. Drain the oil until it reaches the bottom of the fill plug hole.
   - **If the oil level is below the bottom of the fill plug hole:** Add the specified oil.
4. Install and tighten the fill plug to 35-50 lb-ft (47-68 N•m). T
5. Operate the vehicle for five minutes. Check for leaks and correct operation.

Drain and Replace the Oil

NOTE: Check the oil when the transmission is hot.

1. Check that the vehicle is parked on a level surface. Place a large container under the transmission. Place a screen on top of the container.
2. Remove the drain plugs from the bottom of the transmission. Drain and correctly discard the oil.
3. Inspect the screen on the container for metal particles and damaged parts. Service the transmission as necessary.
   - **If you disassemble and replace a transmission with an oil cooler:** Remove the oil cooler. Remove and correctly discard the oil from the cooler and oil lines. Reinstall the cooler and oil lines. Tighten the fasteners to the vehicle manufacturer's specifications.
4. Install and tighten the drain plug to 35-50 lb-ft (47-68 N•m). T
5. Clean the area by the fill plug. Remove the fill plug from the side of the transmission.
6. Add the specified transmission oil through the fill plug hole. Add the oil until the oil level is even with the bottom of the fill plug hole. **Figure 6.1**.

Figure 6.1



7. Install and tighten the fill plug to 35-50 lb-ft (47-68 N•m). T
8. Operate the vehicle for five minutes. Check for leaks and correct operation.

Maintenance

Check the Breather Vent

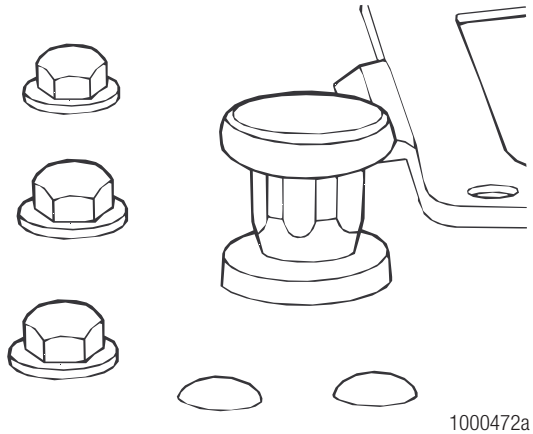
CAUTION

Cover the breather vent when you steam clean the transmission to prevent water from entering the main case. Damage to the transmission can result.

Breather vents help to prevent moisture and contaminants from entering the transmission, which can affect oil and transmission performance. **Figure 6.2**.

1. Check the breather vent for damage.
2. Remove oil and contaminants from the breather vent screen.

Figure 6.2



Check Fastener Torque

Check fastener torque on the following components:

- Clutch housing-to-engine flywheel
- Top cover housing to the main case
- All electrical switches on the top cover housing
- Drain and fill plugs
- Auxiliary case to main case
- Output bearing retainer to auxiliary case
- Piston housing cover to auxiliary case
- Auxiliary countershaft cover to auxiliary case
- Transmission to frame brackets
- Output yoke to output shaft
- Shift cover housing to top cover housing

Inspect the Transmission for Leaks and Damage

CAUTION

Repair all leaks to avoid damage to the transmission.

Inspect the transmission for cracks and damage. Check the following areas for leaks. If you find a leak, verify that it is transmission oil.

- The output yoke and the oil seal in the output bearing retainer on the auxiliary case
- PTO covers on the main case
- The auxiliary case to main case
- The main case and clutch housing
- The clutch housing to flywheel housing
- The auxiliary countershaft covers
- The slave valve to the main case
- The shift lever and tower assembly to the top cover
- The top cover to the main case
- The fill and drain plugs
- The output bearing retainer to the auxiliary case
- The input bearing retainer to the main case
- The speedometer bore to electronic speed pickup in the output bearing retainer

Adjust and Lubricate the Remote Control Assembly Linkage

Cab-over-engine (COE) vehicles use a remote control assembly, which is located on the top of the transmission, that uses linkage to connect the inner shift lever to a shift lever in the vehicle's cab.

For correct operation of the shift lever, you must adjust and lubricate the remote control assembly linkage. Refer to the vehicle manufacturer's instructions for correct procedures, specifications and recommended intervals.

Remove and Install the Remote Control Assembly

NOTE: Refer to the vehicle manufacturer's instructions to remove and install the remote control assembly. The information below provides a general procedure.

1. Follow the vehicle manufacturer's instructions to raise the cab.
2. Measure the length of the adjusting rod from the centerline of each ball socket. Mark the locations of the adjusting rod and ball sockets. **Figures 6.3 and 6.4**.

Figure 6.3

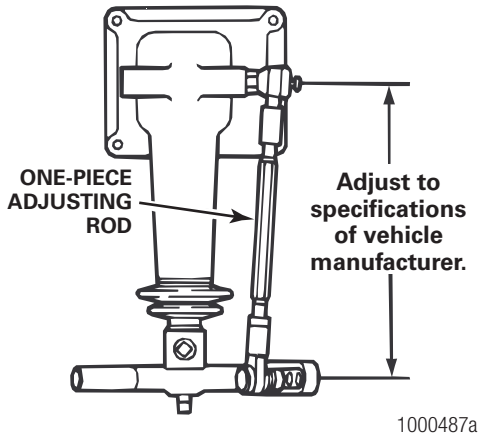
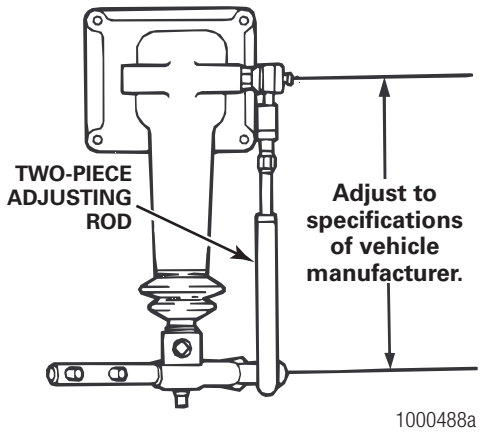


Figure 6.4



3. Disconnect the linkage to the remote control assembly.
4. Remove the capscrews that fasten the remote control housing to the top cover housing. Remove the housing.
5. Remove and discard the gasket. Remove any gasket material between the remote control housing and the top cover housing.
6. Install a new gasket on the transmission.
7. Place the remote control housing into position. Install and tighten the capscrews to 35-45 lb-ft (47-61 N•m). T
8. Connect the linkage to the remote control housing's outer shift lever. Install and tighten the nut to 12-18 lb-ft (17-24 N•m). T
9. Adjust the adjusting rod length to the distance you measured in Step 2 or the vehicle manufacturer's specification.
   A. Loosen the jam nuts and move the adjusting rod to the correct distance.
   B. Tighten the jam nuts to 35-50 lb-ft (47-68 N•m). Follow the vehicle manufacturer's instructions to adjust the linkage. T
   C. Operate the vehicle to verify that it operates correctly.

WARNING

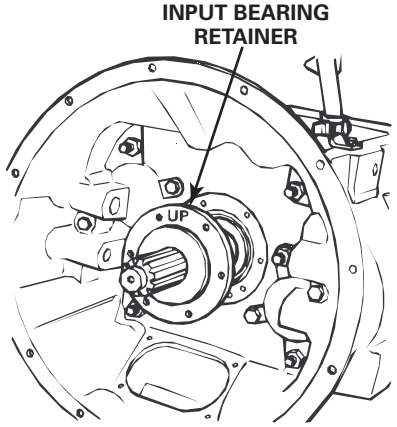
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Remove the Input Shaft Assembly

NOTE: You can remove the input shaft without disassembling the transmission.

1. Remove the transmission from the vehicle.
2. Remove the capscrews and washers that secure the input bearing retainer to the main case. Remove the input bearing retainer. **Figure 7.1**.

Figure 7.1



CAUTION

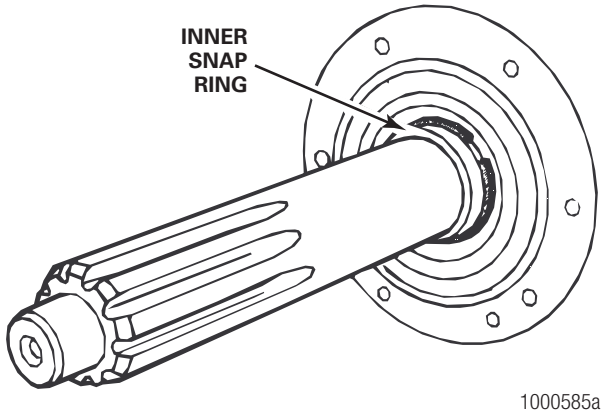
Use a rubber mallet or dead-blow hammer to separate the top cover from the transmission case. Do not use a pry bar or screwdriver, which can damage the top cover and transmission case mounting surfaces. If the cover is still difficult to remove, remove the slave valve and the interlock pin from the main case to prevent damage to components.

3. Use a scraper to remove sealant material between the input bearing retainer and the main case.

NOTE: A shipping seal may be on the input shaft. Remove and discard the seal.

4. Remove the inner snap ring that secures the bearing onto the input shaft. **Figure 7.2**.

Figure 7.2



NOTE: For easier bearing removal, use Owatonna tool set OTC-7070 or G&W tool G-38, or equivalent. To obtain these tools, refer to the Service Notes page on the front inside cover of this manual. **Figures 7.3 and 7.4**.

Figure 7.3

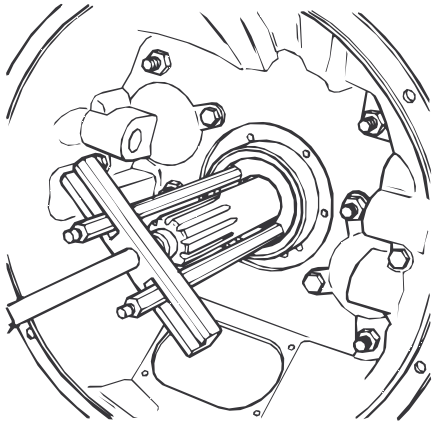
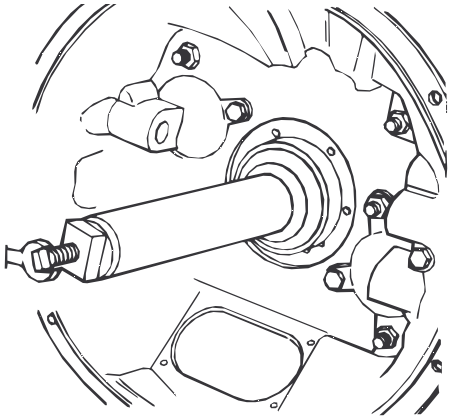
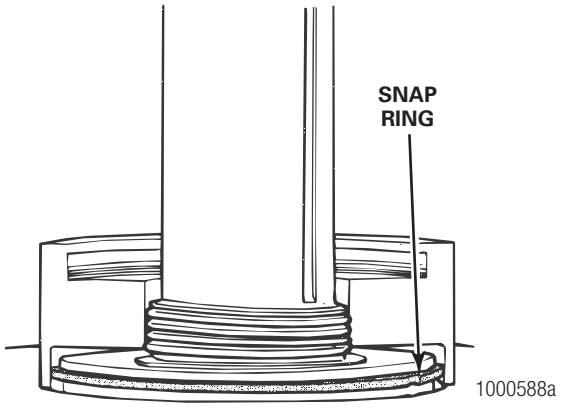


Figure 7.4



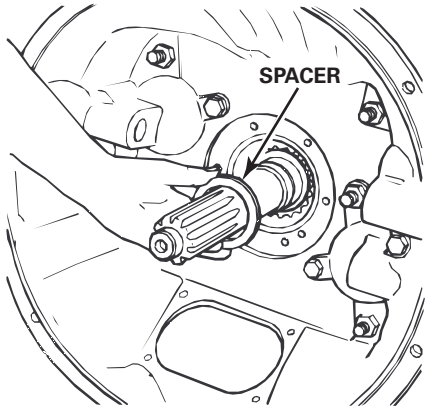
5. Use a tool to remove the input bearing from the shaft. Attach the tool to the bearing's outer snap ring to pull the bearing from the shaft.
   - **If the snap ring is not extended far enough for the tool to grip:** Pull the input shaft out, until you can install the tool onto the snap ring. **Figure 7.5**.

Figure 7.5



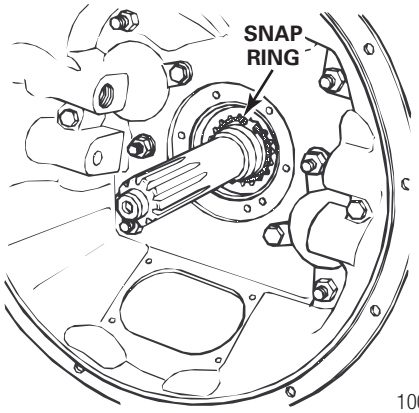
6. Remove the spacer from the input shaft. **Figure 7.6**.

Figure 7.6



7. Remove the snap ring from the gear that secures the input shaft in the gear. **Figure 7.7**.
8. Remove the input shaft.

Figure 7.7



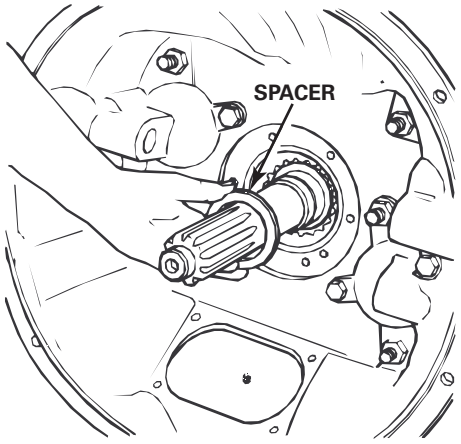
Install the Input Shaft Assembly

NOTE: You can install the input shaft without disassembling the transmission.

1. Use the same oil that is used in the transmission to lubricate all parts.
2. Align the input shaft splines with the splines inside the main drive gear. Install the input shaft into the main drive gear.

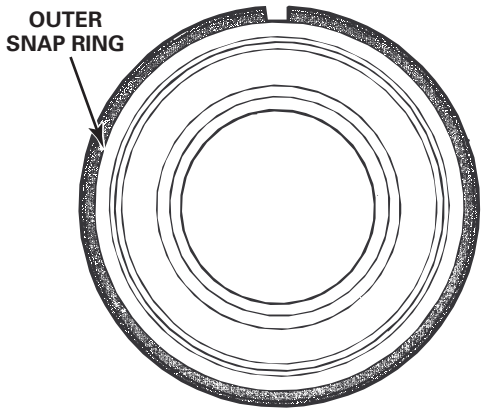
3. Install the snap ring that secures the input shaft in the main drive gear. Install a spacer onto the input shaft. **Figure 7.8**.

Figure 7.8



4. Install the outer snap ring into the bearing groove. **Figure 7.9**.

Figure 7.9

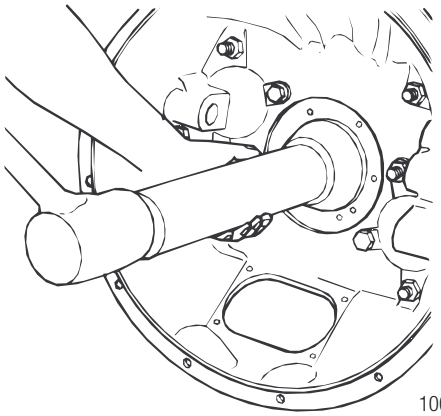


CAUTION

Only use a bearing driver on the INNER race of a bearing to avoid damage to components.

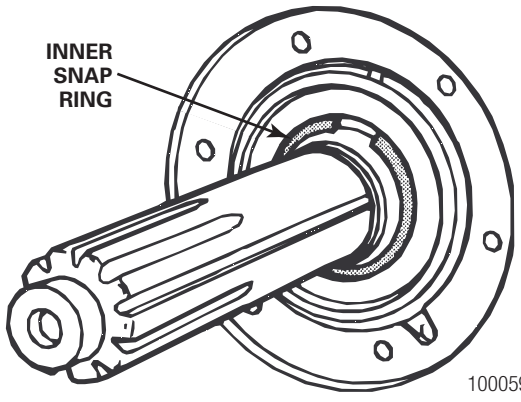
5. Install the bearing over the input shaft and into the case. Use a rubber or plastic mallet, and G&W input bearing shaft driver G-35, to install the bearing onto the input shaft. The bearing is correctly installed when the snap ring touches the case. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual. **Figure 7.10**.

Figure 7.10



6. Install the inner snap ring that secures the bearing onto the input shaft. **Figure 7.11**.

Figure 7.11



WARNING

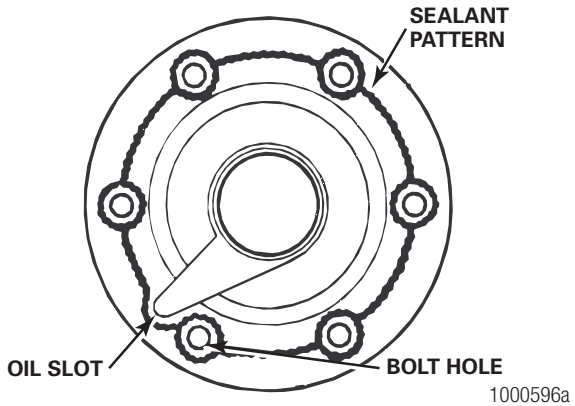
When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

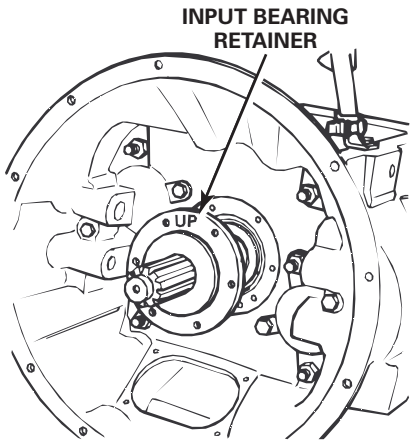
7. Use a sealant dispenser and Loctite® Master Gasket Sealant number 00203 or equivalent to apply a new sealant pattern on the input bearing retainer in the pattern shown in **Figure 7.12**.

Figure 7.12



8. Install the bearing retainer onto the case. Check that the oil passage in the retainer aligns with the oil hole in the case. **Figure 7.13**.
9. Install the retainer capscrews and washers. Tighten capscrews to 65-85 lb-ft (89-115 N•m). **Figure 7.13**. T
10. Operate and test the vehicle.

Figure 7.13



⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

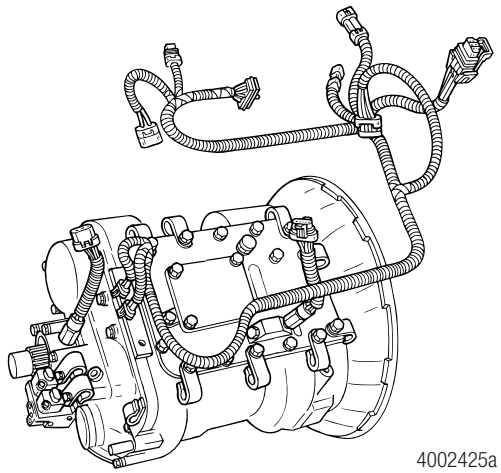
- **Wear safe eye protection.**
- **Wear clothing that protects your skin.**
- **Work in a well-ventilated area.**
- **Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.**
- **You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.**

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin.

Top Cover Removal

1. Remove the wiring harness. Refer to Section 20. **Figure 8.1**.

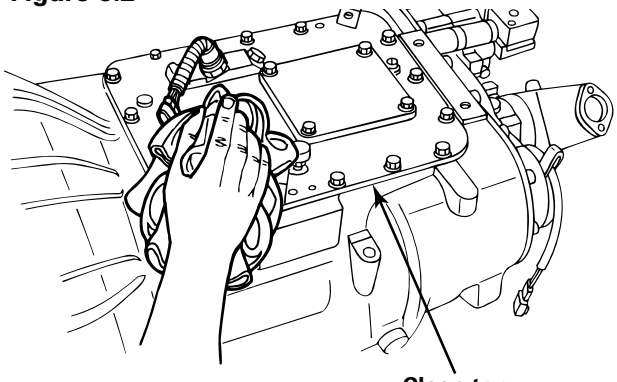
Figure 8.1



4002425a

2. Clean the top cover housing before removal. **Figure 8.2**.

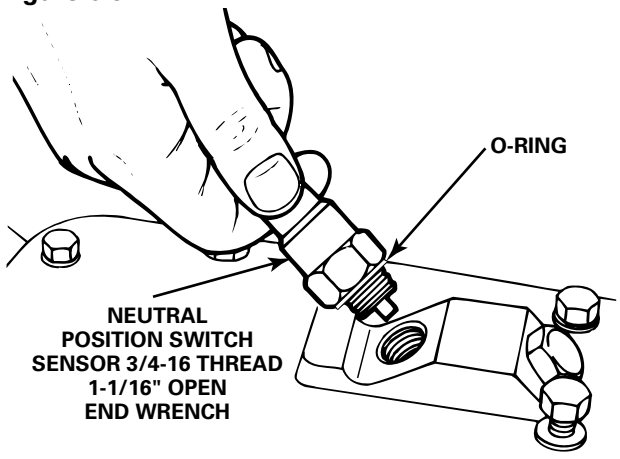
Figure 8.2



4002427a

3. Remove the neutral position switch sensor from the top cover housing. **Figure 8.3**.

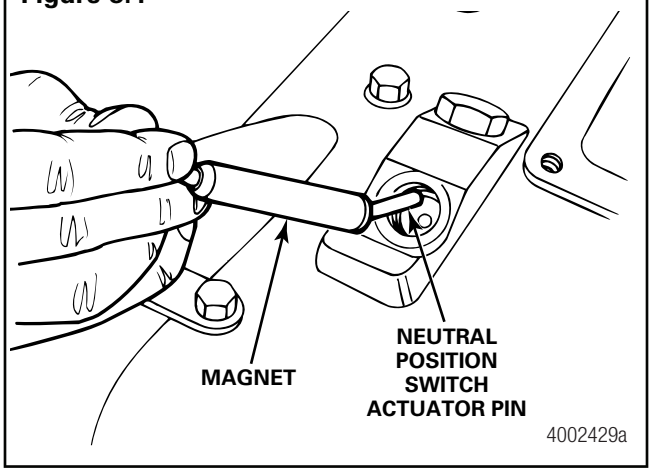
Figure 8.3



4002428a

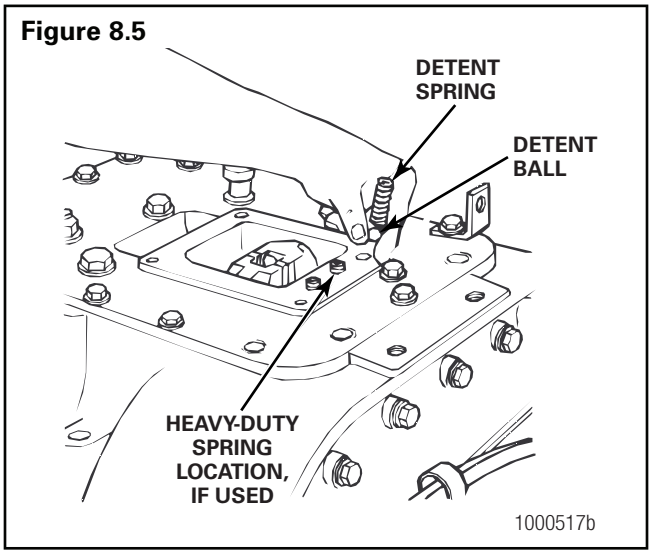
4. Use a magnet to remove the neutral position switch sensor actuator pin from the bore in the top cover housing. **Figure 8.4**.

Figure 8.4



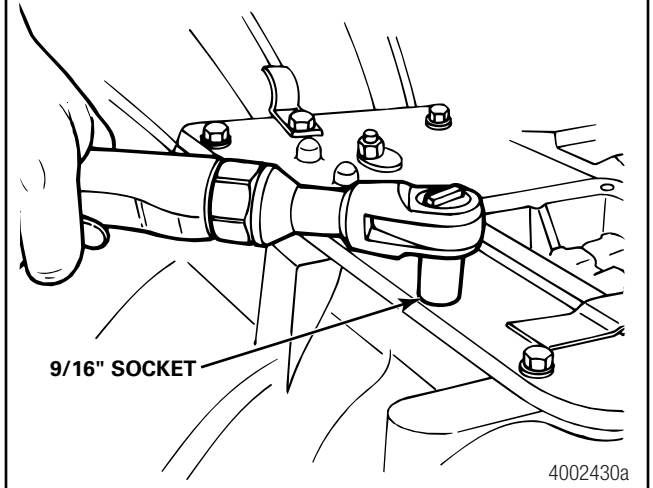
5. Remove the three detent springs from the top cover from the holes in the top cover. If a heavy-duty detent spring is used, the spring, different color, is in the bore on the slave valve side of the transmission. Use a magnet to remove a detent ball from each of the three holes. **Figure 8.5**.

Figure 8.5



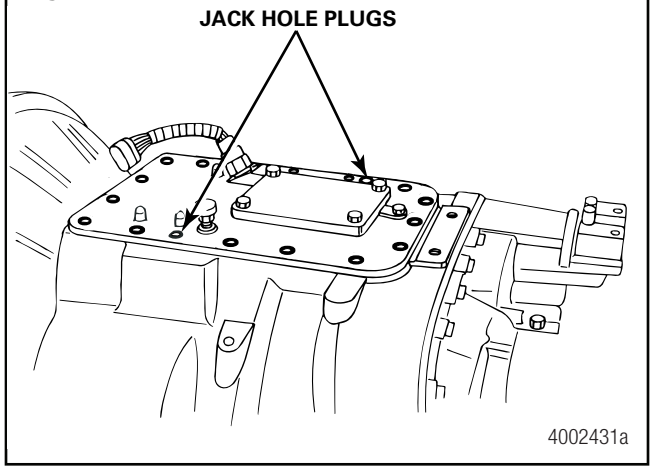
6. Use a 9/16-inch socket to remove the sixteen 3/8-16 top cover housing capscrews. **Figure 8.6**.

Figure 8.6



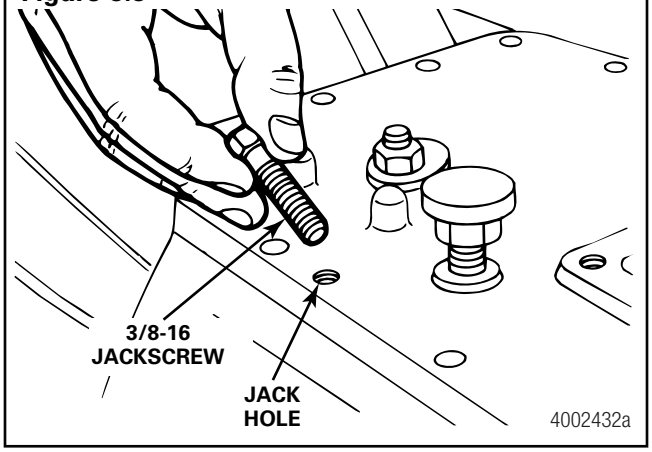
7. Remove jack hole plugs. **Figure 8.7**.

Figure 8.7



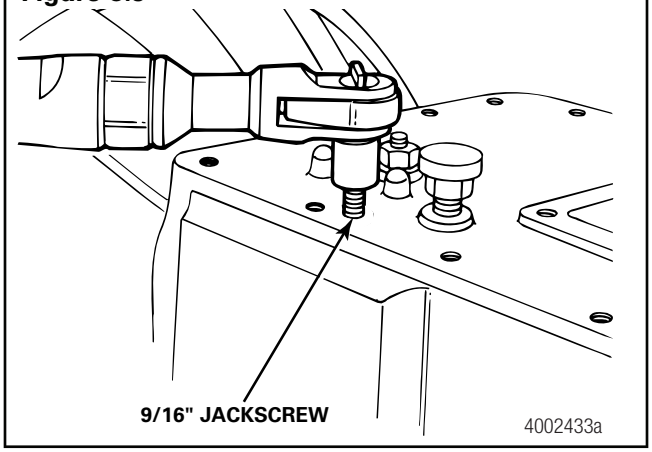
8. Install two of the 3/8-16 capscrews into the threaded jack holes. **Figure 8.8**.

Figure 8.8



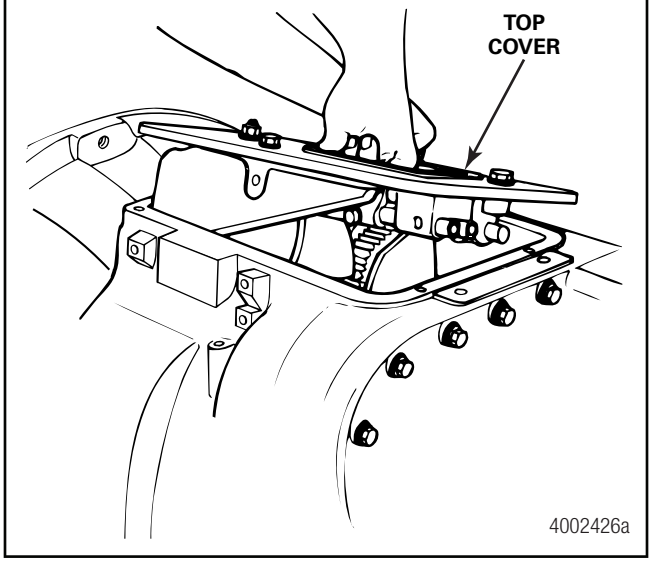
9. Use a hand or air ratchet to alternately turn the two 3/8-16 jackscrews until the top cover is separated from the case. **Figure 8.9**.

Figure 8.9



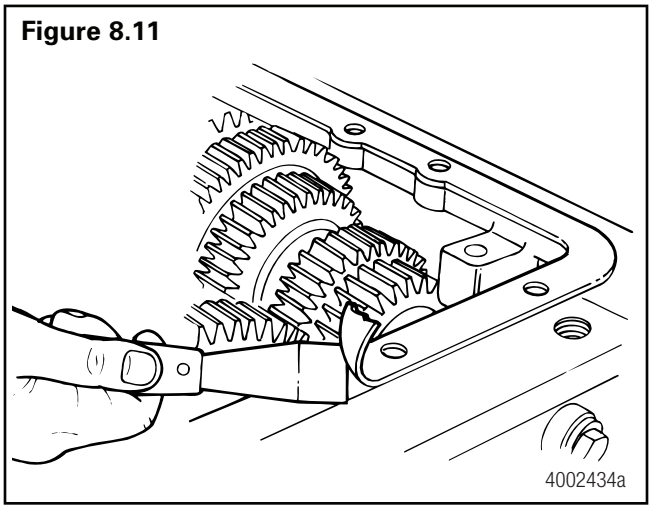
10. Remove the top cover housing from the transmission case assembly. **Figure 8.10**.

Figure 8.10



11. Use a scraper to remove all sealant from the surface of the top cover housing and transmission case assembly. The sealant you remove must not fall inside the transmission. Clean the mounting surface with Loctite® Safety Sealant. **Figure 8.11**.

Figure 8.11

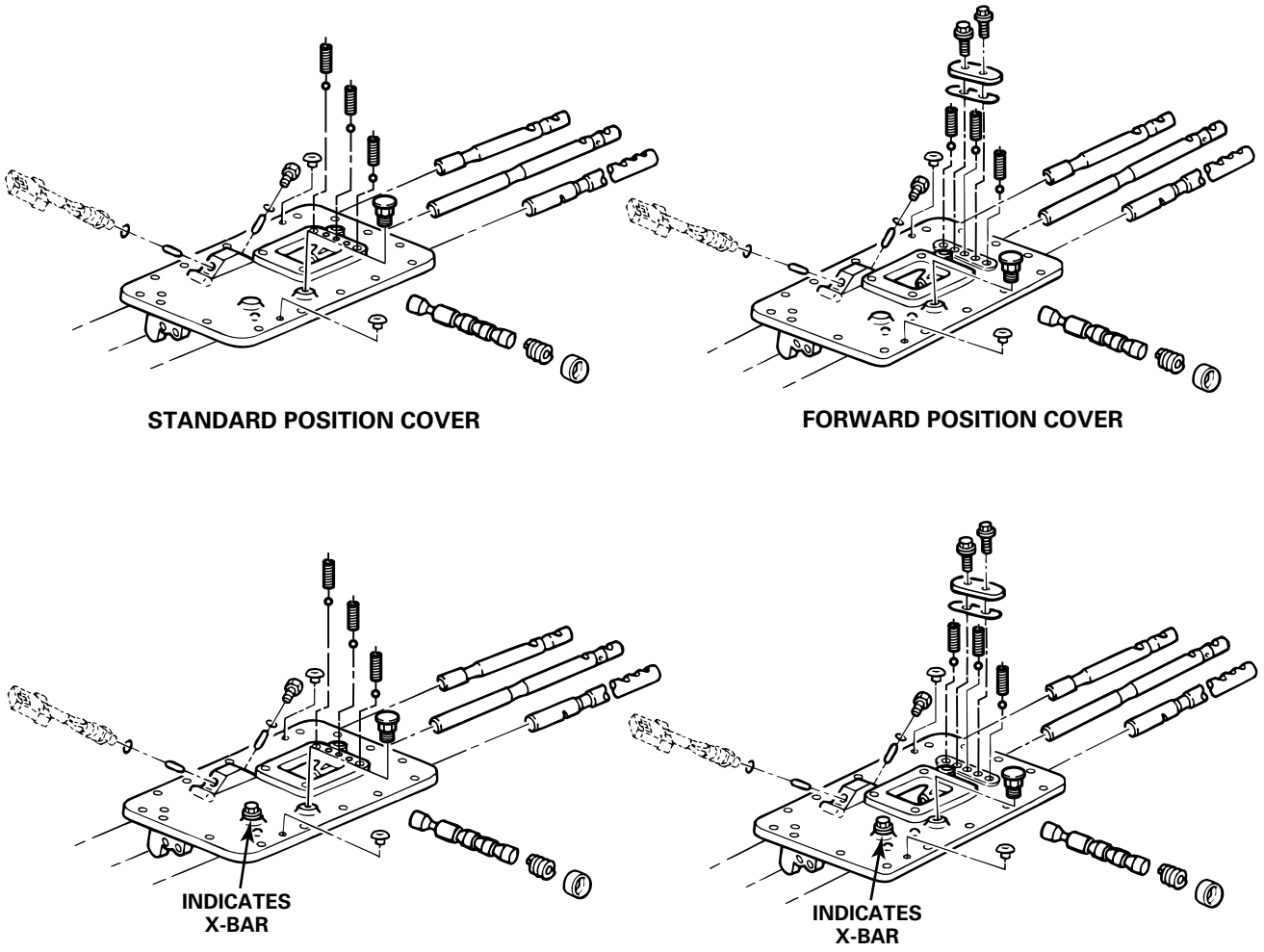


Section 8
Overhaul the Top Cover Assembly

Overhauling the Top Cover Housing

Standard and Forward Positions

Figure 8.12



NOTE: Refer to Maintenance Manual 26A, Nine-Speed, Ten-Speed and Thirteen-Speed Transmissions, for overhaul procedures not covered in this manual. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

Disassembling the Standard and Forward Position Top Cover Assembly

Standard Pattern Top Cover

Refer to **Figures 8.13 and 8.14**.

Figure 8.13

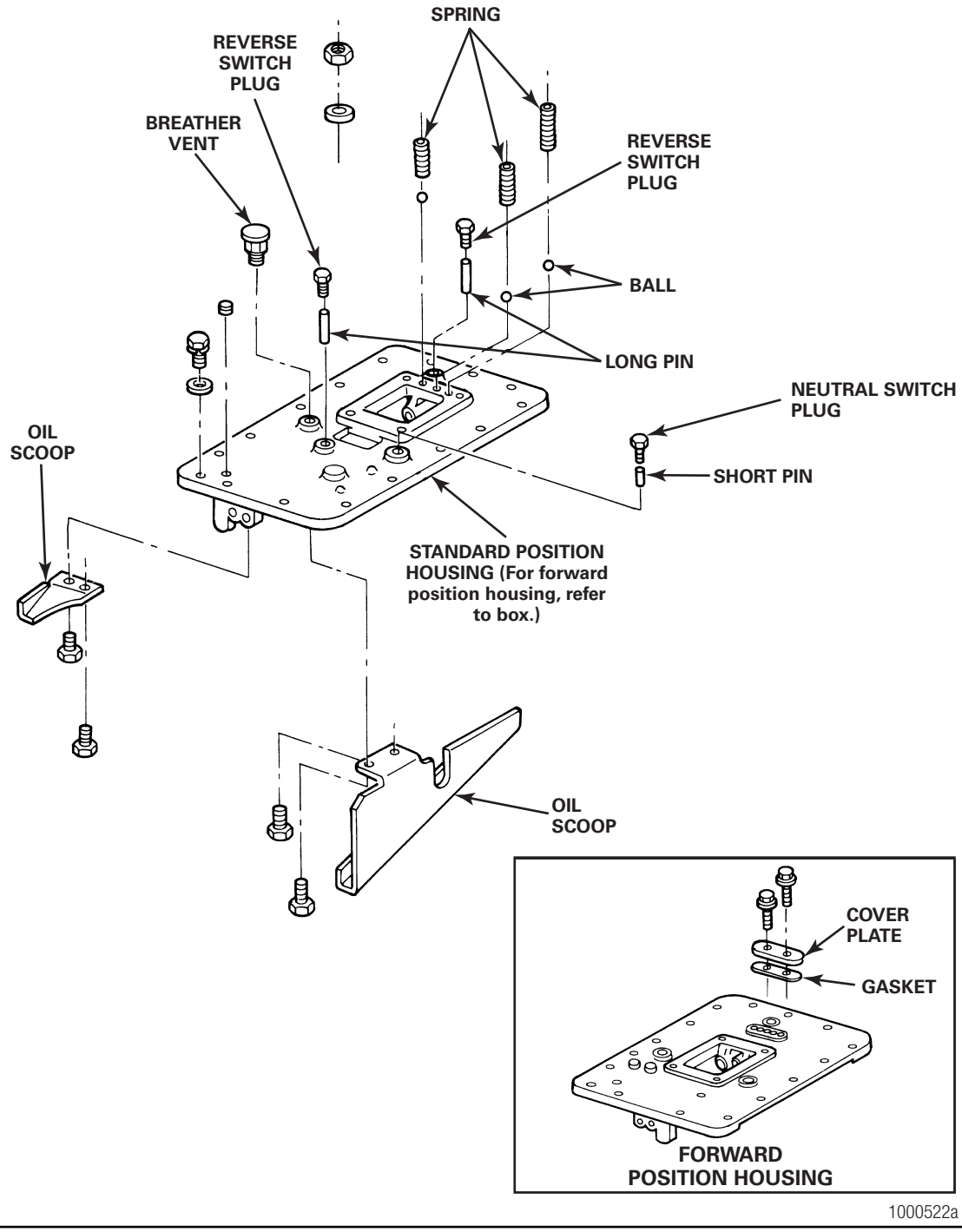
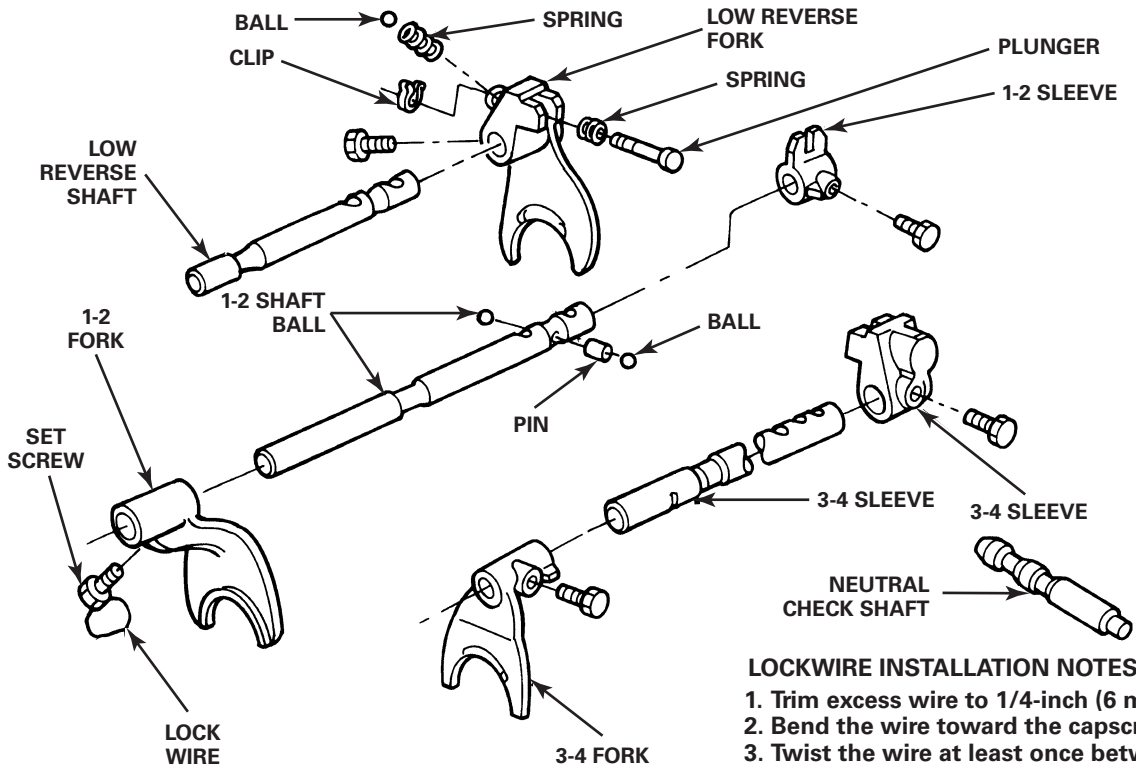


Figure 8.14



LOCKWIRE INSTALLATION NOTES:

1. Trim excess wire to 1/4-inch (6 mm).
2. Bend the wire toward the capscrew.
3. Twist the wire at least once between parts.
4. On the 1-2 sleeve, the wire can be wrapped around the shaft.
5. The wire must not interfere with the movement of the rail.

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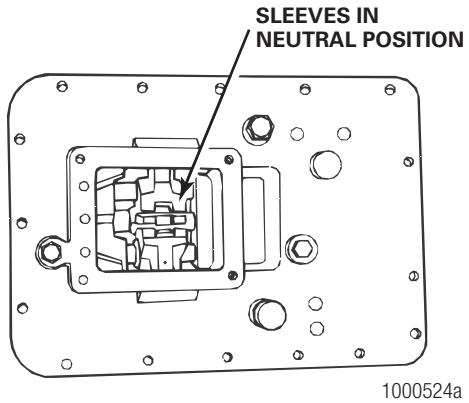
NOTE: The standard position top cover and the forward position top cover use different housings. The forward position housing uses a plate and a gasket installed over the detent balls and springs.

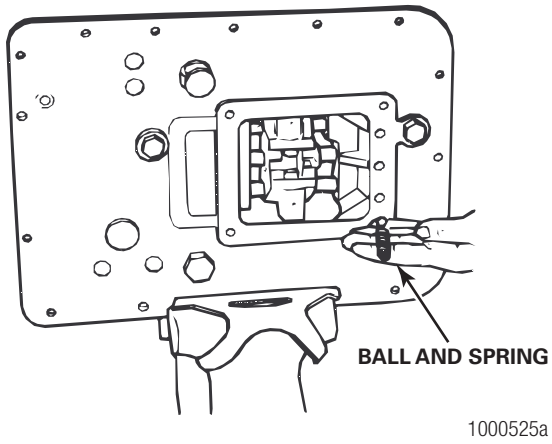
1. Remove the top cover from the transmission case as described in this section. The top cover must be in the neutral position. **Figure 8.15**.

Figure 8.15



2. On forward top covers, remove the capscrews that fasten the spring cover plate, if installed, to the top cover. Remove the plate and the gasket.
3. If installed, remove the three detent springs and balls from the top of the housing.
   - **If a heavy-duty detent spring is used:** The spring, different color, is in the bore on the slave valve side of the transmission. **Figure 8.16**.

Figure 8.16

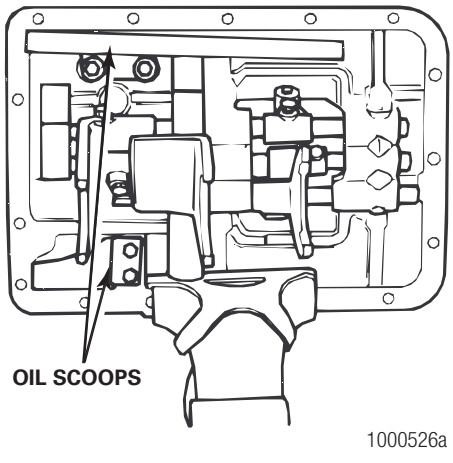


CAUTION

Do not damage the machined surface of the case. If the surface is damaged, the case will leak.

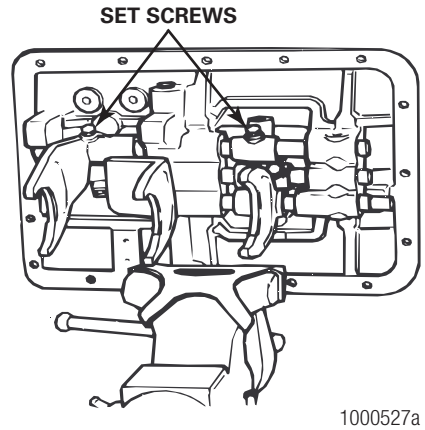
4. Place the top cover on the bench or in a vise with brass protectors on the jaws so that the forks are toward you.
5. Remove the capscrews that fasten the large and the small oil scoops to the cover. **Figure 8.17**.
6. Cut and remove the lock wire on the fork, sleeve and set screw assembly. **Figure 8.17**.

Figure 8.17



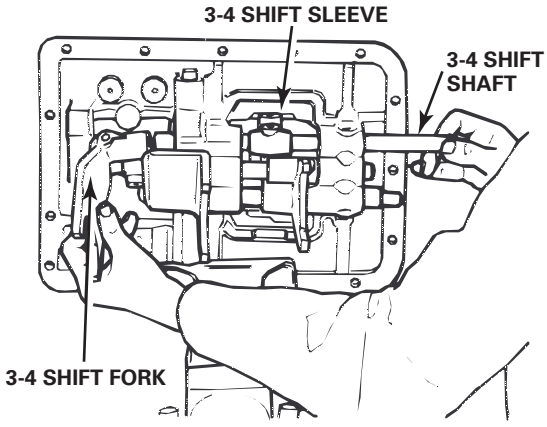
7. Remove the set screws that fasten the shift fork and sleeve assembly to the shift shafts. **Figure 8.18**.

Figure 8.18



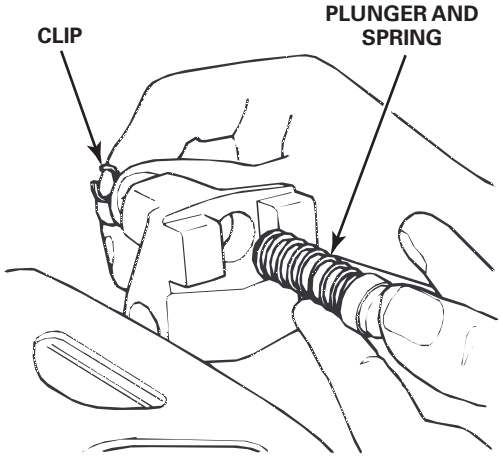
8. Remove the 3-4 shift shaft from the housing. Remove the 3-4 shift sleeve. Remove the 3-4 shift fork. **Figure 8.19**.

Figure 8.19



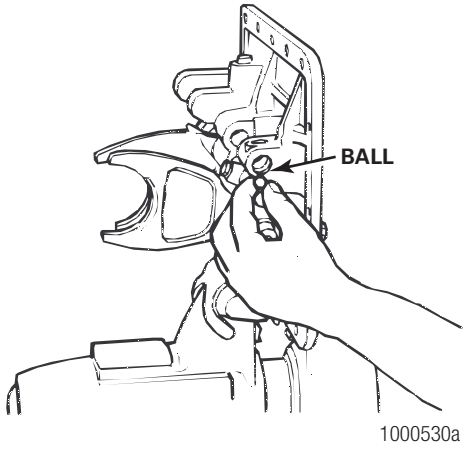
9. If necessary, disassemble the 3-4 shift sleeve. Remove the clip that fastens the 3-4 plunger in the housing. Remove the plunger. **Figure 8.20**.

Figure 8.20



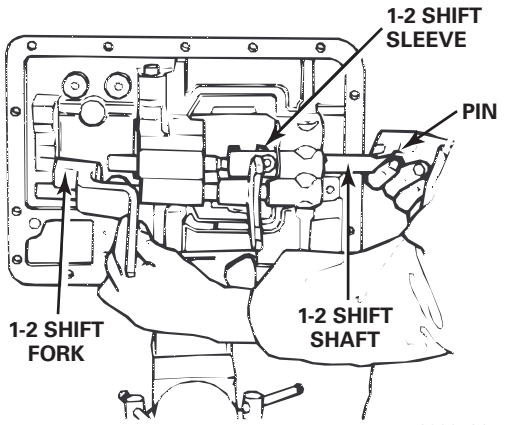
10. Remove the interlock ball from the bottom of the top bore of the first set of bores at the rear of the housing. **Figure 8.21**.

Figure 8.21



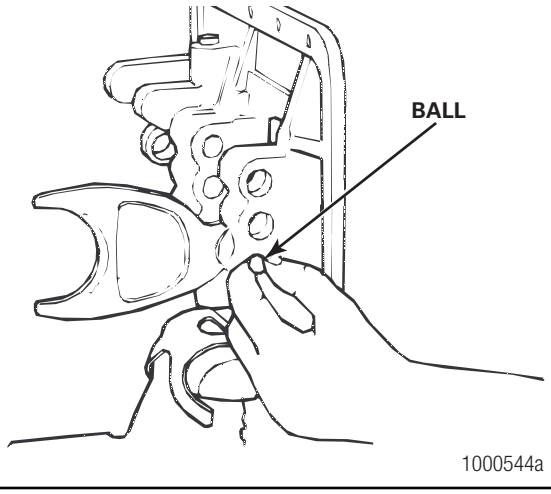
11. Remove the 1-2 shift shaft, the 1-2 shift fork and the 1-2 shift sleeve from the housing. Remove the pin interlock from the end of the 1-2 shift shaft. **Figure 8.22**.

Figure 8.22



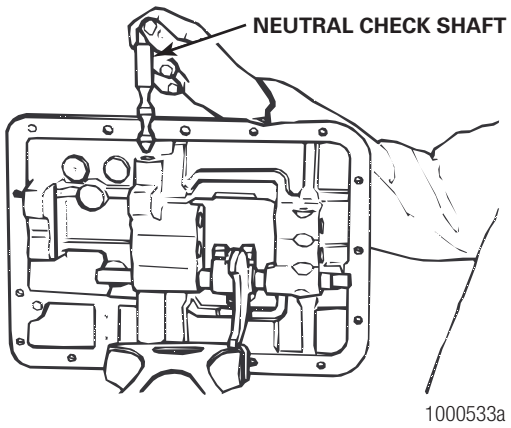
12. Remove the interlock ball from the bottom of the middle bore in the first set of bores in the housing. **Figure 8.23**.

Figure 8.23



13. Remove the neutral check shaft from the top cover. **Figure 8.24.**

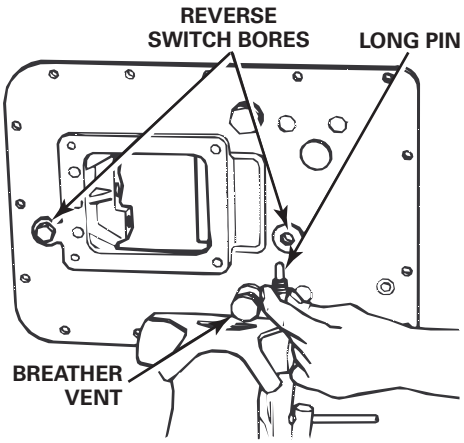
Figure 8.24



NOTE: On standard position top covers, one or two reverse switches may be used. On forward position top covers, one reverse switch is used.

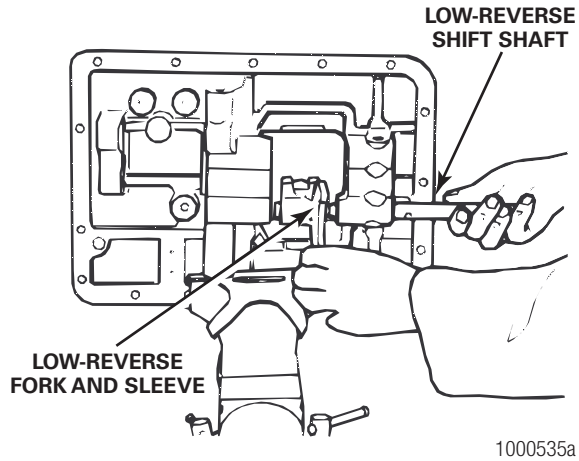
14. Remove the reverse switch(es) or plugs from the top of the housing. Remove the long pin(s) from each bore. **Figure 8.25**.

Figure 8.25



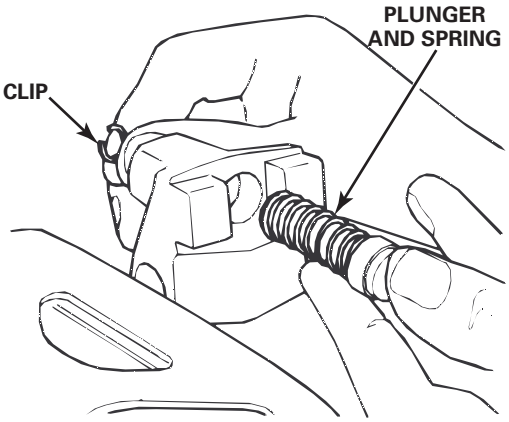
15. Remove the low-reverse shift shaft. Remove the low-reverse shift sleeve and fork assembly. **Figure 8.26**.

Figure 8.26



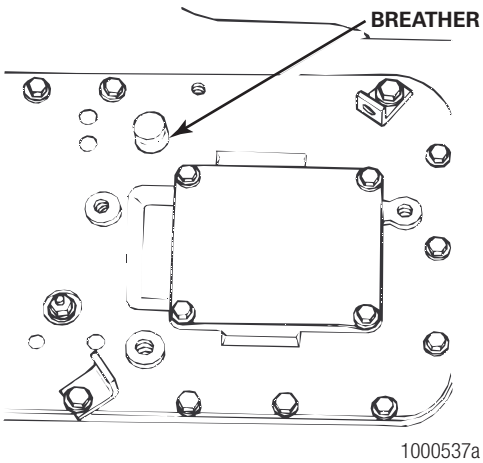
16. If necessary, disassemble the low-reverse sleeve and fork assembly. Remove the clip that fastens the plunger in the housing. Remove the plunger and the spring. Remove the spring and the ball from the bore next to the plunger bore. **Figure 8.27**.

Figure 8.27



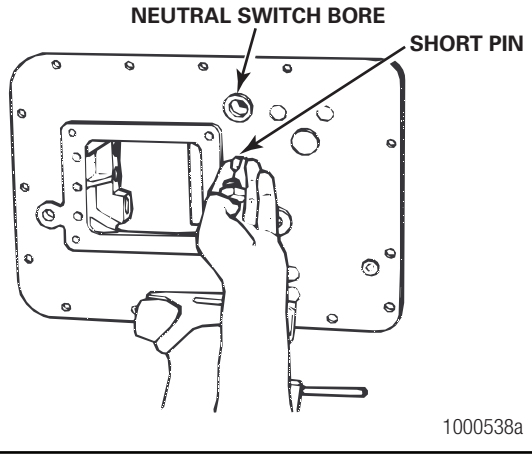
17. If necessary, remove the breather from the top of the cover. **Figure 8.28**.

Figure 8.28



18. Remove the neutral safety switch or plug. Remove the short pin from the bore. **Figure 8.29**.
19. Inspect all parts.

Figure 8.29



Assembling the Standard and Forward Position Top Cover Assembly Standard Pattern Top Cover

Refer to **Figures 8.13 and 8.14**.

⚠ CAUTION

After the set screws with the Loctite® sealant are tightened to the specified torque, do not loosen or tighten them. If loosened or tightened, the set screws must be removed, cleaned and new sealant applied or the set screws may loosen during operation.

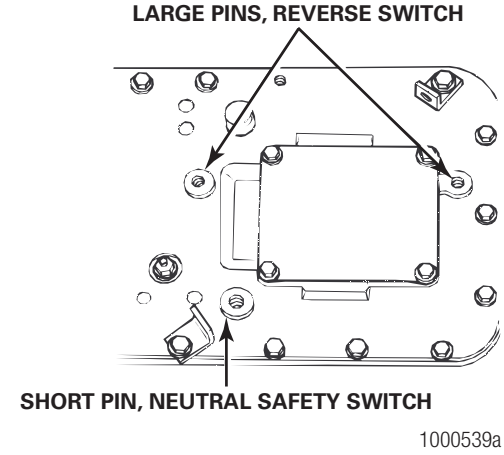
NOTE: The standard position and the forward position top covers use different housing. The forward housing also uses a plate and a gasket installed over the detent balls and springs.

1. Lubricate all the parts of the top cover with the oil that is used in the transmission.
2. Prepare the set screws that fasten the shift sleeves and forks to the shift shafts and the capscrews for the oil scoops.
   A. Clean the threads of the fasteners with Loctite® Safety Solvent 755, Meritor part number 2297-P-6412, or equivalent. Remove all dirt from the threads.

NOTE: Refer to the specifications of the sealant manufacturer for the cure time.

   B. Apply Loctite® 242 Threadlocker, Meritor part number 2297-V-5430, or equivalent to the threads of the fasteners.
3. Install the top cover in a vise with brass jaws. The low-reverse bore holes must be toward the bottom of the vise.
4. Install the short pin in the bore for the neutral safety switch. Install the switch or plug. Tighten to 35-50 lb-ft (48-67 N•m). **Figure 8.30**. T

Figure 8.30

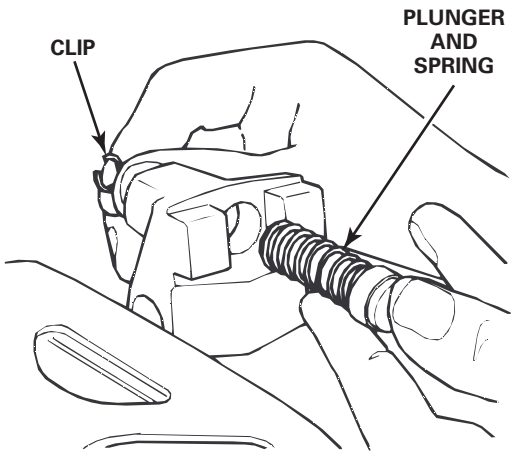


5. Install the breather vent in the top cover. Tighten to 15-20 lb-ft (21-27 N•m). **Figure 8.28**. T

NOTE: On standard position top covers, one or two reverse switches may be used. On forward position top covers, one reverse switch is used.

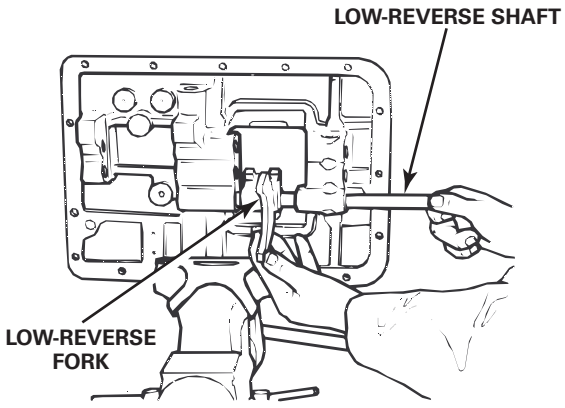
6. Install the larger pin(s) in the bore(s) for the reverse switch. Install the switches or plugs and tighten to 35-50 lb-ft (48-67 N•m). **Figure 8.30**. T
7. If disassembled, install the plunger assembly in the low-reverse shift fork. Refer to the following procedure. **Figure 8.31**.
   A. Place the fork in a vise with brass jaws.
   B. Install the spring and the ball in the bore next to the plunger.
   C. Install the plunger and the spring in the bore of the fork.
   D. Install the snap ring that holds the assembly in the fork.

Figure 8.31



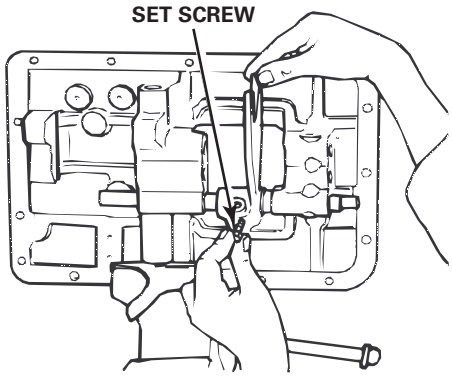
8. Assemble the low-reverse assembly. The low-reverse shaft is the shortest of the three shafts. Refer to the following procedure.
   A. Place the low-reverse shift shaft in the bottom bore of the housing. The boss on the end of the shaft must be toward the rear of the housing. Align the detent grooves in the rail with the detent ball holes in the housing. **Figure 8.32**.

Figure 8.32



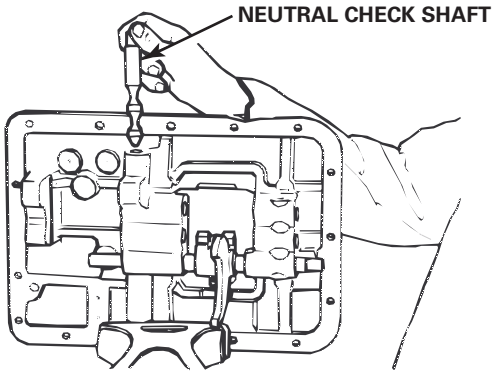
   B. Place the low-reverse shift fork assembly in the top cover so that the plunger of the fork is toward you. Align the bore of the fork and sleeve assembly with the bore in the housing. **Figure 8.32**.
   C. Push the shift shaft through the low-reverse sleeve and fork assembly.
   D. Push the shaft through the assembly until the holes in the fork and shaft are aligned.
   E. Install the set screw with the Loctite® sealant that fastens the fork in position on the shaft. Tighten the set screw to 35-45 lb-ft (47-54 N•m). **Figure 8.33**. T

Figure 8.33



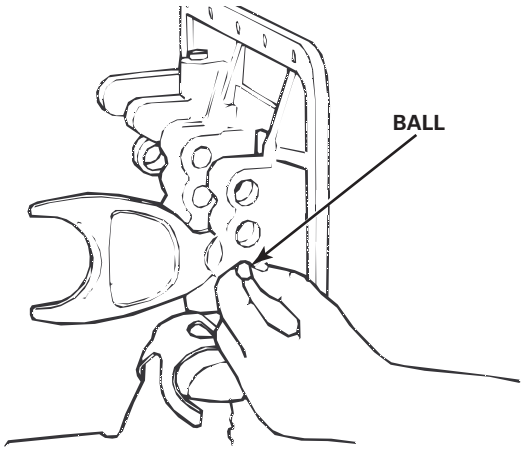
   F. Install the lock wire in the holes in the capscrew and the fork and sleeve assembly. **Figure 8.33**.
9. Install the neutral check shaft in the bore on the top of the housing. Install the round end of the shaft toward the low-reverse shift shaft. The end of the neutral check shaft must touch the slot in the low-reverse shaft. **Figure 8.34**.

Figure 8.34



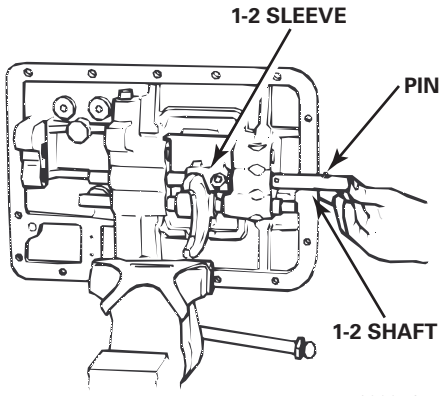
10. Place the large interlock ball in the bottom of the middle bore of the first set of bores on the rear of the housing. **Figure 8.35**.

Figure 8.35



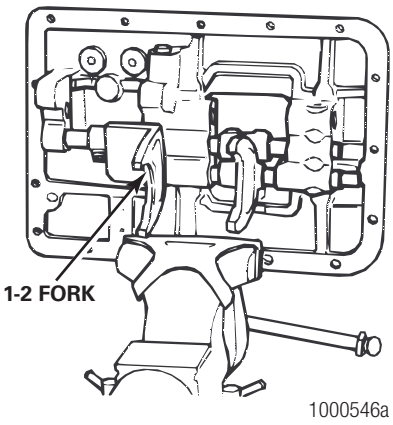
11. Assemble the 1-2 shift rail assembly. The 1-2 shift rail is the same size as the 3-4 shift rail and has a hole drilled through the rail. Refer to the following procedure.
    A. Move the low-reverse shift shaft assembly so that the interlock ball is completely installed in the bore. Move the low-reverse shaft assembly so that the 1-2 rail can be installed.
    B. Place the 1-2 shift shaft in the middle bore of the housing. The identification on the end of the shaft must be toward the front of the housing. Align the detent grooves in the shaft with the detent ball holes in the housing. **Figure 8.36**.

Figure 8.36



    C. Place the interlock pin in the hole drilled in the side of the 1-2 shift shaft. **Figure 8.36**.
    D. Place the 1-2 shift sleeve in the housing. Align the bore of the sleeve with the bore in the housing. The threaded hole in the sleeve must be toward the rear of the housing. **Figure 8.36**.
    E. Push the shift shaft through the 1-2 shift sleeve. **Figure 8.36**.
    F. Place the 1-2 shift fork in the housing. Install the bend on the fork toward the middle set of shift rail bores in the top cover housing. Align the bore of the fork with the bore in the housing. **Figure 8.37**.

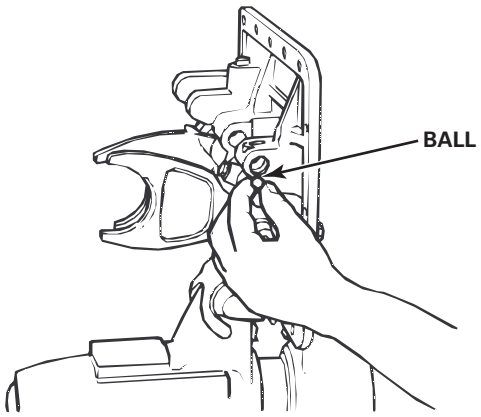
Figure 8.37



    G. Push the shift shaft through the 1-2 fork. **Figure 8.37**.
    H. Push the shaft through the assembly until the holes in the fork and the sleeve are aligned with the holes in the shaft.
    I. Install the set screw with the Loctite® sealant that fastens the fork and the sleeve in position on the shaft. Tighten the set screw to 35-45 lb-ft (47-54 N•m). T
    J. Install the lock wire in the holes in the set screws.

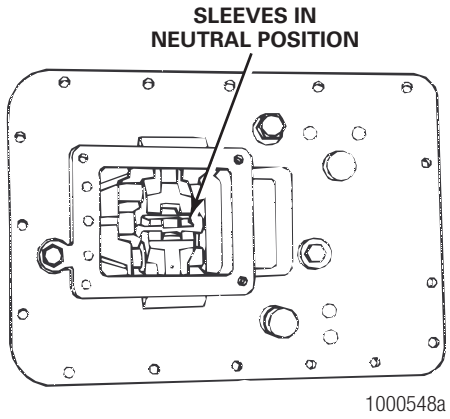
12. Place the interlock ball in the bottom of the top bore of the first set of bores at the rear of the housing. **Figure 8.38**.

Figure 8.38



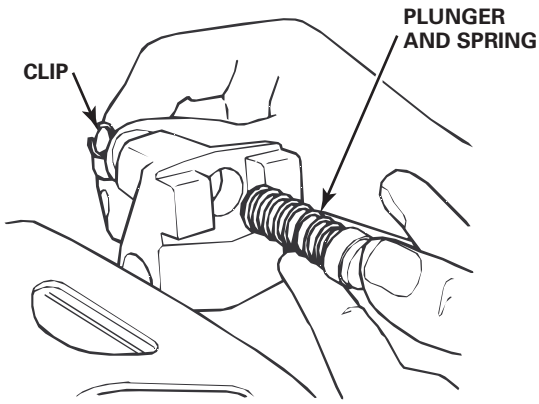
13. The low-reverse sleeve and the 1-2 sleeve must be in the neutral position. The slots in the sleeve must be aligned. **Figure 8.39**.

Figure 8.39



14. If removed, install the plunger assembly in the 3-4 shift sleeve. Place the sleeve in a vise with brass jaws. Install the spring, if used, and the plunger in the sleeve. Install the snap ring that holds the assembly in the fork. **Figure 8.40**.

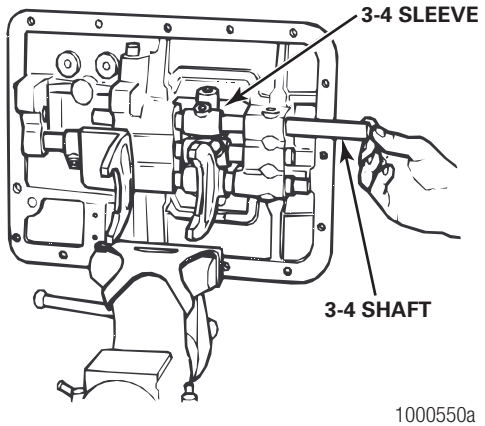
Figure 8.40



NOTE: On R-ratio transmissions, the bill of material refers to the 3-4 shift fork as the Overdrive (O/D) shift fork and the 3-4 shift sleeve as the O/D shift sleeve.

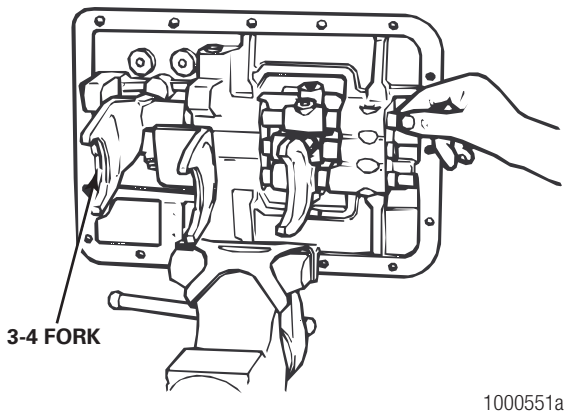
15. Assemble the 3-4 shift rail assembly. The 3-4 shift shaft has a slot on one side. Refer to the following procedure.
    A. Move the 1-2 shift shaft assembly so that the interlock ball is completely installed in the bore. Move the 1-2 shaft assembly so that the 3-4 shaft can be installed.
    B. Place the 3-4 shift shaft in the top bore of the housing. The interlock slot on the end of the rail must be toward the rear of the housing. Align the detent grooves in the shaft with the detent ball holes in the housing. **Figure 8.41**.

Figure 8.41



C. Place the 3-4 shift sleeve in the housing. Align the bore of the fork and sleeve assembly with the bore in the housing. Align the slot pin in the 3-4 sleeve with the hole in the 1-2 sleeve. **Figure 8.42**.

Figure 8.42



D. Push the shift shaft through the 3-4 shift sleeve.

E. Place the 3-4 shift fork in the housing. Install the bend on the fork toward the last set of bores in the housing. Align the bore of the fork with the bore in the housing. **Figure 8.41**.

F. Push the shift shaft through the 3-4 fork.

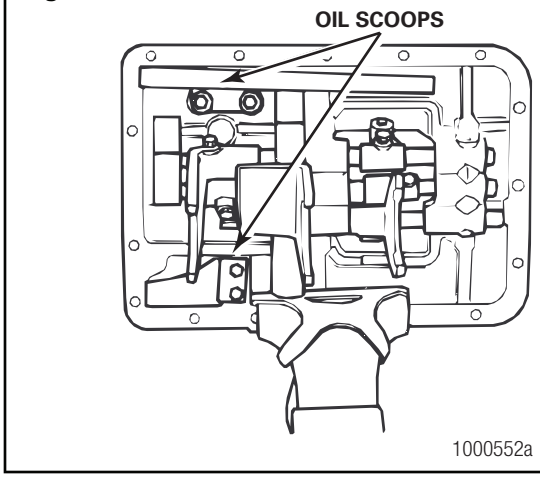
G. Push the shaft through the assembly until the holes in the fork and the sleeve are aligned with the holes in the shaft.

H. Install the set screw with the Loctite® sealant that fastens the 3-4 fork and the sleeve to the rail. Tighten the set screw to 35-45 lb-ft (47-54 N•m).

I. Install the lock wire in the capscrews, the sleeve and the fork.

16. If removed, install the large oil scoop on the housing. Install and tighten the capscrews with the Loctite® sealant to 10-13 lb-ft (13-17 N•m). **Figure 8.43**.

Figure 8.43



17. If removed, install the small scoop on the housing. Install and tighten the capscrews with the Loctite® sealant to 10-13 lb-ft (13-17 N•m). **Figure 8.43**.

Section 8
Overhaul the Top Cover Assembly

Disassembling the Standard and the Forward Position X-Bar Top Cover Assembly

X-Bar Top Cover

Refer to **Figures 8.44 and 8.45**.

Figure 8.44

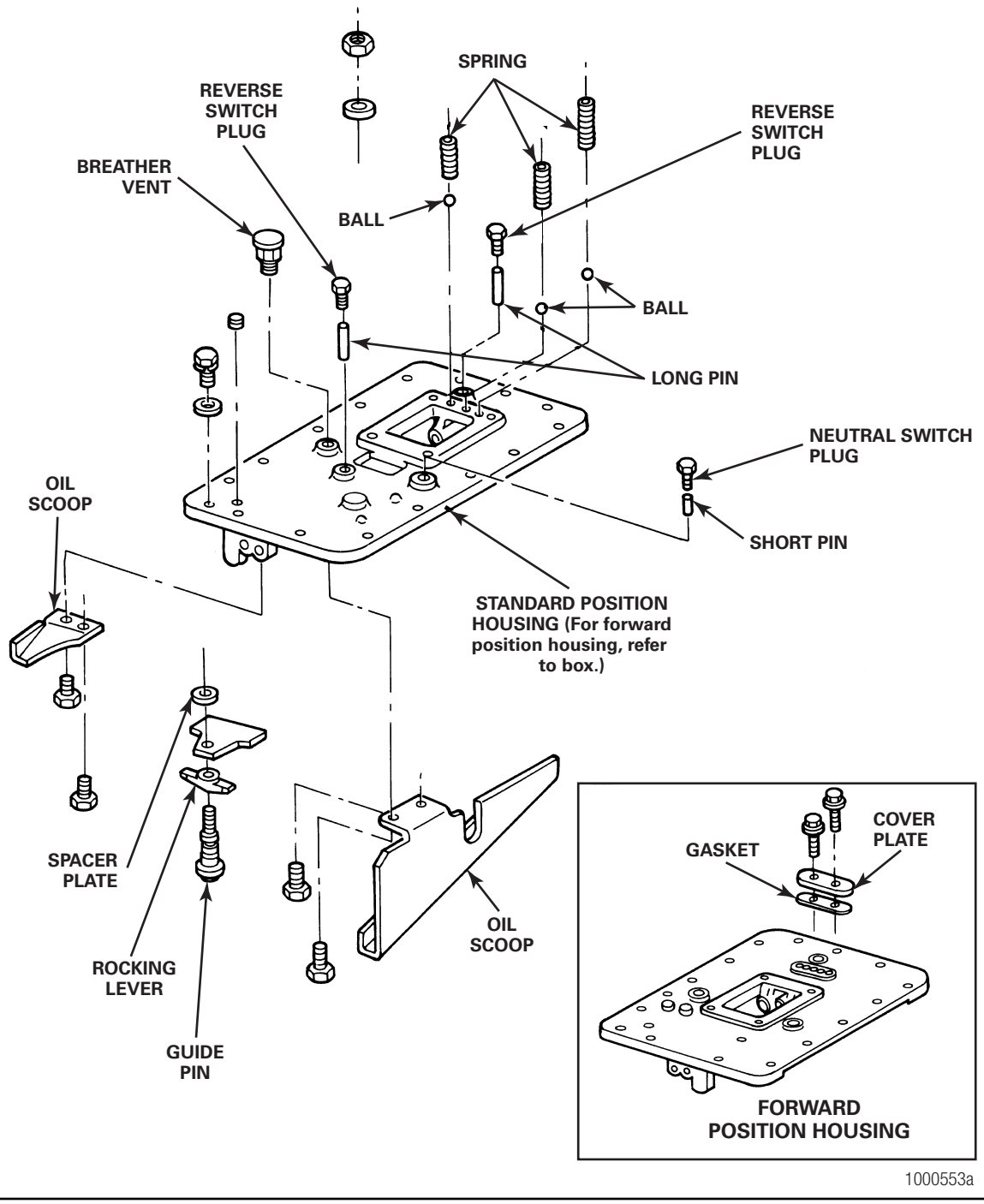
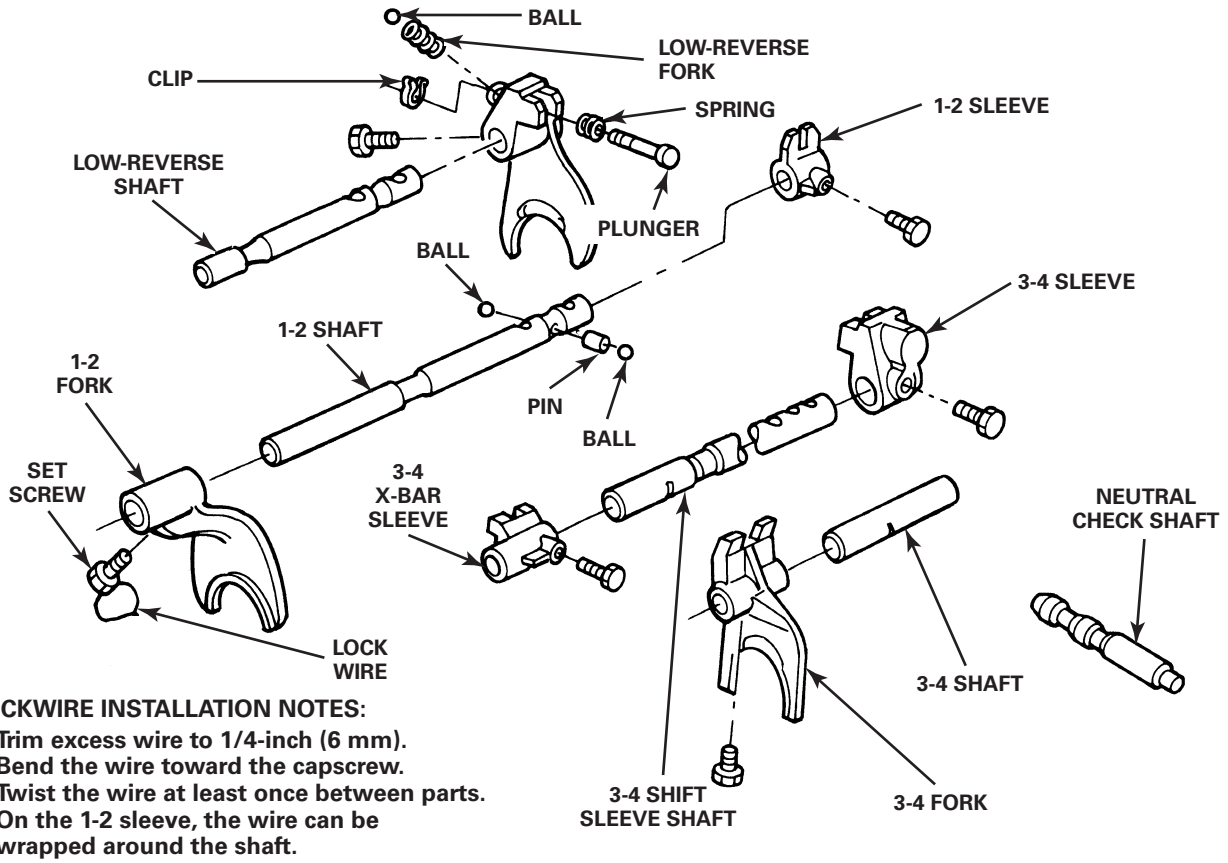


Figure 8.45



LOCKWIRE INSTALLATION NOTES:

1. Trim excess wire to 1/4-inch (6 mm).
2. Bend the wire toward the capscrew.
3. Twist the wire at least once between parts.
4. On the 1-2 sleeve, the wire can be wrapped around the shaft.
5. The wire must not interfere with the movement of the rail.

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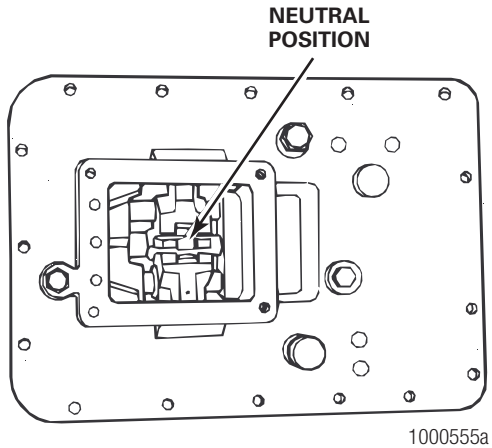
Section 8
Overhaul the Top Cover Assembly

NOTE: The standard position X-bar top cover assembly and the forward position X-bar top cover assembly use different housings. The forward housing also uses a plate and a gasket installed over the detent balls and springs.

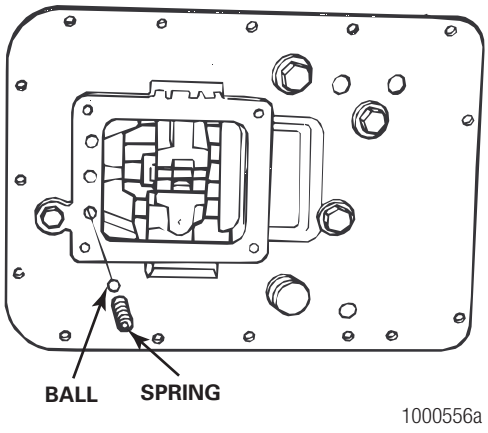
1. Remove the top cover assembly as described in this section. The top cover assembly must be in the neutral position. **Figure 8.46**.

Figure 8.46



2. On forward top covers, remove the capscrews that fasten the detent spring cover plate, if installed, to the top cover assembly. Remove the plate and the gasket.
3. If installed, remove the three detent springs and balls from the top of the housing. **Figure 8.47**.
   - **If a heavy-duty detent spring is used:** The spring, different color, is in the bore on the slave valve side of the transmission.

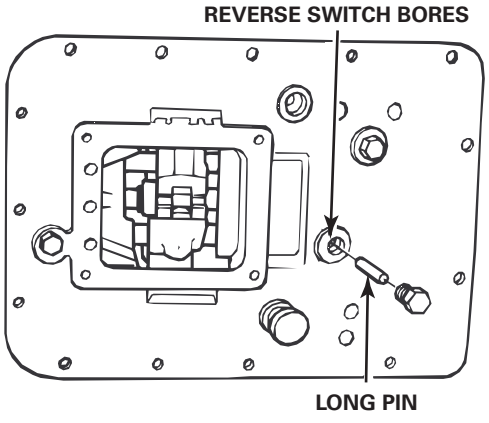
Figure 8.47



NOTE: On standard position top cover assemblies, two reverse switches may be used. On forward position housings, one reverse switch is used.

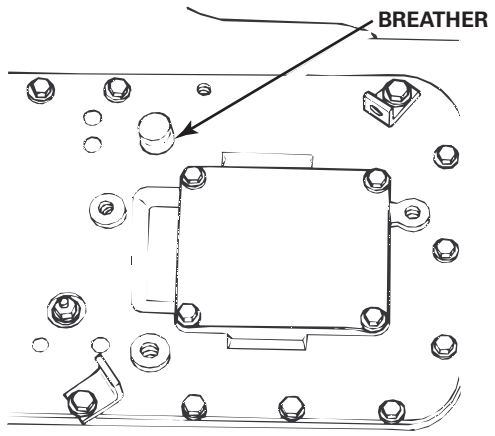
4. Remove the reverse switches or plugs from the housing. Remove the long pins from each bore. **Figure 8.48**.

Figure 8.48



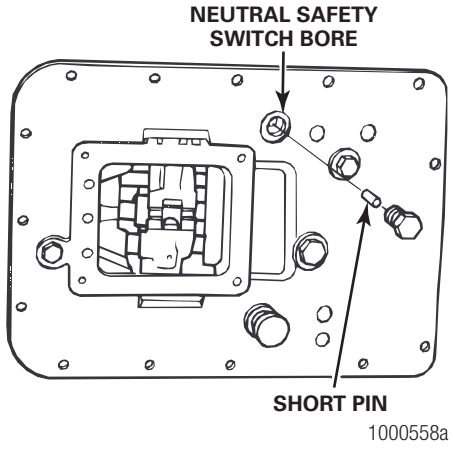
5. If necessary, remove the breather from the top of the cover. **Figure 8.49**.

Figure 8.49



6. Remove the neutral safety switch or plug. Remove the short pin from the bore. **Figure 8.50**.

Figure 8.50

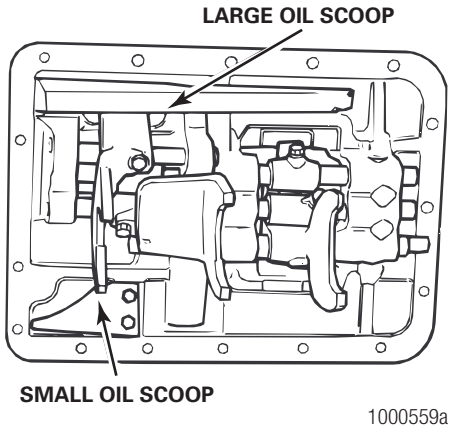


⚠ CAUTION

Do not damage the machined surface of the case. If the surface is damaged, the case will leak.

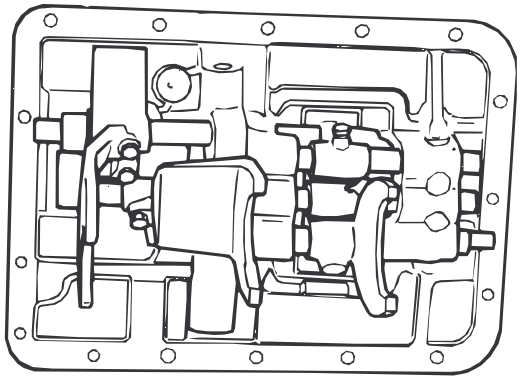
7. Place the top cover assembly on the bench or in a vise with brass protectors on the jaws of the vise so that the forks are toward you.
8. Remove the capscrews that fasten the large and the small oil scoops to the cover. **Figure 8.51**.

Figure 8.51



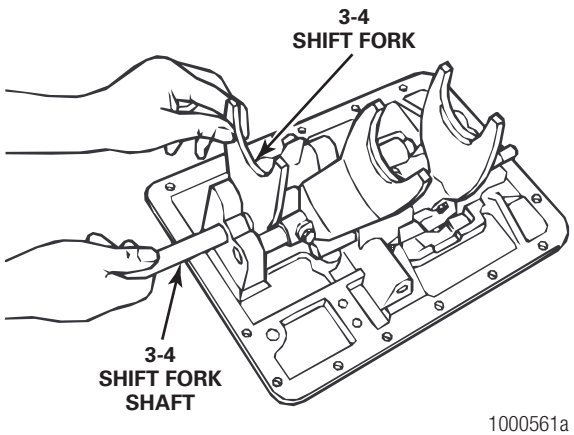
9. Remove the lock wire from the following. **Figure 8.52**.
   - 3rd-4th fork
   - 3rd-4th shift sleeve
   - 1st-2nd shift fork
   - 1st-2nd shift sleeve
   - Low-Reverse shift fork

Figure 8.52



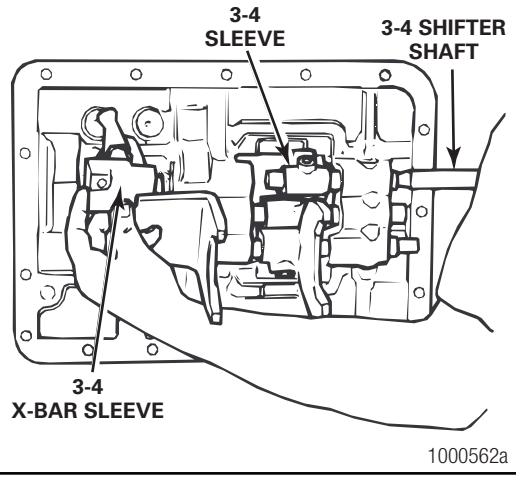
10. Remove the set screw from the 3rd-4th fork and the 3rd-4th shift fork shaft from the housing. Remove the 3rd-4th fork. **Figure 8.53**.

Figure 8.53



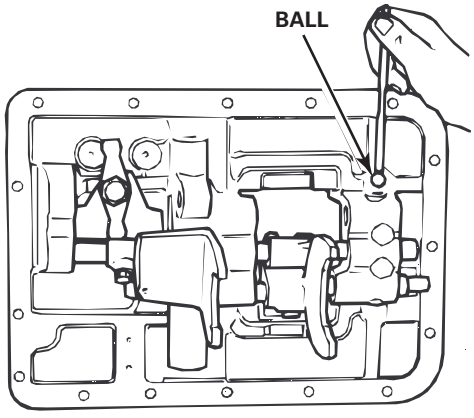
11. Remove the set screw and remove the 3-4 shift sleeve shaft from the housing. Remove the 3-4 X-bar sleeve. **Figure 8.54**.

Figure 8.54



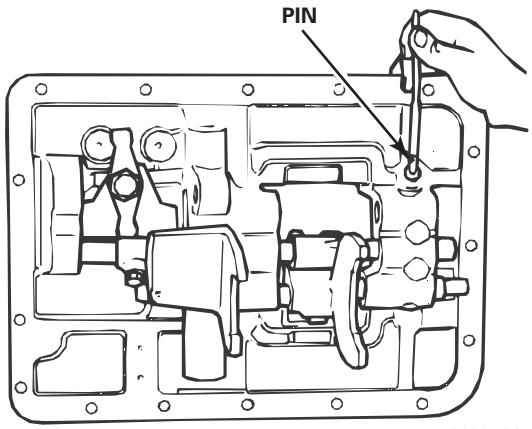
12. Remove the interlock ball from the bottom of the top bore of the first set of bores at the rear of the housing. **Figure 8.55**.

Figure 8.55



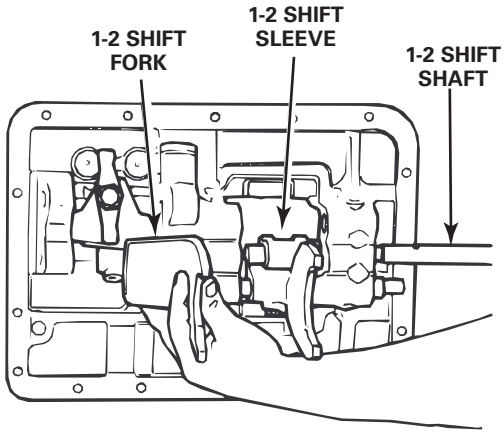
13. Remove the interlock pin from the end of the 1-2 shift shaft. **Figure 8.56**.

Figure 8.56



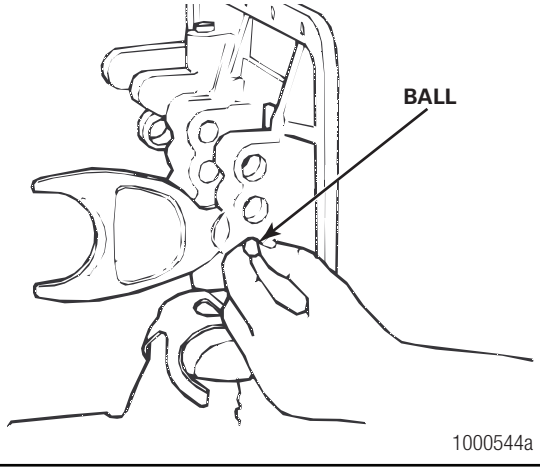
14. Remove the set screws and remove the 1-2 shift shaft, the 1-2 shift fork and the 1-2 shift sleeve from the housing. **Figure 8.57**.

Figure 8.57



15. Remove the interlock ball from the bottom of the middle bore in the first set of bores in the rear of the housing. **Figure 8.58**.

Figure 8.58

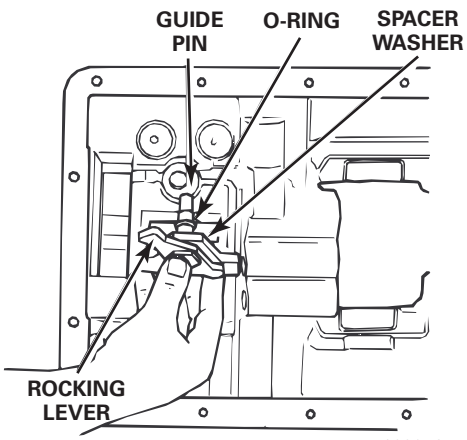


⚠ CAUTION

Remove the O-ring on the guide pin before you remove the rocking lever and the spacer plate to prevent damage to the O-ring.

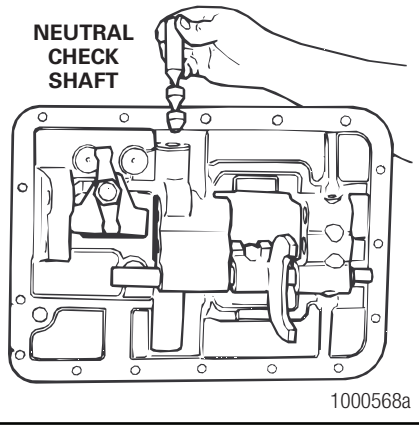
16. Remove the nut and the washer that fasten the guide pin and the rocking lever assembly to the housing. Remove the O-ring from the guide pin. Remove the rocking lever and the spacer plate. **Figure 8.59**.

Figure 8.59



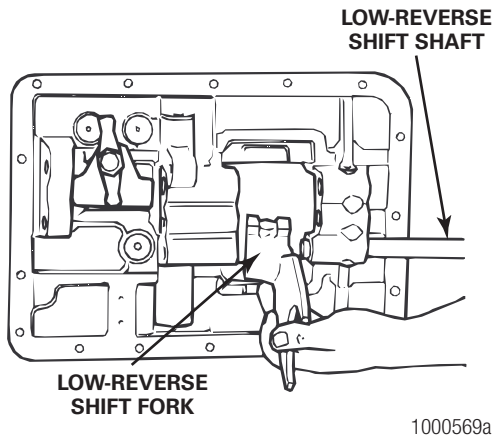
17. Inspect the O-ring on the guide pin. Replace the O-ring if worn or damaged.
18. Remove the neutral check shaft from the top cover assembly. **Figure 8.60**.

Figure 8.60



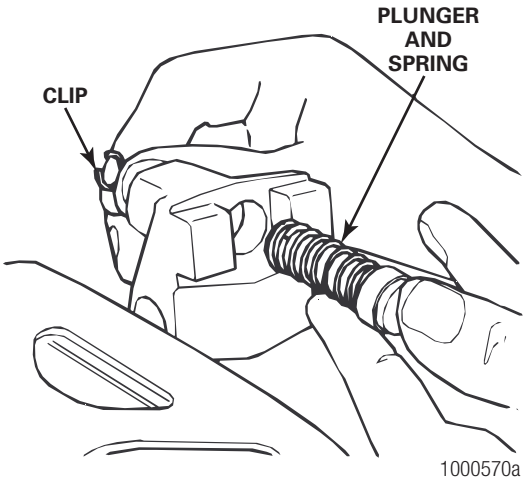
19. Remove set screws and remove the low-reverse shift shaft. Remove the low-reverse shift sleeve and fork assembly. **Figure 8.61**.

Figure 8.61



20. If necessary, disassemble the low-reverse sleeve and fork assembly. Remove the clip that fastens the plunger in the housing. Remove the plunger and the spring. Remove the spring and the ball from the bore next to the plunger bore. **Figure 8.62**.
21. Inspect all parts.

Figure 8.62



Assembling the Standard and the Forward Position X-Bar Top Cover Assembly

X-Bar Top Cover

Refer to **Figures 8.44 and 8.45**.

CAUTION

After the set screws with the Loctite® sealant are tightened to the specified torque, do not loosen or tighten them. If loosened or tightened, the set screws must be removed, cleaned and new sealant applied or the set screws may loosen during operation.

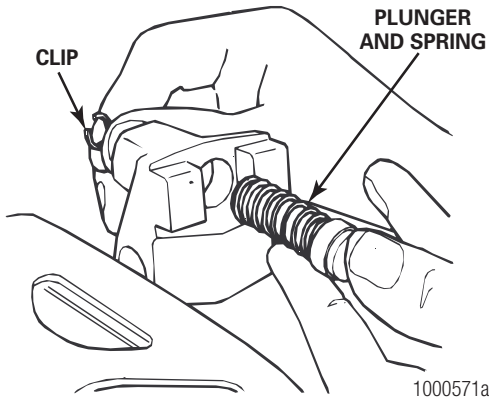
NOTE: The standard position X-bar top cover assembly and the forward position X-bar top cover assembly uses different covers. The forward cover also uses a plate and a gasket installed over the detent balls and springs.

1. Lubricate all the parts of the top cover with the oil that is used in the transmission.
2. Prepare the set screws that fasten the shift sleeves and forks to the shift shafts and the capscrews for the oil scoops.
   A. Clean the threads of the fasteners with Loctite® Safety Solvent 755, Meritor part number 2297-P-6412, or equivalent. Remove all dirt from the threads.

NOTE: Refer to the specifications of the sealant manufacturer for the cure time.

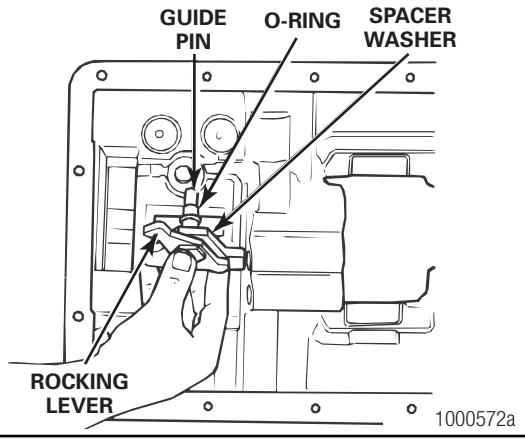
   B. Apply Loctite® 242 Threadlocker, Meritor part number 2297-V-5430, or equivalent to the threads of the fasteners.
3. If disassembled, install the plunger assembly in the low-reverse fork assembly. **Figure 8.63**.
   A. Place the fork in a vise with brass jaws.
   B. Install the ball and the spring in the bore next to the plunger.
   C. Install the plunger and the spring in the bore of the fork.
   D. Install the snap ring that holds the assembly in the fork.

Figure 8.63



4. Assemble and install the rocking lever assembly according to the following procedure. **Figure 8.64**.

Figure 8.64



A. Install the guide pin through the rocking lever.

B. Install the spacer plate on the guide pin.

CAUTION

Install the O-ring on the guide pin after you install the rocking lever and the spacer plate or the O-ring will be damaged.

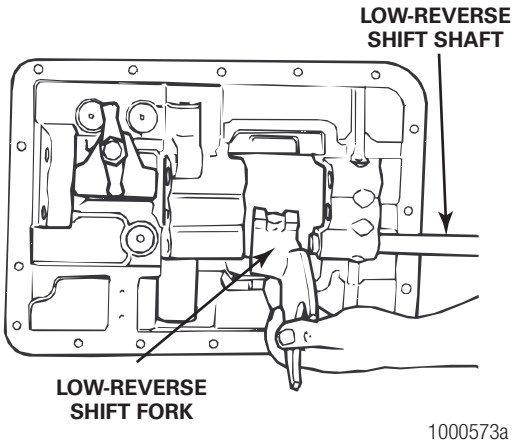
C. Install a new O-ring on the guide pin.

D. Install the assembly so that the long part of the spacer plate is toward the center of the housing.

E. Install a new nut and a new washer that fasten the guide pin to the housing. Tighten to 35-45 lb-ft (47-54 N•m). T

5. Install the low-reverse fork assembly according to the following procedure. **Figure 8.65**.

Figure 8.65



A. Place the low-reverse shift shaft in the bottom bore in the rear of the housing. The two detent grooves must be toward the rear of the housing. Align the detent grooves in the shaft with the detent ball holes in the housing.

B. Place the low-reverse shift fork assembly in the housing so that the lower lever slot is toward the center of the assembly. Align the bore of the fork with the bore in the housing.

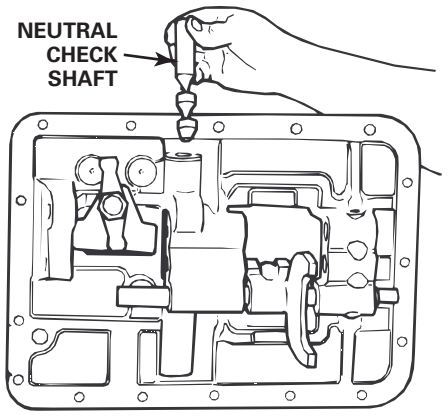
C. Push the shift shaft through the fork and sleeve assembly until the holes in the fork and shaft are aligned.

D. Install the set screw with the Loctite® sealant that fastens the fork in position on the shaft. Tighten the set screw to 35-45 lb-ft (47-54 N•m). T

E. Install the lock wire in the holes in the set screw and the fork assembly.

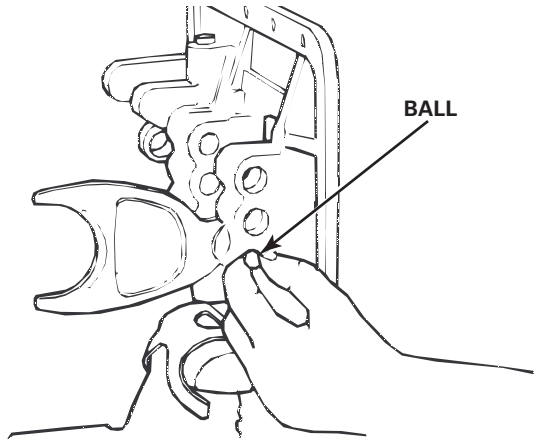
6. Install the neutral check shaft in the bore on the top of the housing. Install the round end of the shaft toward the low-reverse shift rail. The end of the shaft must touch the slot in the rail. **Figure 8.66**.

Figure 8.66



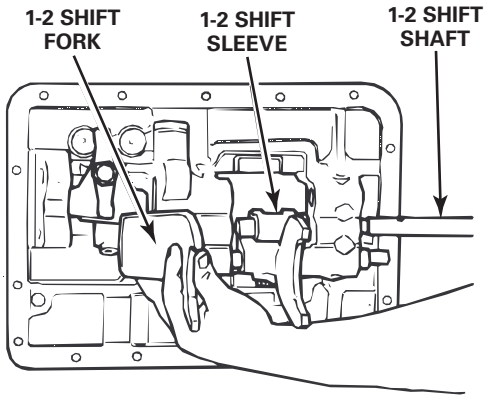
7. Place the large interlock ball in the bottom of the middle bore of the first set of bores on the rear of the housing. **Figure 8.67**.

Figure 8.67



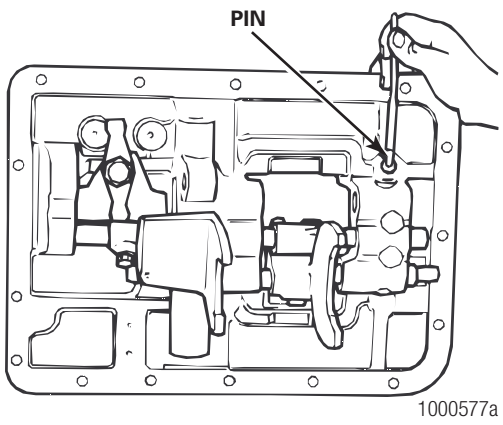
8. Assemble the 1-2 shift shaft assembly. The 1-2 shift shaft is the same size as the 3-4 shift shaft and has a hole drilled through the shaft. Refer to the following procedure.
   A. Move the low-reverse shift shaft assembly so that the interlock ball is completely installed in the bore. Move the low-reverse shaft assembly so that the 1-2 shaft can be installed.
   B. Place the 1-2 shift shaft in the middle bore of the housing. The part identification on the end of the shaft must be toward the front of the housing. Align the detent grooves in the shaft with the detent ball holes. **Figure 8.68**.

Figure 8.68



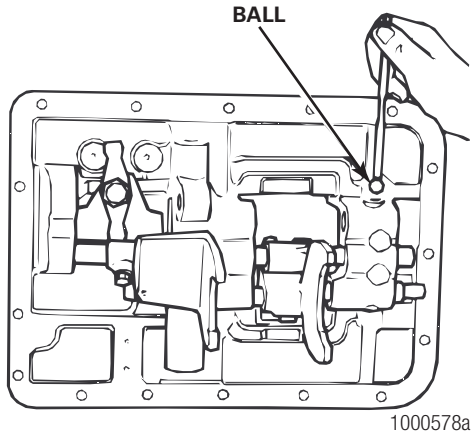
   C. Place the 1-2 shift sleeve in the housing. Align the bore of the sleeve with the bore in the housing. Install the threaded hole in the sleeve must be toward the rear of the housing. **Figure 8.68**.
   D. Push the shift shaft through the 1-2 shift sleeve. **Figure 8.68**.
   E. Place the 1-2 shift fork in the housing. Install the bend on the fork toward the middle set of bores. Align the bore of the fork with the bore in the housing. **Figure 8.68**.
   F. Push the shift shaft through the 1-2 fork. **Figure 8.68**.
   G. Push the rail through the assembly until the holes in the fork and the sleeve are aligned with the holes in the shaft.
   H. Install the set screws with the Loctite® sealant that fastens the 1-2 fork and the sleeve to the rail. Tighten the set screws to 35-45 lb-ft (47-54 N•m).
   I. Install the lock wire in the holes in the set screws and the fork and the sleeve. Wrap the lock wire around the barrel of the shaft.
   J. Place the interlock pin in the hole drilled in the end of the 1-2 shift shaft. **Figure 8.69**.

Figure 8.69



9. Place the interlock ball in the bottom of the top bore of the first set of bores at the rear of the housing. **Figure 8.70**.

Figure 8.70



10. The low-reverse sleeve and the 1-2 sleeve must be in the NEUTRAL position. The slots in the sleeve must be aligned.

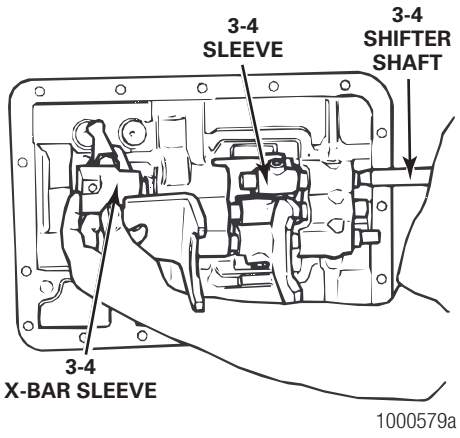
NOTE: On R-ratio transmissions, the bill of material refers to the 3-4 shift fork as the Overdrive (O/D) shift fork and the 3-4 X-bar sleeve as the O/D shift sleeve.

11. Assemble the 3-4 shift sleeve and shaft assembly. The 3-4 shift sleeve shaft has a slot on one side. Refer to the following procedure.

A. Move the 1-2 shift shaft assembly so that the interlock ball is completely installed in the bore. Move the 1-2 shaft assembly so that the 3-4 shift sleeve shaft can be installed.

B. Place the 3-4 shift sleeve shaft in the top bore of the housing. The interlock slot on the end of the shaft must be toward the rear of the housing. Align the detent grooves in the shaft with the detent ball holes in the housing. **Figure 8.71**.

Figure 8.71



C. Place the 3-4 shift sleeve in the housing. Align the bore of the sleeve with the bore in the housing. Align the slot in the 3-4 shift sleeve with the slot in the 1-2 sleeve. **Figure 8.71**.

D. Push the shift shaft through the 3-4 shift sleeve.

E. Place the 3-4 X-bar sleeve in the housing. Align the slot in the sleeve over the rocking lever assembly. Align the bore of the sleeve with the bore in the housing. **Figure 8.71**.

F. Push the shift shaft through the 3-4 X-bar sleeve.

G. Push the shaft through the assembly until the holes in the sleeves are aligned with the holes in the shaft.

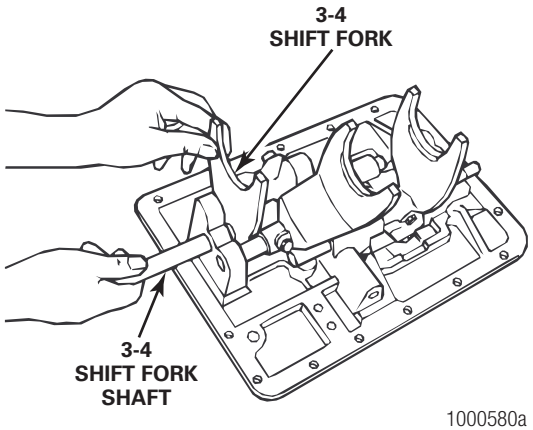
H. Install the set screws with the Loctite® sealant that fastens the sleeves to the shaft. Tighten the set screws to 35-45 lb-ft (47-54 N•m). T

I. Install the lock wire in the holes in the sleeves and the set screws.

NOTE: On R-ratio transmissions, the bill of material refers to the 3-4 shift fork as the Overdrive (O/D) shift fork and the 3-4 X-bar sleeve as the O/D shift sleeve.

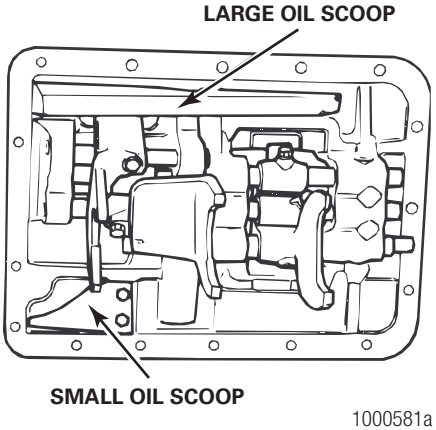
12. Install the 3-4 fork and 3-4 shift fork shaft according to the following procedure.
    A. Place the 3-4 shift fork shaft in the top bore at the front of the housing. **Figure 8.72**.

Figure 8.72



    B. Place the 3-4 shift fork in the housing. Align the slot on the fork with the rocking lever assembly. Align the bore of the fork and sleeve assembly with the bore in the housing. **Figure 8.72**.
    C. Push the shift shaft through the 3-4 fork.
    D. Install the set screw with the Loctite® sealant that fastens the 3-4 fork to the shaft. Tighten the set screw to 35-45 lb-ft (47-54 N•m). T
    E. Install the lock wire in the holes in the set screws and the fork.
13. If removed, install the large and small oil scoops on the housing. Install and tighten the capscrews with the Loctite® sealant to 10-13 lb-ft (14-17 N•m). **Figure 8.73**. T

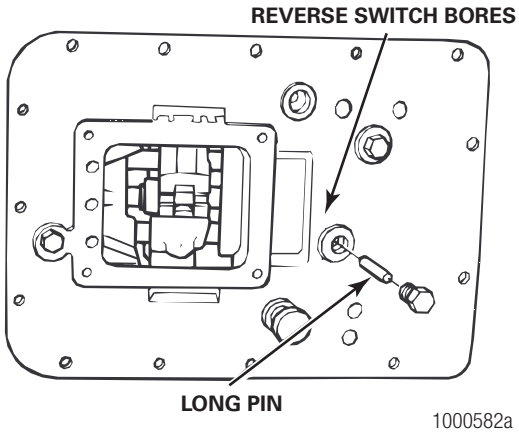
Figure 8.73



NOTE: On standard position top covers assemblies, one or two reverse switches may be used. On forward position top covers, one reverse switch is used.

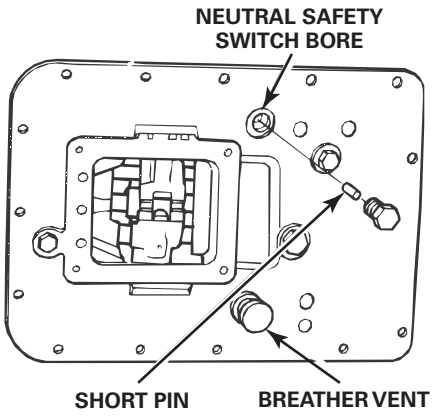
14. Install the larger pin(s) in the bore(s) for the reverse lamp switch. Install the switches or plugs and tighten to 35-50 lb-ft (48-67 N•m). **Figure 8.74**. T

Figure 8.74



15. Install the short pin in the bore for the neutral safety switch. Install the switch or plug and tighten to 35-50 lb-ft (48-67 N•m). **Figure 8.75**. T
16. Install the breather vent in the top cover. Tighten to 15-20 lb-ft (21-27 N•m). **Figure 8.75**. T

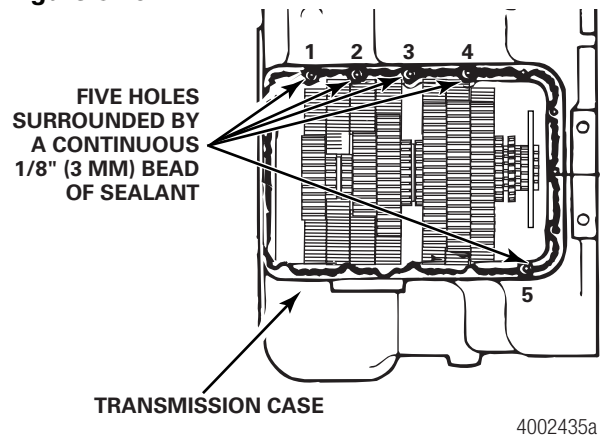
Figure 8.75



Top Cover Installation

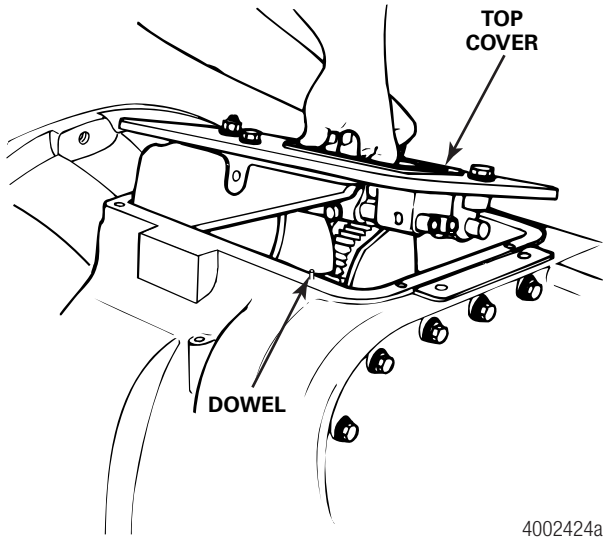
1. Apply Loctite® Ultra Grey Adhesive/Sealant 18581, Meritor part number 2297-A-7021, onto the transmission case assembly. **Figure 8.76**.

Figure 8.76



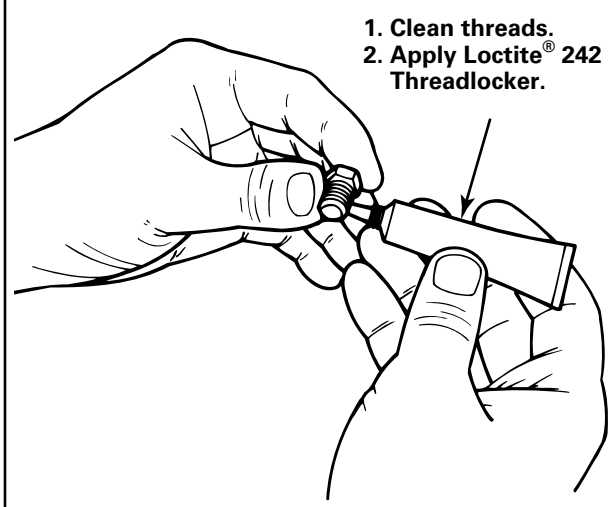
2. Place the top cover shift shafts in the neutral position. Place the shift collars in the neutral position. Install the top cover and align and engage the forks with the sliding clutch collars. **Figure 8.77**.

Figure 8.77



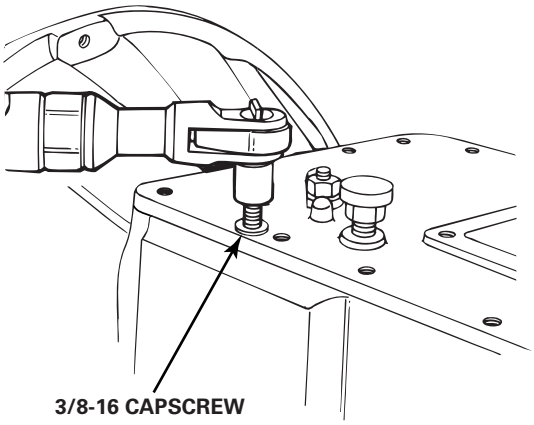
3. Clean mounting capscrew threads. Apply Loctite® 242Threadlocker, Meritor part number 2297-V-2430, or equivalent to the threads. **Figure 8.78**.

Figure 8.78



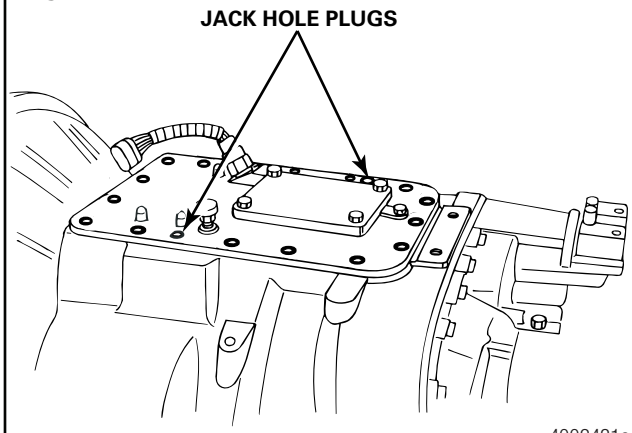
4. Install the sixteen 3/8-16 mounting capscrews and washers for the top cover housing. Use a torque wrench to tighten the capscrews to 25-35 lb-ft (34-47 N•m). **Figure 8.79**. T

Figure 8.79



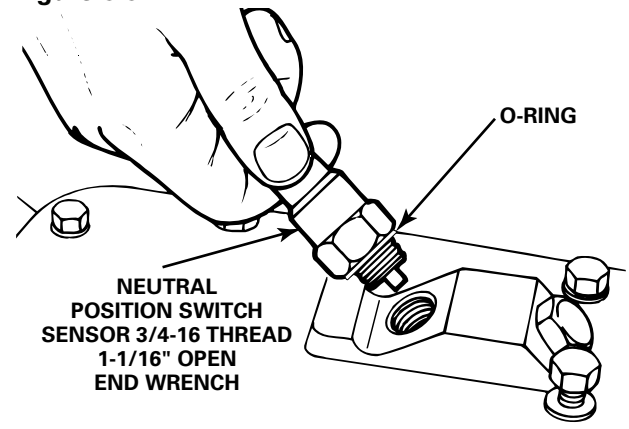
5. Install the jack hole plugs. **Figure 8.80**.

Figure 8.80



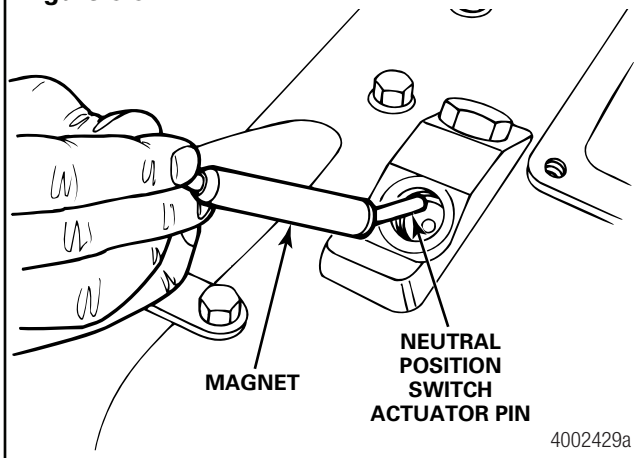
6. Install the neutral position switch sensor. Use a torque wrench to tighten the sensor to 150-210 lb-in (17-24 N•m). **Figure 8.81**.

Figure 8.81



7. Install the neutral position switch sensor actuator pin into the bore in the top cover housing. **Figure 8.82**.

Figure 8.82



8. Install a detent ball in each of the three holes in the top cover. Install a spring on top of each detent ball in the holes in the top cover. Replace the detent springs as a set. Use the yellow spring, Meritor part number 2258-D-1278, in all the holes. **Figure 8.82**.
   - **If a heavy-duty detent spring is used:** Install the spring, different color, in the bore on the slave valve side of the transmission.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

Solvent cleaners can be flammable, poisonous and cause burns. Examples of solvent cleaners are carbon tetrachloride, and emulsion-type and petroleum-base cleaners. Read the manufacturer's instructions before using a solvent cleaner, then carefully follow the instructions. Also follow the procedures below.

- **Wear safe eye protection.**
- **Wear clothing that protects your skin.**
- **Work in a well-ventilated area.**
- **Do not use gasoline, or solvents that contain gasoline. Gasoline can explode.**
- **You must use hot solution tanks or alkaline solutions correctly. Read the manufacturer's instructions before using hot solution tanks and alkaline solutions. Then carefully follow the instructions.**

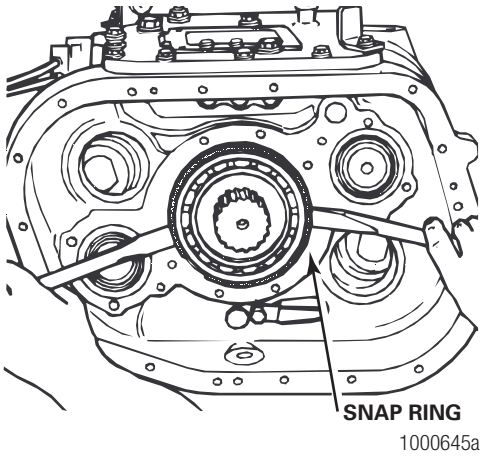
CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

Disassembly

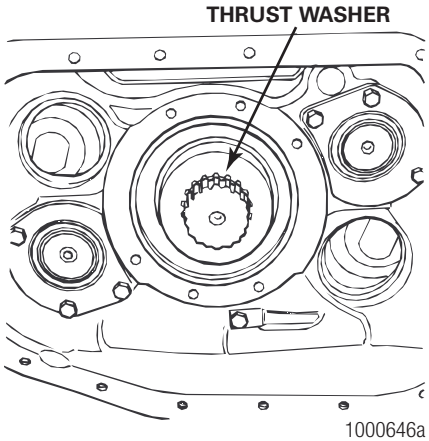
1. Place a pry bar under the snap ring on the ball bearing assembly (auxiliary drive gear). Remove the bearing. **Figure 9.1**.

Figure 9.1



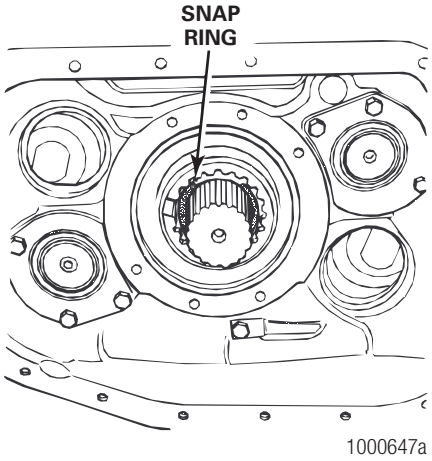
2. Remove the auxiliary drive gear thrust washer from the mainshaft. **Figure 9.2**.

Figure 9.2



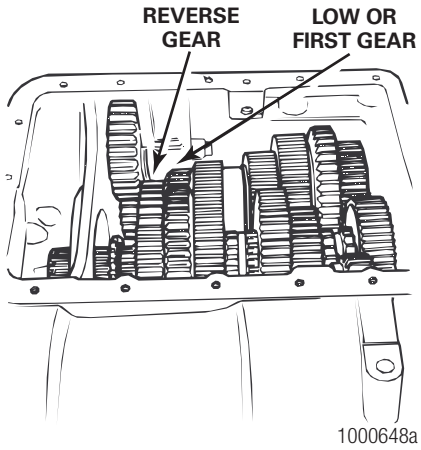
3. Remove the snap ring from the reverse gear on the mainshaft. **Figure 9.3**.

Figure 9.3



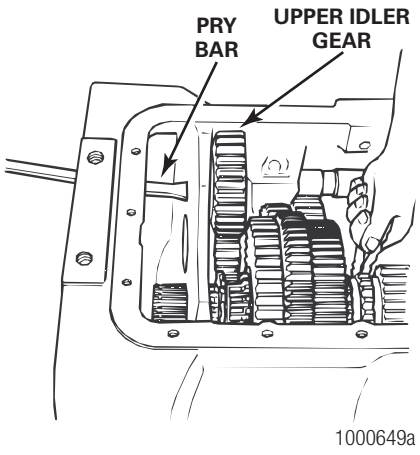
4. Slide the clutch collar into low or first gear. Move reverse gear against low or first gear. **Figure 9.4**.

Figure 9.4



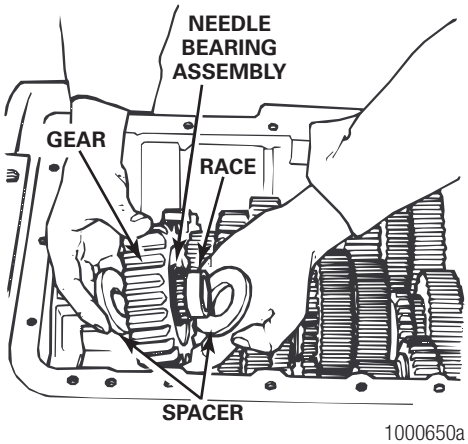
5. Place a pry bar between the case and the end of the idler shaft to prevent the upper countershaft's reverse idler shaft from moving. **Figure 9.5**.

Figure 9.5



6. Remove the nut and washer that secures the gear onto the shaft.
7. Remove the upper reverse idler shaft from the rear of the case. Remove the reverse idler gear, two spacer washers, bearing race and needle bearing assembly. **Figure 9.6**.

Figure 9.6



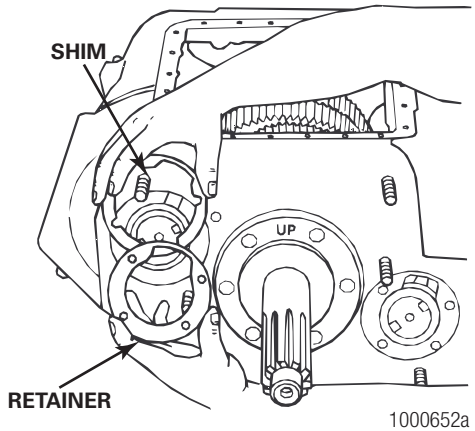
CAUTION

Support the mainshaft when you service the countershaft to ensure that timing marks remain aligned and thrust washers are not damaged by the weight of the mainshaft.

8. Install the auxiliary drive gear and bearing assembly so that the mainshaft is supported in the case.

9. Remove the Allen-head screws that secure the front upper countershaft retainer to the case. Remove the retainer and shims. **Figure 9.7**.

Figure 9.7

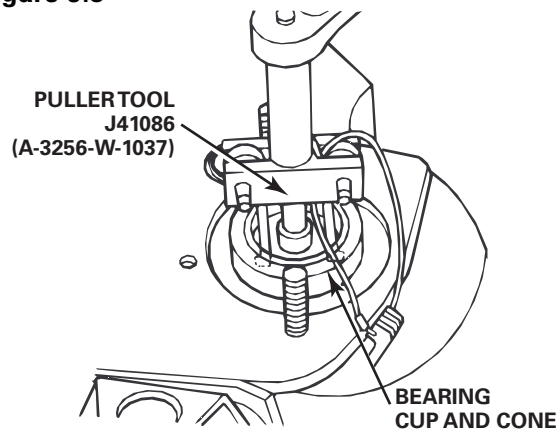


CAUTION

Use hand tools to rotate the bearing puller tool's forcing screw. Do not use power tools. Damage to components can result.

10. Remove the front upper countershaft bearing cup and cone. Use a bearing puller tool, Meritor part number 3256-W-1037, or equivalent. Ensure that you install the correct tool keys between the puller jaws and countershaft. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual. **Figure 9.8**.
    - **If you can easily remove the cup:** The cup is a loose fit cup. Discard it and replace it with a press fit cup and cone assembly. Check that you are using the correct parts.

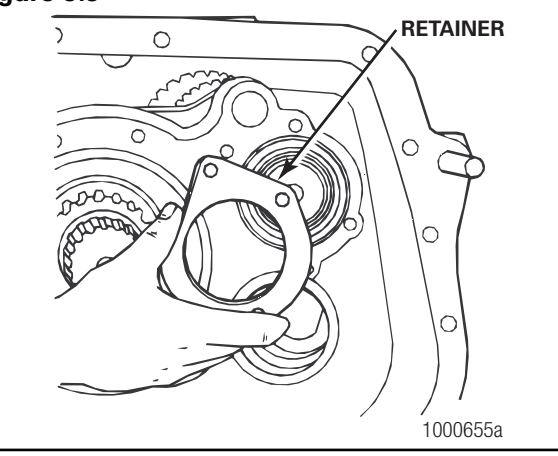
Figure 9.8



NOTE: Two types of rear countershaft bearing retainers are used on Platform "G" transmissions according to a transmission's serial number — LB93017865 and below; and LB93017866 and above. Verify that you are using the correct retainer.

11. Remove the rear upper countershaft retainer fasteners. Remove the retainer. **Figure 9.9**.

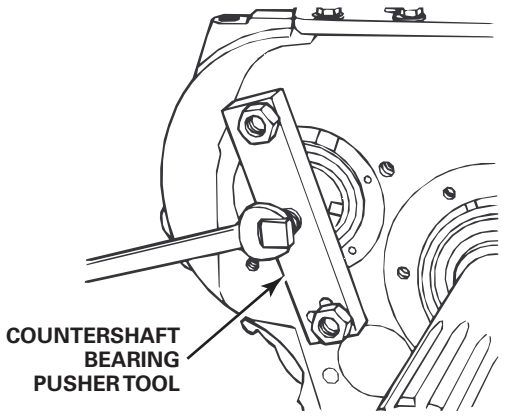
Figure 9.9



12. Install countershaft bearing pusher tool, Meritor part number 3256-D-1044 or G&W tool number G-28, or equivalent onto the front of the countershaft. To obtain these tools, refer to the Service Notes page on the front inside cover of this manual.

13. Rotate the forcing screw until you can remove the rear countershaft bearing from the main case. Ensure that the countershaft does not push against the mainshaft. **Figure 9.10**.
    - **If you can easily remove the cup:** The cup is a loose fit cup. Discard it and replace it with a press fit cup and cone assembly. Check that you are using the correct parts.

Figure 9.10



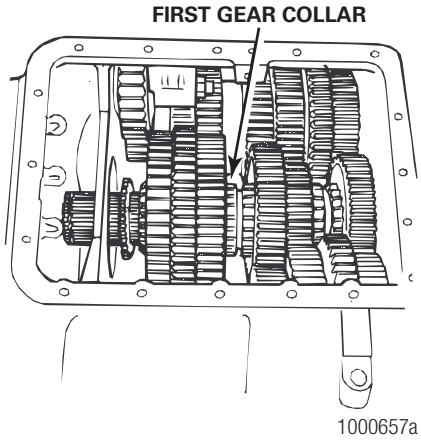
14. Move the upper countershaft assembly FORWARD and to the side of the case. Ensure that the countershaft is separated from the mainshaft assembly.
15. Remove the auxiliary drive gear from the mainshaft.
16. Use the following procedure to remove the mainshaft.

WARNING

The mainshaft assembly weighs more than 50 pounds. Use a rope or a lifting device to install the mainshaft into the case to prevent serious personal injury and damage to components.

17. Ensure that Reverse gear is against the Low gear.
18. Place a rope or a lifting hook under the first-second gear collar. Slide the mainshaft assembly to the REAR of the case. **Figure 9.11**.

Figure 9.11



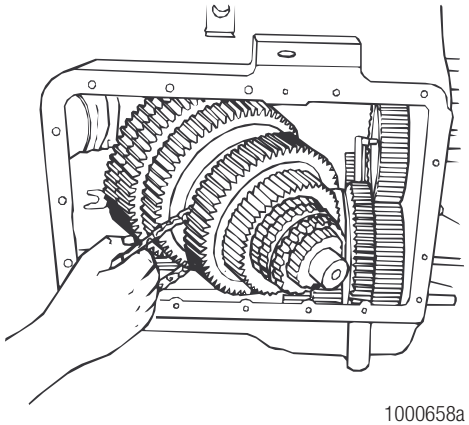
WARNING

Secure Reverse gear when you remove the mainshaft assembly from the main case to prevent the gear from falling from the mainshaft. Serious personal injury and damage to components can result.

19. Tilt the front of the mainshaft UP. Secure Reverse gear and lift the mainshaft assembly from the case. **Figure 9.12**.

    Refer to Inspect Parts in this section.

Figure 9.12

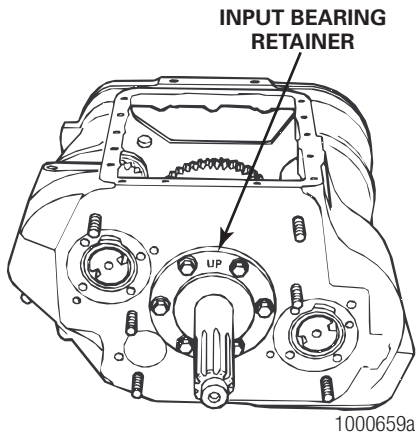


Remove the Input Shaft

NOTE: You must remove the top cover, mainshaft and auxiliary drive gear before you remove the input shaft.

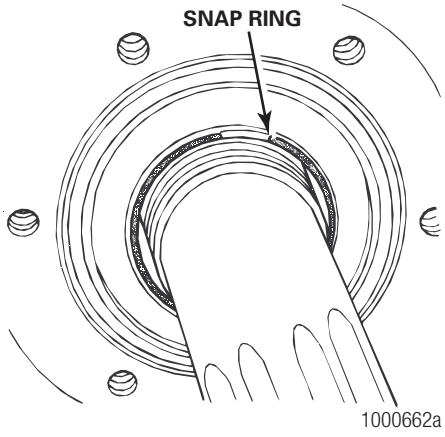
1. Remove the mounting capscrews and washers from the input bearing retainer. Remove the retainer. **Figure 9.13**.

Figure 9.13



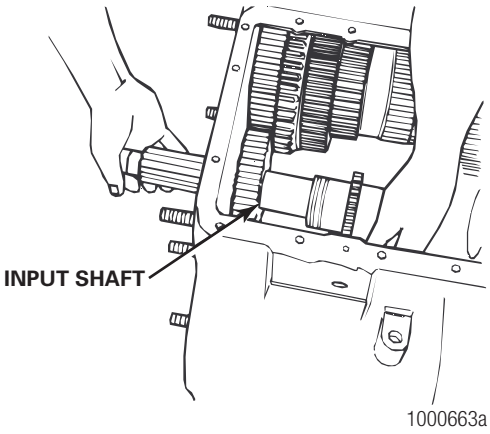
2. Use a scraper to remove sealant material from the main case and the input bearing retainer.
3. Remove the input shaft.
4. Remove the snap ring that secures the input shaft in the bearing. **Figure 9.14**.

Figure 9.14



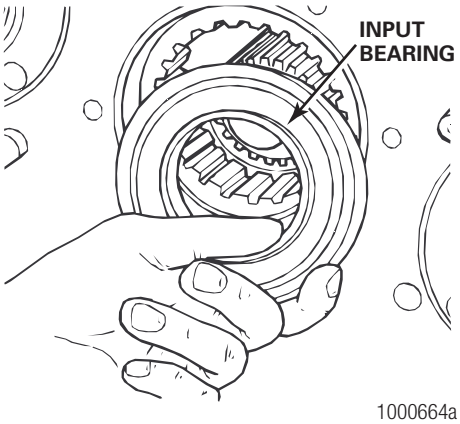
5. Remove the input shaft from the main case. If necessary, use a rubber mallet to drive the input shaft from the main case. **Figure 9.15**.

Figure 9.15



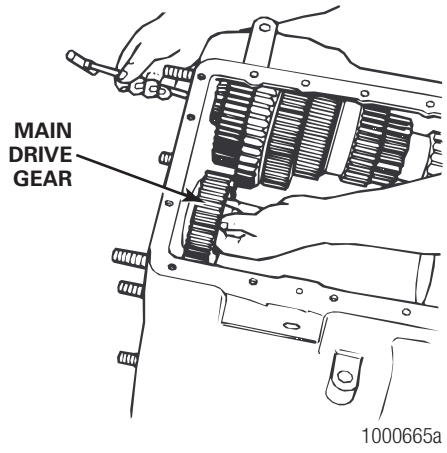
6. Remove the input bearing from the main case. If necessary, remove the snap ring from the bearing. **Figure 9.16**.

Figure 9.16



7. Remove the main drive gear and spacer from the main case. **Figure 9.17**.

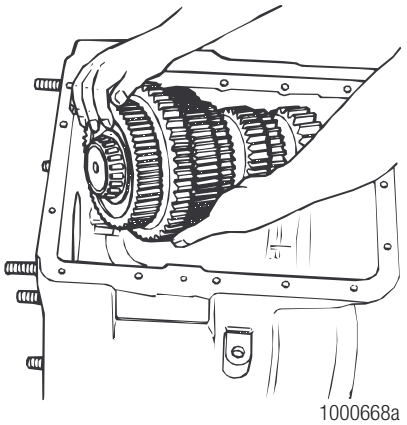
Figure 9.17



Remove the Main Countershafts

1. Remove the auxiliary drive gear and mainshaft. Remove the input shaft and main drive. Refer to the procedures in this section.
2. If installed, remove the long capscrews or the T-handle tools, Meritor part number 3256-Y-1013, from the countershaft assemblies. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual.
3. Push the countershaft assemblies to the REAR of the case. Tilt the FRONT of the countershaft UP and remove the countershaft.
4. Remove the UPPER and LOWER countershafts from the main case. Mark the countershafts to reinstall them correctly. **Figure 9.18**.

Figure 9.18



Remove the Reverse Idler Gear Assembly

1. Remove the UPPER reverse idler gear assembly and the mainshaft. Remove the input shaft. Refer to the procedures in this section.
2. Remove the main countershafts. Refer to the procedures in this section.
3. Place a pry bar between the main case and the end of the idler shaft to prevent the LOWER reverse idler shaft from moving.
4. Remove the nut and washer that fasten the gear onto the shaft. **Figure 9.19**.
5. Remove the reverse idler gear, two spacer washers, bearing race, and bearing needle assembly. **Figure 9.20**.

Figure 9.19

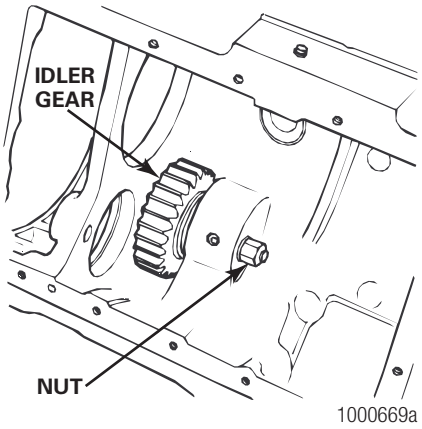
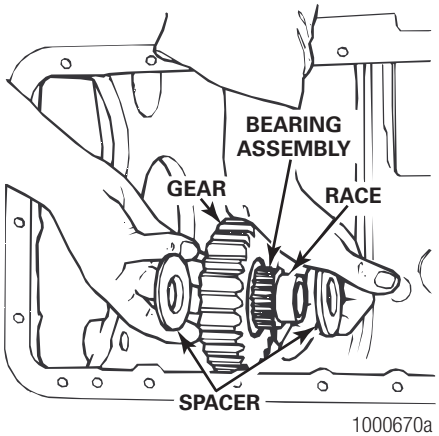


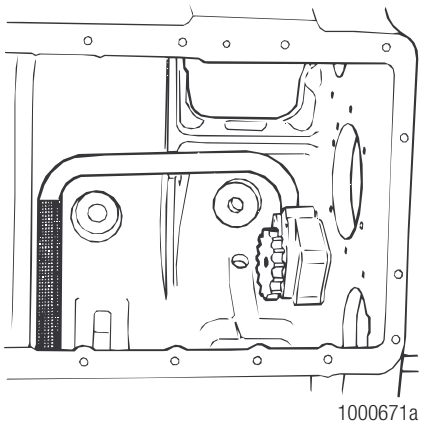
Figure 9.20



Remove the Oil Pump

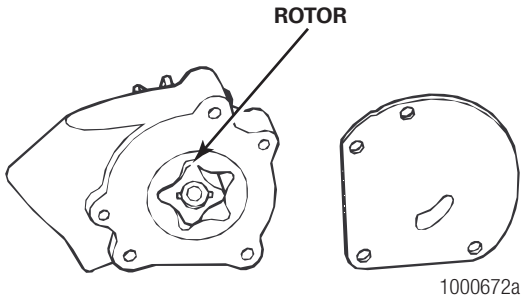
1. Remove the auxiliary drive gear, mainshaft, input shaft and countershafts. Refer to the procedures in this section.
2. Remove the Allen-head capscrews and washers that secure the pump to the main case. **Figure 9.21**.

Figure 9.21



3. Remove the pickup tube bracket from the main case.
4. Remove the pump. If necessary, use a plastic or rubber hammer to separate the pump from the main case.
5. Clean the pickup screen on the tube. Replace the pickup tube assembly if the tube or screen is damaged.
6. If installed, inspect the pump-to-case O-ring on the front of the pump. Replace the O-ring if it is worn or damaged.
7. Remove the cover and inspect the pump. If the O-ring or the pump rotors are damaged, replace the parts. **Figure 9.22**.

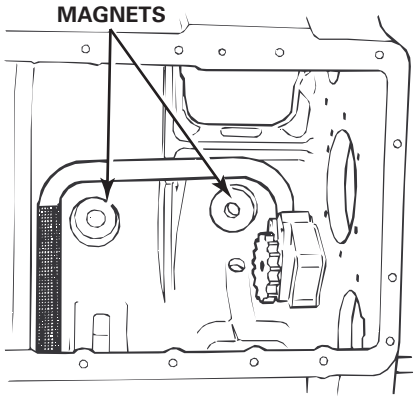
Figure 9.22



Remove the Magnets

1. Remove the auxiliary drive gear, mainshaft, input shaft and countershafts. Refer to this section for instructions.
2. Remove the magnets from the bottom of the case. **Figure 9.23**.

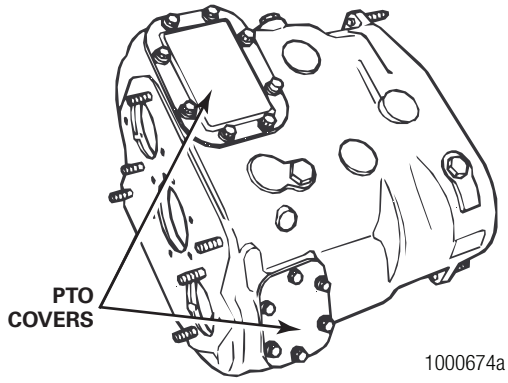
Figure 9.23



Remove the PTO Covers

1. Drain the lubricant from the transmission.
2. Remove the capscrews that secure the PTO covers to the side and bottom of the case. Remove the covers. **Figure 9.24**.
3. Use a scraper to remove sealant material from the PTO covers and main case.

Figure 9.24



Inspect Parts

It is important to inspect all parts before the transmission is assembled. Check all parts for wear and replace damaged parts. Replacement of damaged parts now will prevent failure of the assembly later.

Tapered Roller Bearings

NOTE: The bearing cup and the bearing cone must be replaced as an assembly except when the cup is loose in the bore. If the cup is loose in the bore, install an oversize cup. In all other situations, do not replace the cup or the cone separately. Replace the cup and the cone in a matched set from the same manufacturer. For replacement part number, refer to **Table A**.

Table A: Tapered Roller Bearing Cup and Cone Replacement

Component	Bearing Cup and Cone Location	Transmission	Design Level	Part Number
Main Countershaft	Front	All	1	A-1228-W-1349
			2	A-1228-T-1346①
	Rear	All	1	A-1228-V-1348
			2	A-1228-S-1345②
Auxiliary Countershaft	Front	9- and 10-Speed	1	A-1228-X-1350②
			2	A-1228-S-1345②
		13-Speed	1	A-1228-U-1373
			2	A-1228-S-1345②
	Rear	9- and 10-Speed	1	A-1228-Y-1373
			2	A-1228-U-1347③
		13-Speed	1	A-1228-Y-1351
			2	A-1228-U-1347③

① Use part number XCD2139DT.
② Use part number XC11807DN.
③ Use part number XC1837DF.

Ball Bearings

Inspect ball bearings for wear and damage. The bearings must rotate in the race. The outer race must not be worn or damaged. On bearings with grooves, the grooves must not be worn or damaged. Replace any worn or damaged bearings.

Gears

Inspect the teeth of the gears for wear and damage. Inspect the splines inside the gears for wear and damage. Inspect the gears for cracks or pits. Replace gears that are worn, damaged or cracked.

Shafts

Inspect the splines and the grooves for wear and damage. The shafts must not be twisted. Threads on the end of the shafts must not be worn or damaged. Replace any worn or damaged shafts.

O-Rings and Oil Seals

Inspect the O-rings and the oil seals for cuts and cracks. The parts must not be brittle or hard. Replace any worn, damaged or hard O-rings and oil seals.

Clutch Collars

Inspect the teeth of the outside of the clutch collar for wear and damage. Inspect the splines inside the clutch collar for wear and damage. Replace any worn or damaged clutch collars.

Case Housings

Inspect the case housings for cracks. Replace cracked housings.

Top Cover

Inspect the tips of the forks for wear and damage. The forks must not be bent. The shift rail must not be worn or damaged. Inspect the detent pin and springs for wear or damage. Replace any worn or damaged parts.

Output Yokes

Inspect the seal surface, the splines and the end of the output yoke for wear and damage. Do not sand or grind the seal surface. Replace any worn or damaged parts.

Repair or Replace Parts

- Replace a fastener when the corners of the head are worn.
- Replace damaged washers.
- Replace gaskets and oil seals when you repair the transmission.
- Clean parts. Apply new gasket material where required when you assemble the transmission.
- Use a fine emery cloth to remove nicks and burs from parts with machined or ground surfaces, except yokes.
- Use a die or tap of the correct size to clean and repair fastener threads and holes.

Cleaning the Ground or Polished Parts

CAUTION

Do not use hot solution tanks or water and alkaline solutions to clean ground or polished parts. Damage to parts can result.

Use a cleaning solvent to clean ground or polished parts and surfaces. Kerosene or diesel fuel can be used for this purpose. DO NOT USE GASOLINE.

Do NOT clean ground or polished parts in a hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

Cleaning the Rough Parts

Rough parts can be cleaned with the ground or polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts must remain in the hot solution tanks until they are completely cleaned and heated.

Drying the Cleaned Parts

Parts must be dried immediately after cleaning. Dry parts with clean paper, rags or compressed air.

Preventing Corrosion and Rust on Cleaned Parts

Apply lubricant to cleaned and dried parts that are not damaged and are to be immediately assembled.

If parts are to be stored, apply a special material that prevents corrosion and rust to all surfaces. Store the parts inside special paper or other material that prevents corrosion and rust.

Reassembly

Install the PTO Covers

1. Use a sealant dispenser and Loctite® Ultra Grey Adhesive/Sealant 18581, Meritor part number 2297-A-7021, or equivalent to apply a new sealant pattern on the PTO covers on the main case. You must install the sealant in the pattern shown in **Figures 9.25 and 9.26**.

Figure 9.25
PTO COVERS-TO-TRANSMISSION CASE GASKET PATTERN
• Apply the pattern on the transmission case.

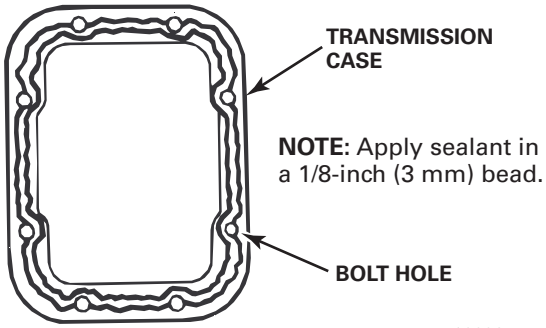
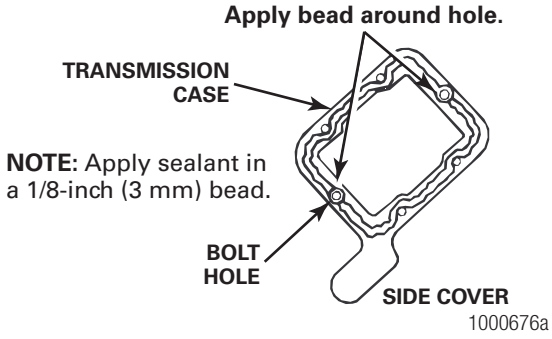


Figure 9.26
PTO COVERS-TO-TRANSMISSION CASE GASKET PATTERN
• Apply the pattern on the transmission case.

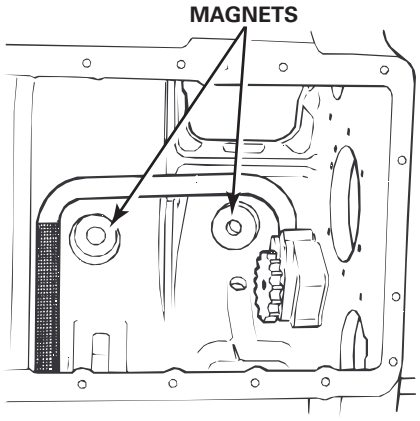


2. Install the eight-hole PTO cover onto the bottom of the case. Install the mounting capscrews and washers. Tighten the capscrews to 35-45 lb-ft (47-61 N•m).
3. Install the six-hole PTO cover onto the bottom of the case. Install the mounting capscrews and washers. Tighten the capscrews to 35-45 lb-ft (47-61 N•m).

Install the Four Magnets

1. Use a weak alkaline solution or a commercial cleaning solvent to remove all oil and dirt from the main case.
2. Remove all dirt and metal particles from the magnets.
3. Use a sealant dispenser and Loctite® Ultra Grey Adhesive/Sealant 18581, Meritor part number 2297-A-7021, or equivalent to apply a new sealant pattern on the bottom of the magnets.
4. Install the four magnets in the bottom of the case. **Figure 9.27**.
5. Install the main countershafts, input shaft and mainshaft. Refer to instructions in this section.

Figure 9.27

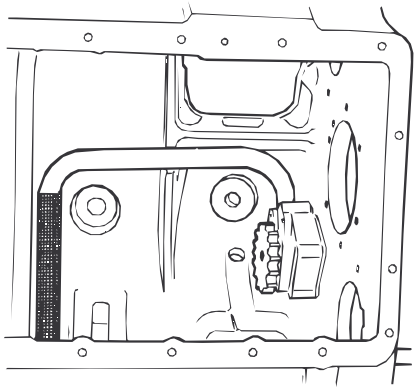


Install the Oil Pump

1. Lubricate all parts with new oil that is used in the transmission.
2. Install the pump into the case. **Figure 9.28**. Install the capscrews and washers. Tighten the capscrews to 7-10 lb-ft (10-13 N•m).

3. Connect the pickup tube bracket to the case. Install and tighten the capscrew.
4. Install the main countershafts, input shaft and mainshaft. Refer to instructions in this section.

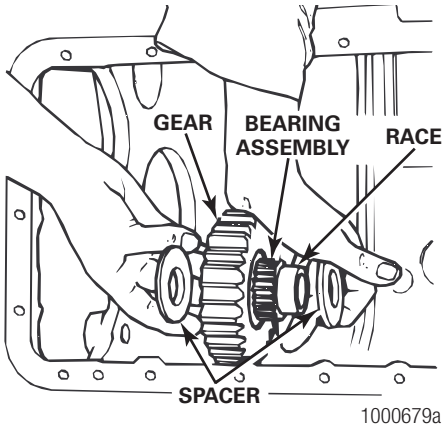
Figure 9.28



Install the Reverse Idler Gear Assemblies

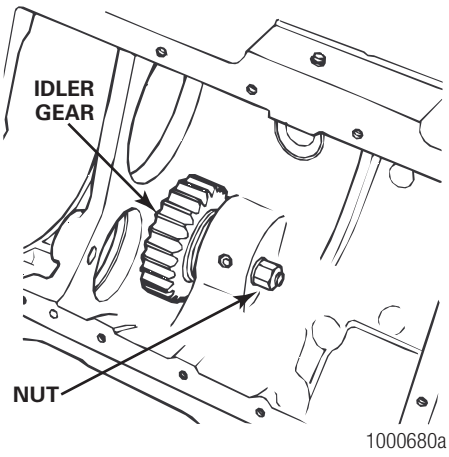
1. Lubricate all parts with new oil that is used in the transmission.
2. Install the needle bearing assembly inside the lower reverse idler gear. **Figure 9.29**.

Figure 9.29



3. Install the inner race inside the needle bearing assembly. **Figure 9.29**.
4. Install a spacer washer on each side of the reverse idler gear. **Figure 9.29**.
5. Place the lower idler gear into position in the bottom of the main case.
6. Install the shaft through the reverse idler gear assembly from the auxiliary cover-side of the transmission case.
7. Install the nut and washer that secures the lower reverse idler gear assembly in the main case. Hold the end of the shaft with a screwdriver. Tighten the nut to 75-100 lb-ft (101-135 N•m). **Figure 9.30**. T
8. Install the countershafts, input shaft and mainshaft. Install the upper reverse idler gear. Refer to instructions in this section.

Figure 9.30

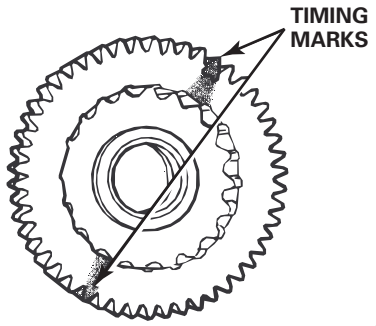


Install the Input Shaft

1. Use paint to make a timing mark on one tooth of the input shaft's main driven gear. Make another paint mark directly opposite, 180 degrees, the first mark. **Figure 9.31**.

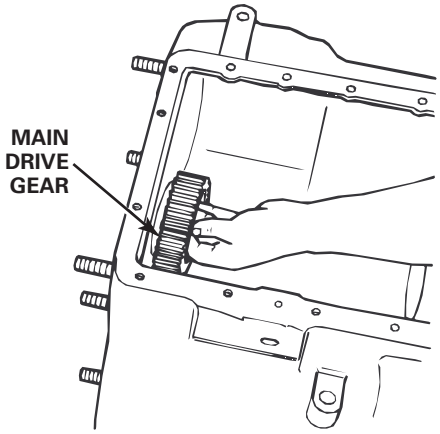
Figure 9.31

MAIN DRIVE GEAR — MARK ONE TOOTH ON EACH SIDE 180˚ APART



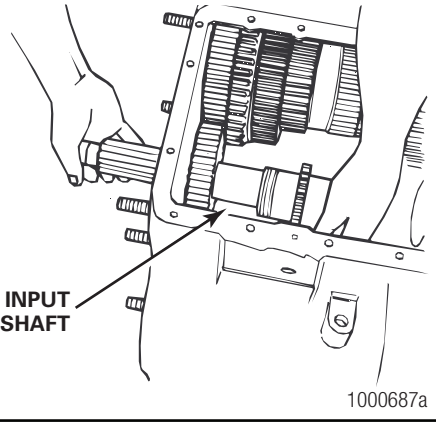
2. Use the following instructions to install the input shaft.
   A. Lubricate all parts with new oil that is used in the transmission.
   B. If removed, install the snap ring inside the main drive gear.
   C. Install the main drive gear into position in the main case. **Figure 9.32**.
   D. If removed, use a hammer and the correct driver to install a new bushing into the end of the input shaft.

Figure 9.32



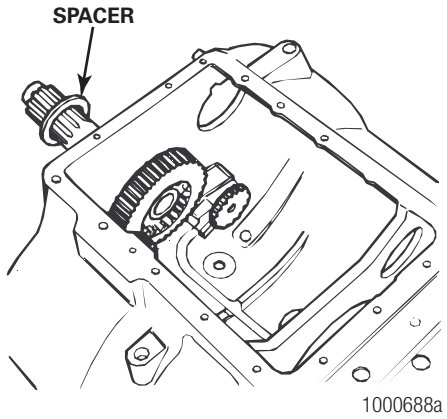
3. Install the input shaft through the main drive gear. The input shaft is installed correctly when the snap ring groove on the shaft is toward the OUTSIDE of the main case. **Figure 9.33**.

Figure 9.33



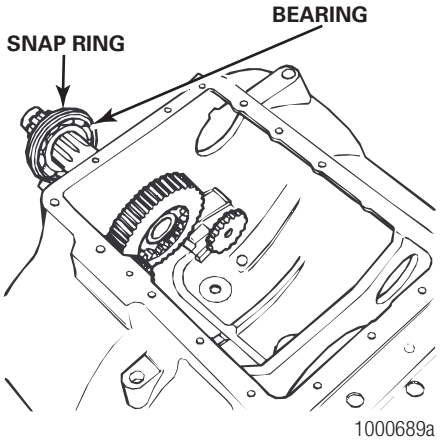
4. Install a spacer onto the input shaft. **Figure 9.34**.

Figure 9.34



5. If removed, install the outer snap ring onto the bearing.
6. Install the bearing over the input shaft and into the main case. **Figure 9.35**.

Figure 9.35

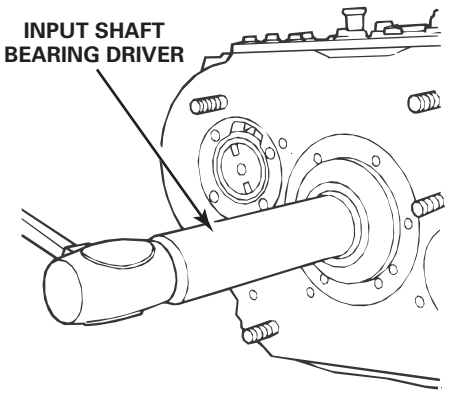


CAUTION

When you use a input bearing shaft driver, only place the tool on the bearing's inner race to prevent damage to the bearing.

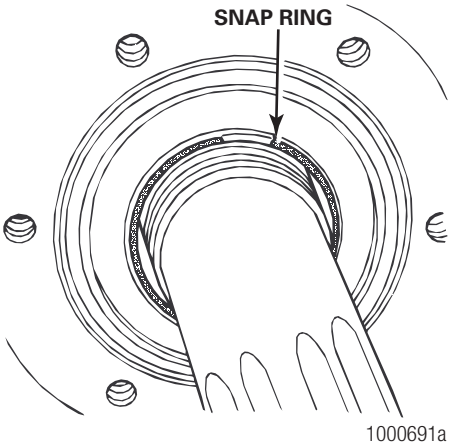
7. Place the bearing over the input shaft and into the main case. Use a rubber or plastic mallet and G&W tool number G-35 input bearing shaft driver to install the bearing onto the input shaft. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual. **Figure 9.36**.

Figure 9.36



8. Install the snap ring into the groove on the input shaft bearing. **Figure 9.37**.

Figure 9.37

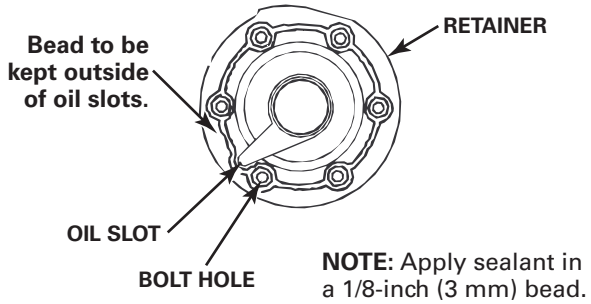


9. Use a sealant dispenser and Loctite® Ultra Grey Adhesive/Sealant 18581, Meritor part number 2297-A-7021, or equivalent to apply a new sealant pattern on the input retainer. **Figure 9.38**.

Figure 9.38

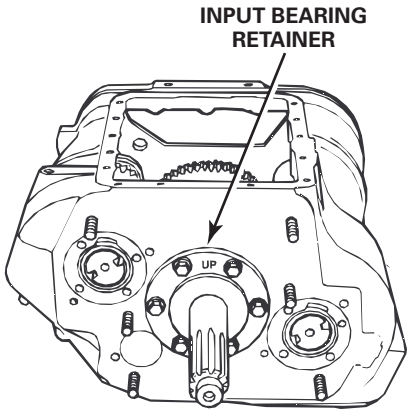
INPUT BEARING RETAINER-TO-TRANSMISSION CASE GASKET PATTERN

• Apply the pattern on the input bearing retainer.



10. Place the input retainer on the main case. Install the mounting capscrews and washers and tighten to 25-35 lb-ft (34-47 N•m). **Figure 9.39**. T

Figure 9.39



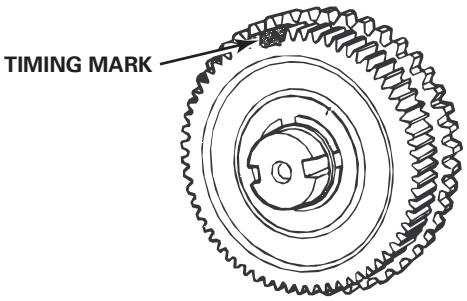
Install the Main Countershafts

CAUTION

Replace the bearing cup and cone as a matched set from the same manufacturer. Do not replace the cup or cone separately. Damage to components can result.

1. Lubricate all parts with new oil that is used in the transmission.
2. Use paint to make a timing mark on two teeth of each countershaft driven gear. Check that the timing mark is aligned with the key slot and the "O" stamping on the countershaft. **Figure 9.40**.

Figure 9.40



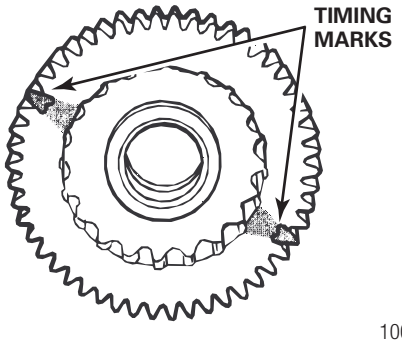
COUNTERSHAFT DRIVEN GEAR — MARK TWO TEETH OVER THE SLOT FOR THE KEY OR THE "O" STAMPING

1000694a

3. Use paint to make a timing mark on one tooth of the input shaft main drive gear. Make another paint mark directly opposite, 180 degrees, the first mark. **Figure 9.41**.

Figure 9.41

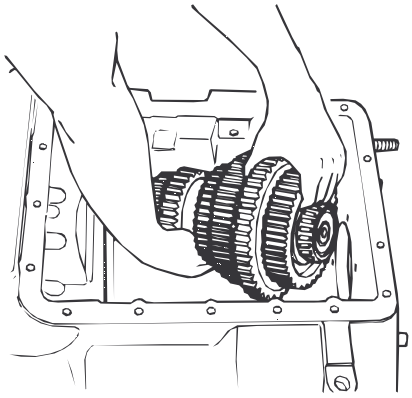
MAIN DRIVE GEAR — MARK ONE TOOTH ON EACH SIDE 180° APART



1000695a

4. Install the LOWER countershaft assembly so that the large gears are toward the FRONT of the main case. Move the countershaft toward the side of the case. **Figure 9.42**.

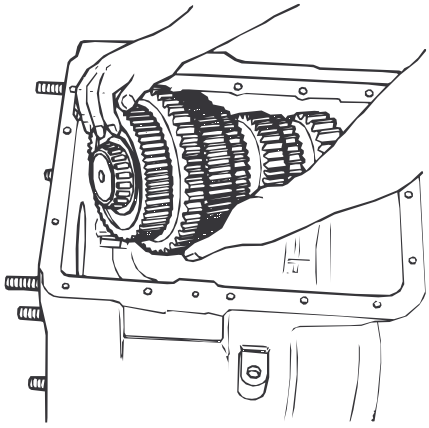
Figure 9.42



1000696a

5. Install the UPPER countershaft assembly into the case. The large gears must be toward the FRONT of the case. Move the countershaft toward the side of the case. **Figure 9.43**.
6. Install a long capscrew or T-handle tool, Meritor part number 3256-Y-1013, into the hole in the front of the UPPER countershaft. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual.

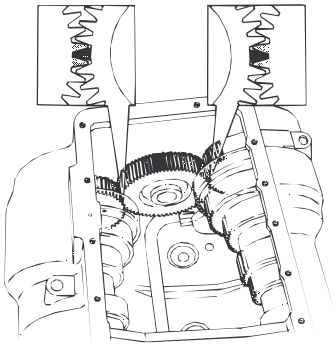
Figure 9.43



1000697a

7. Rotate the input shaft and move the LOWER countershaft assembly to align the timing marks. **Figure 9.44**.
8. Install the mainshaft as described in this section.

Figure 9.44



MAIN DRIVE GEAR TIMING MARK
COUNTERSHAFT DRIVEN GEAR TIMING MARK

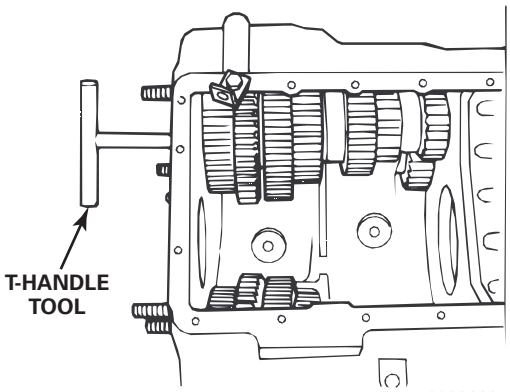
1000698a

Install the Mainshaft

NOTE: The input shaft and main countershafts must be installed in the case before you install the mainshaft.

1. Lubricate all parts with new oil that is used in the transmission. Install Loctite® 242 Threadlocker, Meritor part number 2297-V-5430, or equivalent on fastener threads.
2. Move the UPPER countershaft toward the side of the case. The rear bearing cone must be installed on the UPPER countershaft. **Figure 9.45**.

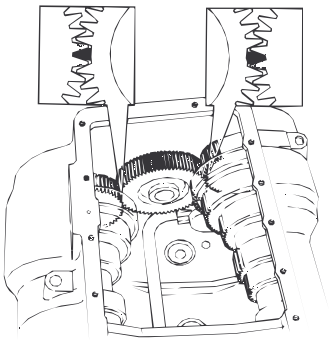
Figure 9.45



1000699a

3. Install a long capscrew or T-handle tool, Meritor part number 3256-Y-1013, in the hole in the front of the UPPER countershaft. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual.
4. Rotate the input shaft and move the LOWER countershaft assembly to align the timing marks. **Figure 9.46**.

Figure 9.46



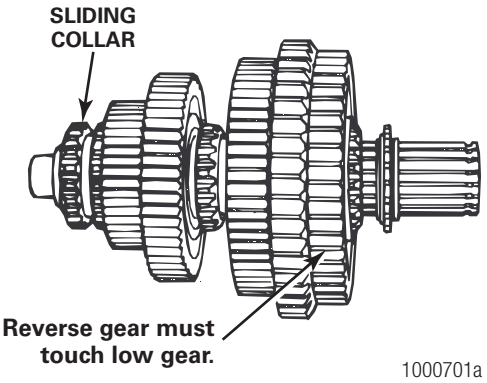
MAIN DRIVE GEAR TIMING MARK
COUNTERSHAFT DRIVEN GEAR TIMING MARK

1000700a

5. Remove the snap ring to remove the auxiliary drive gear assembly from the mainshaft.

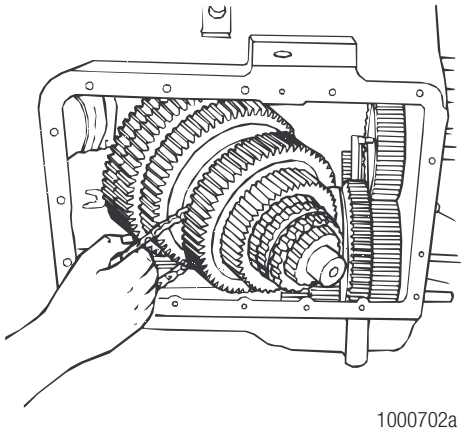
6. Remove the snap ring that secures the reverse gear to the mainshaft. Slide the reverse gear FORWARD until the gear touches the low gear. **Figure 9.47**.

Figure 9.47



7. Install the sliding collar onto the front of the mainshaft. **Figure 9.47**.
8. Install lifting hooks or a rope under the mainshaft assembly. Install the mainshaft assembly into the main case. Check that the front of the mainshaft is installed into the input shaft bushing.
9. Temporarily install the auxiliary drive gear to support the rear of the mainshaft. Remove the lifting hooks or rope. **Figure 9.48**.

Figure 9.48

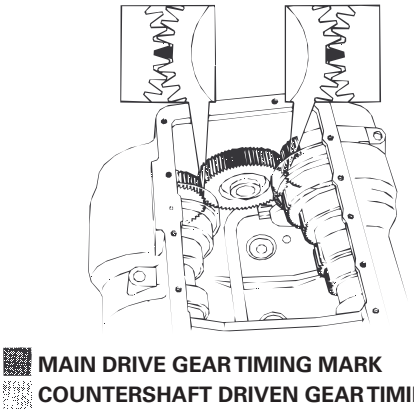


CAUTION

Support the mainshaft when you service the countershaft to ensure that the timing marks remain aligned and the weight of the mainshaft does not damage the thrust washers.

10. Install the auxiliary drive gear and bearing assembly to support the mainshaft in the case.
11. Align the timing marks on the input shaft main drive gear with the timing marks on the UPPER countershaft. Use a T-handle tool or long capscrew to move the countershaft. **Figure 9.49**. Remove the T-handle tool or capscrew.

Figure 9.49



NOTE: The bearing cone must be installed on the rear of the countershaft.

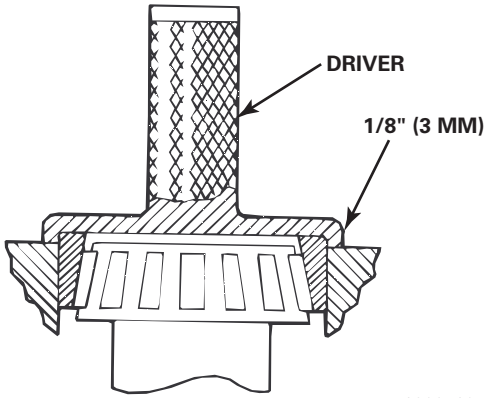
12. Use the following instructions to install the UPPER REAR bearing cup and the UPPER FRONT bearing cone onto the countershaft.
    A. Place the cup in the UPPER REAR countershaft bore. Use a plastic hammer to install the cup into the bore.
    B. Temporarily install the auxiliary drive gear to support the rear of the mainshaft. Remove the lifting hooks or rope.

CAUTION

Use a piloted bearing driver to install the cup into the bore. The cup must extend 0.125-inch (3 mm) above the surface of the main case. Ensure that the driver does not touch the bearing cone. Damage to the cone can result.

13. Use a hammer and a piloted bearing driver to install the REAR cup into the bore. The cup is installed correctly when it extends 0.125-inch (3 mm) above the surface of the main case. **Figure 9.50**.

Figure 9.50



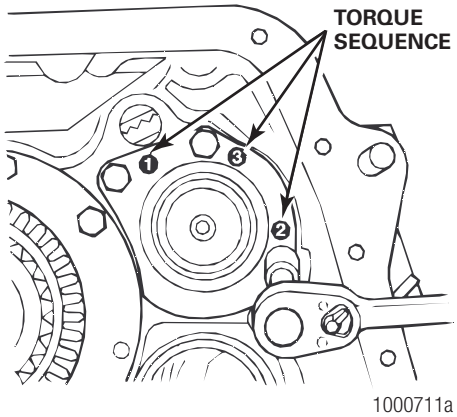
14. Clean the three capscrews that secure the countershaft rear bearing retainer to the main case. Apply Loctite® 242 Threadlocker, Meritor part number 2297-V-5430, or equivalent to capscrew threads.

CAUTION

Use a new hardened countershaft bearing retainer to install the REAR countershaft cup to prevent damage to the transmission.

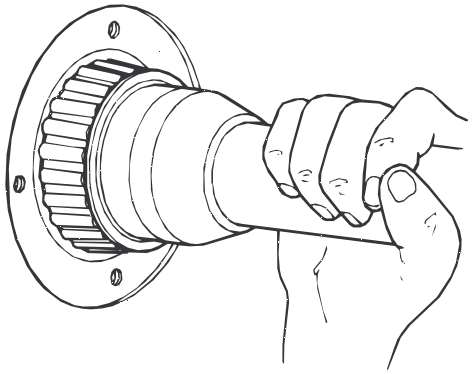
15. Place a new hardened countershaft rear bearing retainer into position on the main case. Install the capscrews. Alternately and evenly tighten the capscrews to 35 lb-ft (47 N•m) until the bearing retainer touches the main case. **Figure 9.51**. T

Figure 9.51



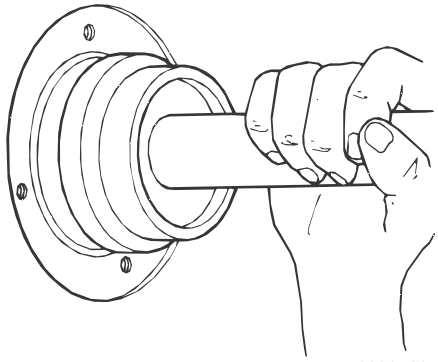
16. Use a hammer and piloted bearing driver tool to install the UPPER FRONT countershaft cone. The cone is installed correctly when the bottom of the cone is against the countershaft. **Figure 9.52**.

Figure 9.52



17. Place the cup into the UPPER FRONT countershaft bore. Use a plastic hammer to start installing the cup into the bore.
18. Use a hammer and piloted bearing driver to install the UPPER FRONT countershaft cup. The cup is installed correctly when it touches the bearing cone. **Figure 9.53**.
19. Use a hammer and piloted bearing driver to install the FRONT cup into the bore. The cup is correctly installed when it extends 0.125-inch (3 mm) above the surface of the main case.

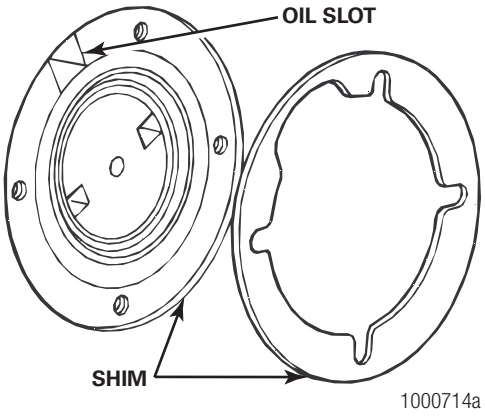
Figure 9.53



NOTE: Replace worn or damaged shims.

20. Install one of the following shim selections into the UPPER FRONT countershaft bearing bore. Ensure that the oil slot and oil hole are aligned. **Figure 9.54**.
    - The shims you removed during disassembly
    - A 0.005-inch (0.127 mm) shim, Meritor part number 2803-R-2826
    - A 0.0075-inch (0.190 mm) shim, Meritor part number 2803-S-2827

Figure 9.54

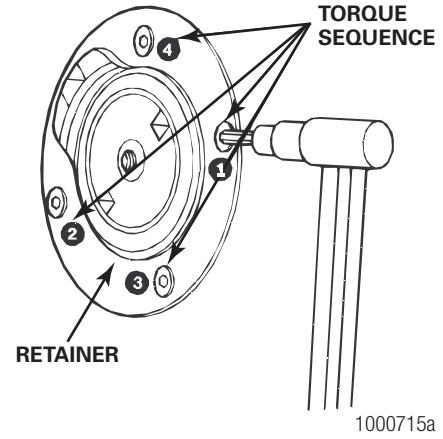


CAUTION

Ensure that the retainer and shims are correctly installed against the main case. Check that the retainer does not push the shims against the cup, which will result in incorrect end play. Damage to components can result.

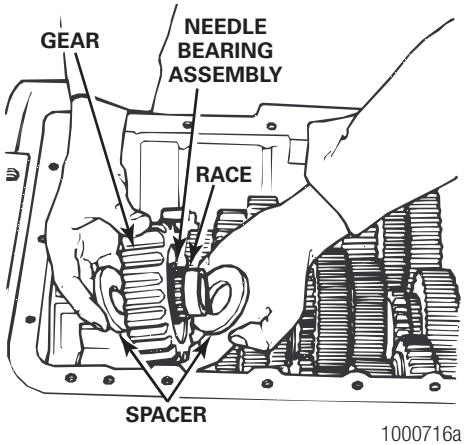
21. Install a new retainer for the UPPER and LOWER FRONT countershaft bearings. Install the Allen-head capscrews. Alternately and evenly tighten the capscrews to 120 lb-in (14 N•m). **Figure 9.55**.

Figure 9.55



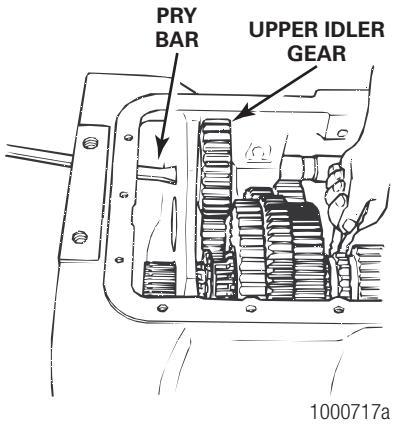
22. Check the end play on the UPPER and LOWER main countershafts.
    - **When end play is between 0.002-0.006-inch (0.050-0.152 mm):** Proceed to the following procedure.
23. Use the following procedure to install the UPPER reverse idler gear assembly into the top of the main case.
    A. Install the needle bearing assembly inside of the gear. **Figure 9.56**.
    B. Install the INNER race inside of the needle bearing assembly. **Figure 9.56**.
    C. Install a spacer washer on each side of the reverse idler gear. **Figure 9.56**.
    D. Place the reverse idler gear into position on top of the main case.
    E. From the auxiliary cover side of the transmission case, install the shaft through the reverse idler gear assembly.

Figure 9.56



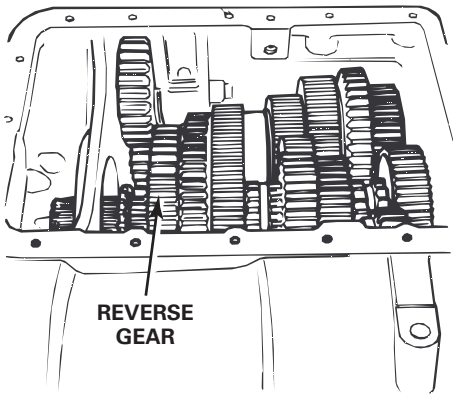
24. Install the nut and washer onto the upper reverse idler gear assembly. Hold the end of the shaft with a screwdriver. Tighten the nut to 75-100 lb-ft (100-135 N•m). **Figure 9.57**.

Figure 9.57



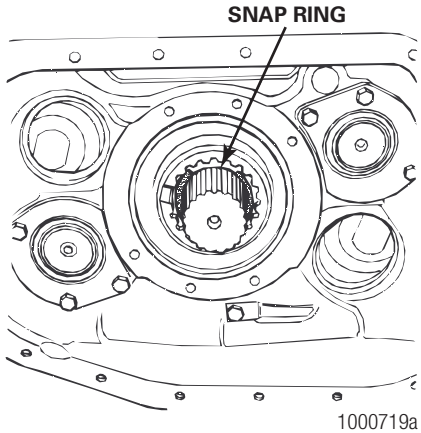
25. Move the reverse gear to the REAR of the mainshaft. Remove the auxiliary drive gear. **Figure 9.58**.

Figure 9.58



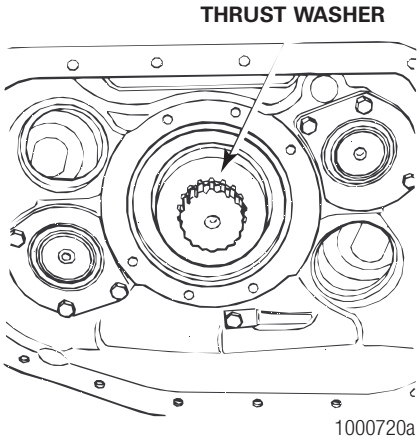
26. Install a new snap ring that secures the reverse gear onto the mainshaft. Check that the snap ring is completely installed into the groove. **Figure 9.59**.

Figure 9.59



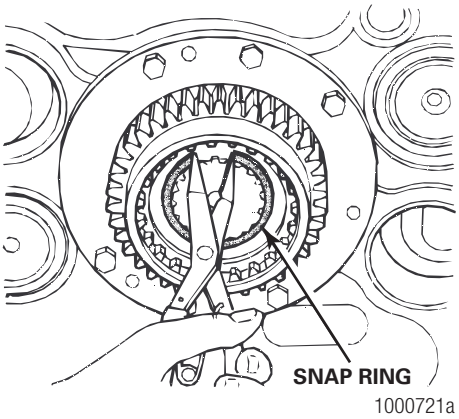
27. Install the thrust washer onto the mainshaft. **Figure 9.60**.

Figure 9.60



28. Use the following procedure to install the auxiliary drive gear assembly onto the mainshaft and into the REAR of the main case.
    A. Install the bearing assembly into the main case over the mainshaft.
    B. Install the two-piece retainer onto the case.
    C. Install and tighten the capscrews to 35-45 lb-ft (47-61 N•m). T
    D. Install the auxiliary drive gear onto the mainshaft. The snap ring groove must be visible on the mainshaft.
    E. Install a new snap ring that secures the auxiliary drive gear onto the mainshaft. **Figure 9.61**.

Figure 9.61



WARNING

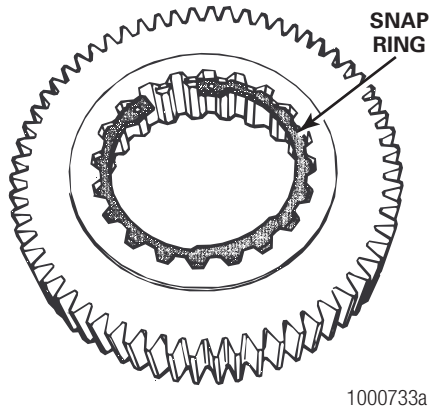
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Overhaul

NOTE: Remove the thrust washer, the snap ring in the reverse gear, and the front sliding collar when you remove the mainshaft from the transmission.

1. If installed, remove the third-fourth sliding collar from the mainshaft.
2. Place the mainshaft in a vise with brass jaws. The mainshaft's auxiliary drive gear end should be TOWARD you.
3. Remove these parts from the mainshaft in the following order. Keep all parts together.
   A. Remove the snap ring from the second groove from the TOP of the mainshaft.
   B. Use a small punch to push the key away from the roll pin at the BOTTOM of the mainshaft.
   C. Remove the key from the TOP of the mainshaft.
   D. Remove the spacer washer and thrust washer.
   E. Remove the Reverse gear. Remove the clutch collar.
   F. Remove the thrust washer, spacer and Low or first gear.
   G. Remove the first or second gear. Remove the spacer and thrust washer. Remove the clutch collar.
   H. Remove the thrust washer, spacer and the second or third gear.
   I. Remove the overdrive or the third gear. Remove the spacer and thrust washer.
4. If worn or damaged, remove and replace the roll pin.
5. If worn or damaged, remove and replace the snap rings from inside the gears. **Figure 10.1**.
6. Inspect all parts for wear and damage.

Figure 10.1



Assembly

CAUTION

Use the correct snap ring in the gears, or the transmission will not operate correctly. Damage to components can result.

1. If removed, install the correct snap rings in the gears. Use the following part numbers for the transmission you are overhauling.
   - Use part number 1229-X-4418 for transmissions with serial numbers LB93021753 and BELOW.
   - Use part number 1229-W-4625 for transmissions with serial numbers LB93021754 and ABOVE.

WARNING

When you use a hammer and steel drift, verify that the tools are in good condition. Do not use worn or damaged tools, which can break or shatter components. Serious personal injury can result.

2. If removed, use a hammer and steel drift to install a new roll pin. **Figure 10.2**.
3. Lubricate all parts of the mainshaft with the same oil used in the transmission.
4. Install the mainshaft in a vise with brass jaws. The slot for the key must be toward you.

Figure 10.2

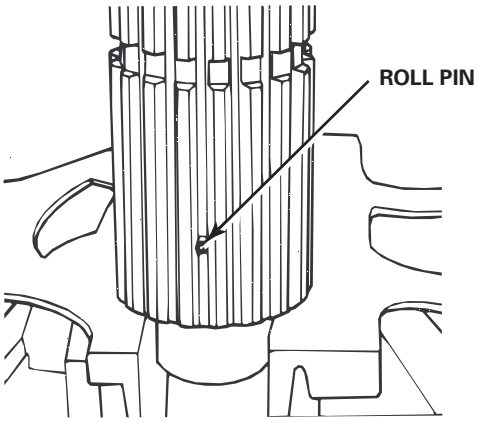
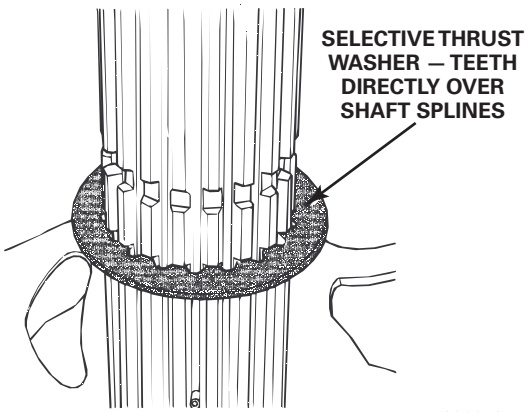


Figure 10.3



CAUTION

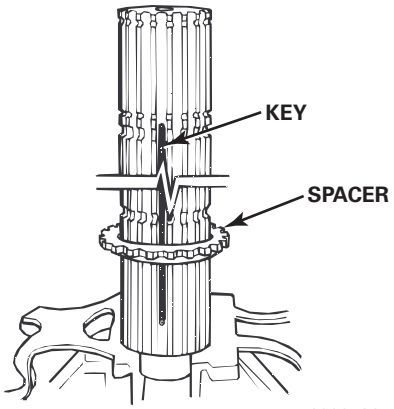
Ensure that you install the correct selective washer. Do not mix washers, or the transmission will not operate correctly. Damage to the transmission can result.

5. Choose the correct selective thrust washer for the third or overdrive gear. Refer to the following procedures.
   - **If the selective washers are not replaced:** Use the original washers.
   - **If the selective washers are replaced:** Install the medium-size washer.
   - **For transmissions with serial numbers LB93021753 and BELOW:** Use a 0.220-inch (5.60 mm) washer.
   - **For transmissions with serial numbers LB93021754 and ABOVE:** Use a 0.275-inch (7.00 mm) washer.
6. Install the selective thrust washer for the third or overdrive gear. Refer to the following procedure. **Figure 10.3**.
   A. Install the washer onto the mainshaft. The smooth side of the washer should be TOWARD you.
   B. Slide the washer to the groove above the roll pin.
   C. Move the washer so that the washer teeth are directly over the mainshaft splines. The washer must not slide down the mainshaft.

NOTE: You will remove and install the key during this procedure. Mark the groove where the roll pin is installed.

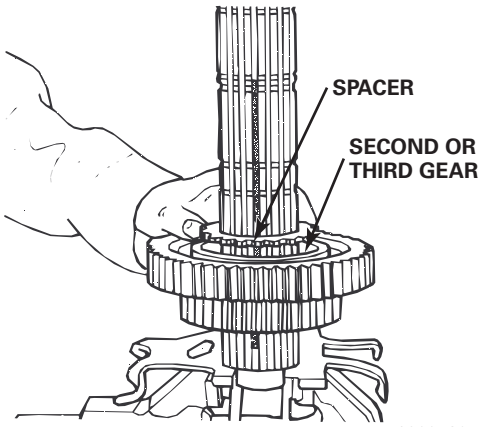
7. Install the key into the slot where the roll pin is installed. The key must touch the roll pin. **Figure 10.4**.

Figure 10.4



8. Install the spacer on top of the washer. **Figure 10.4**.
9. Install the third or overdrive gear onto the shaft. The mainshaft splines must engage the spacer teeth, and the snap ring must be against the spacer.
10. Install the second or third gear. The snap ring must be toward the third or overdrive gear. **Figure 10.5**.

Figure 10.5



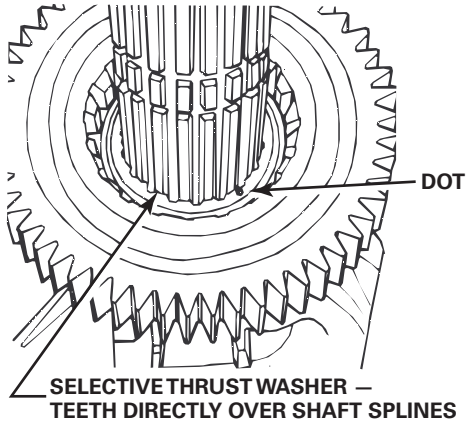
11. Install a spacer. The spacer teeth must engage the gear splines. **Figure 10.5**.

CAUTION

Ensure that the selective washers do not move when you remove the key. If the washers move, the gears will fall. Damage to components can result.

12. Remove the key.
13. Choose the correct selective washer for the second or third gear. Refer to the following procedures.
    - **If the selective washers are not replaced:** Use the original washers.
    - **If the selective washers are replaced:** Install the medium-size washer.
    - **For transmissions with serial numbers LB93021753 and BELOW:** Use a 0.216-inch (5.50 mm) washer.
    - **For transmissions with serial numbers LB93021754 and ABOVE:** Use a 0.272-inch (6.90 mm) washer.
14. Install the correct selective thrust washer for the second or third gear. Refer to the following procedure. **Figure 10.6**.
    A. Install the washer onto the shaft. The chamfered side with the dot should be toward you.
    B. Slide the washer to the second groove above the roll pin.
    C. Move the washer so that the washer teeth are directly over the mainshaft splines. The washer must not slide down the mainshaft.
       - **If necessary:** Place a small screwdriver in the dot to move the washer. **Figure 10.6**.

Figure 10.6



15. Check the clearance between the third and second gears, or the overdrive and third gears. Refer to the following procedure.
    A. Place two screwdrivers across from each other between the gears. **Figure 10.7**.

NOTE: Only lightly push on the screwdrivers when the feeler gauges are not installed.

    B. Lightly push on the screwdrivers to evenly spread the gears. The gears must be parallel to each other. **Figure 10.7**.

Figure 10.7

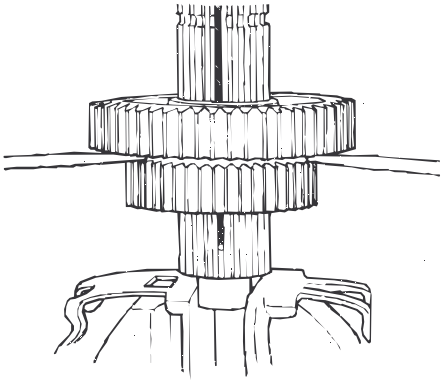
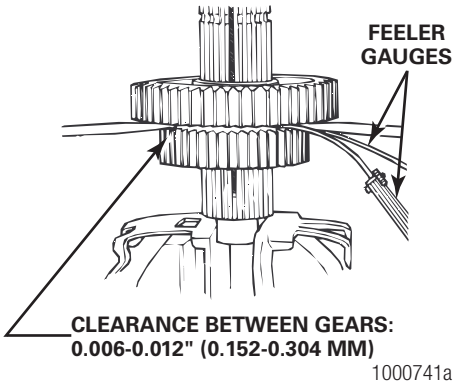


Figure 10.8



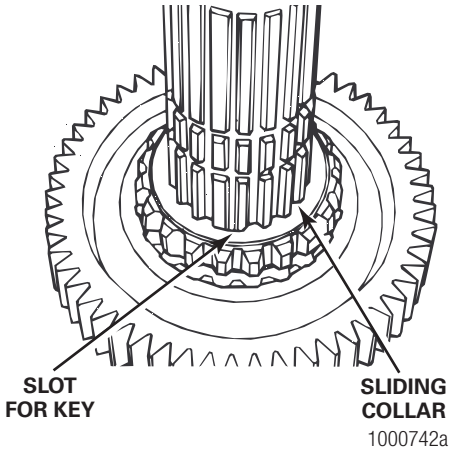
16. Install two small feeler gauges between the hubs. Each gauge must be opposite the other. The clearance must be 0.006-0.012-inch (0.152-0.304 mm). **Figure 10.8**.
    - **If clearance is less than 0.006-inch (0.152 mm):** Install a thinner selective thrust washer into the second or third gear.
    - **If clearance is more than 0.012-inch (0.304 mm):** Install a thicker selective thrust washer.

Table B: Thrust Washer Sizes

Serial Number	Inch (mm)
LB93021753 and below	0.216, 0.220 and 0.224 (5.50, 5.60 and 5.70)
LB93021754 and above	0.272, 0.275 and 0.279 (6.90, 7.00 and 7.10)

17. Remove the screwdrivers and feeler gauges.
18. Install the sliding collar. The slot in the collar must be installed over the key. **Figure 10.9**.

Figure 10.9

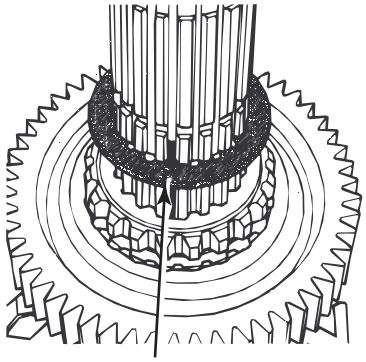


⚠ CAUTION

Ensure that you install the correct selective washer. Do not mix washers, or the transmission will not operate correctly. Damage to the transmission can result.

19. Choose the correct selective thrust washer for the third or overdrive gear. Refer to the following procedures.
    - **If the selective washers are not replaced:** Use the original washers.
    - **If the selective washers are replaced:** Install the medium-size washer.
    - **For transmissions with serial numbers LB93021753 and BELOW:** Use a 0.220-inch (5.60 mm) washer.
    - **For transmissions with serial numbers LB93021754 and ABOVE:** Use a 0.275-inch (7.00 mm) washer.
20. Remove the key. Install the selective thrust washer for the first or second gear. Refer to the following procedures. **Figure 10.10**.
    A. Install the washer onto the mainshaft. The smooth side must be TOWARD you.
    B. Slide the washer to the third groove above the roll pin.
    C. Move the washer so that the washer teeth are directly over the mainshaft splines. The washer must not slide down the shaft.

Figure 10.10



SELECTIVE THRUST WASHER — TEETH DIRECTLY OVER SHAFT SPLINES

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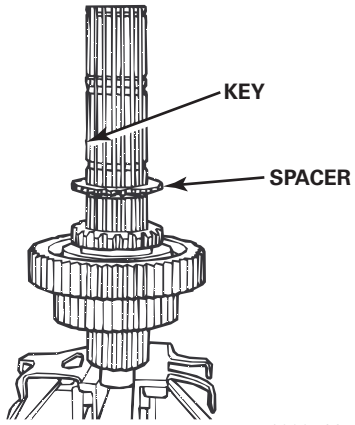
21. Install the key into the slot where the roll pin is installed. The key must touch the roll pin. **Figure 10.11**.

Figure 10.11



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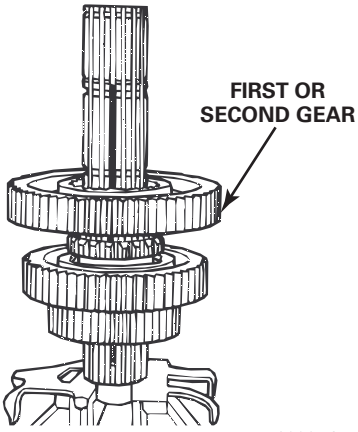
22. Install the spacer on top of the washer. **Figure 10.11**.
23. Install the first or second gear onto the mainshaft. The gear splines must engage the spacer teeth, and the snap ring must be against the spacer. **Figure 10.12**.

Figure 10.12



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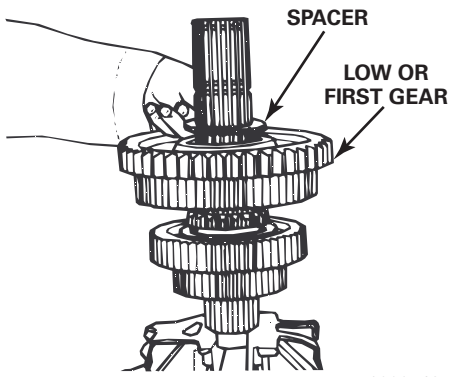
24. Install the low or first gear. The snap ring must be toward the first or second gear. **Figure 10.13**.

Figure 10.13



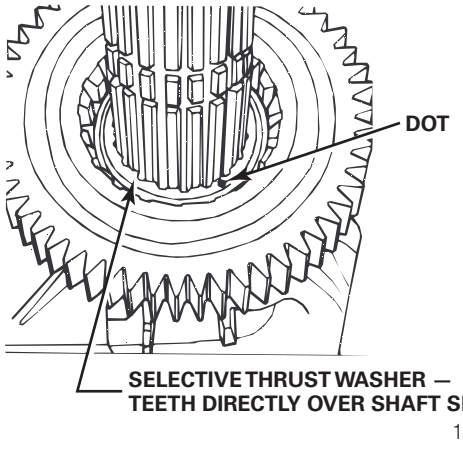
25. Install a spacer. The spacer teeth must engage the gear splines.

CAUTION

Ensure that the selective washers do not move when you remove the key. If the washers move, the gears will fall. Damage to components can result.

26. Remove the key.
27. Choose the correct selective thrust washer for the third or overdrive gear. Refer to the following procedures.
    - **If the selective washers are not replaced:** Use the original washers.
    - **If the selective washers are replaced:** Install the medium-size washer.
    - **For transmissions with serial numbers LB93021753 and BELOW:** Use a 0.215-inch (5.50 mm) washer.
    - **For transmissions with serial numbers LB93021754 and ABOVE:** Use a 0.272-inch (6.90 mm) washer.
28. Install the selective thrust washer for the low or first gear. Refer to the following procedure. **Figure 10.14**.
    A. Install the washer onto the shaft. The chamfered side with the dot should be toward you.
    B. Slide the washer to the second groove above the roll pin.
    C. Move the washer so that the washer teeth are directly over the mainshaft splines. The washer must not slide down the mainshaft.
       - **If necessary:** Place a small screwdriver in the dot to move the washer. **Figure 10.14**.

Figure 10.14

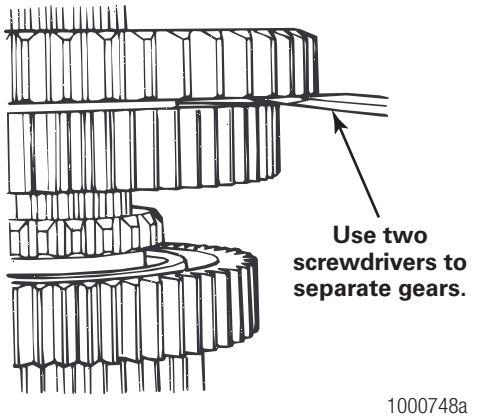


29. Check the clearance between the low or first, and the first or second gear. Refer to the following procedure.
    A. Place two screwdrivers across from each other between the first and low, or the second and first gears. **Figure 10.15**.

NOTE: Only lightly push on the screwdrivers when the feeler gauges are not installed.

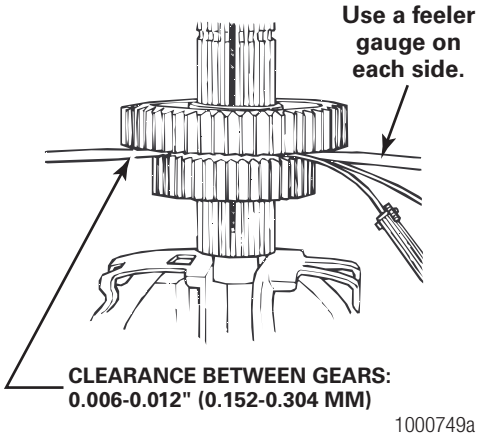
    B. Lightly push on the screwdrivers to evenly spread the gears. The gears must be parallel to each other. **Figure 10.15**.

Figure 10.15



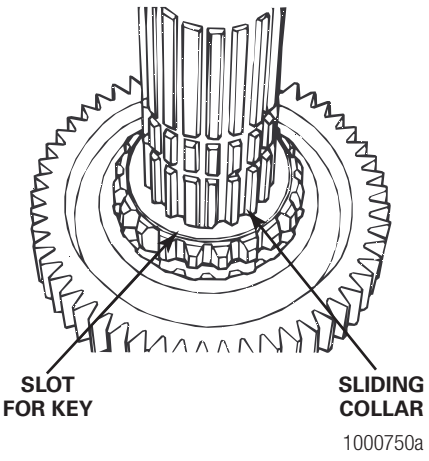
30. Install two small feeler gauges between the hubs. Each gauge must be opposite the other. The clearance must be 0.006-0.012-inch (0.152-0.304 mm). **Figure 10.16**.
    - **If clearance is less than 0.006-inch (0.152 mm):** Install a thinner selective thrust washer into the second or third gear.
    - **If clearance is more than 0.012-inch (0.304 mm):** Install a thicker selective thrust washer.

Figure 10.16



31. Remove the screwdrivers and feeler gauges.
32. Install the sliding collar onto the mainshaft. The slot in the collar must be installed over the key. **Figure 10.17**.

Figure 10.17



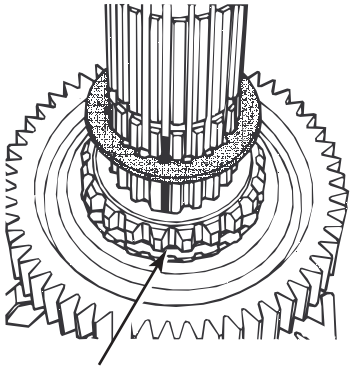
CAUTION

Ensure that the selective washers do not move when you remove the key. If the washers move, the gears will fall. Damage to components can result.

33. Choose the correct selective thrust washer for the third or overdrive gear. Refer to the following procedures.
    - **If the selective washers are not replaced:** Use the original washers.
    - **If the selective washers are replaced:** Install the medium-size washer.
    - **For transmissions with serial numbers LB93021753 and BELOW:** Use a 0.215-inch (5.50 mm) washer.
    - **For transmissions with serial numbers LB93021754 and ABOVE:** Use a 0.272-inch (6.90 mm) washer.

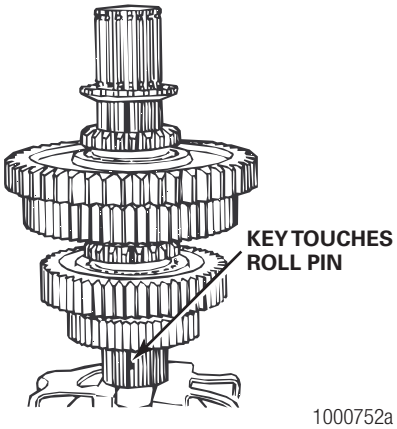
34. Remove the key. Install the selective thrust washer for the Reverse gear. Refer to the following procedure. **Figure 10.18**.
    A. Install the washer onto the shaft. The smooth side should be TOWARD you.
    B. Slide the washer to the fifth groove above the roll pin.
    C. Move the washer so that the washer teeth are directly over the mainshaft splines. The washer must not slide down the mainshaft.

Figure 10.18



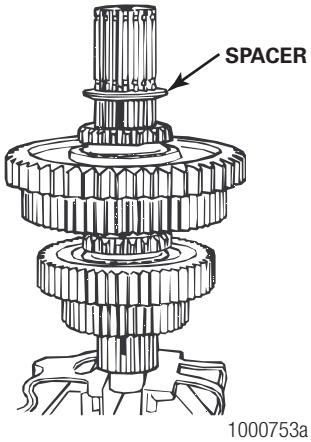
35. Install the key into the slot where the roll pin is installed. Verify that the key touches the roll pin. **Figure 10.19**.

Figure 10.19



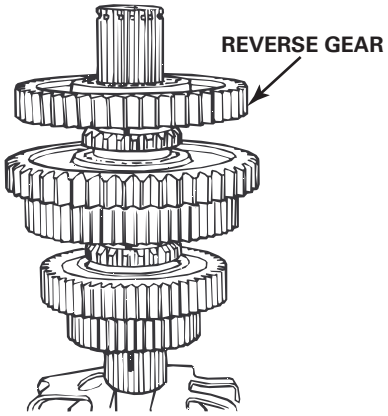
36. Install the spacer on TOP of the washer. **Figure 10.20**.

Figure 10.20



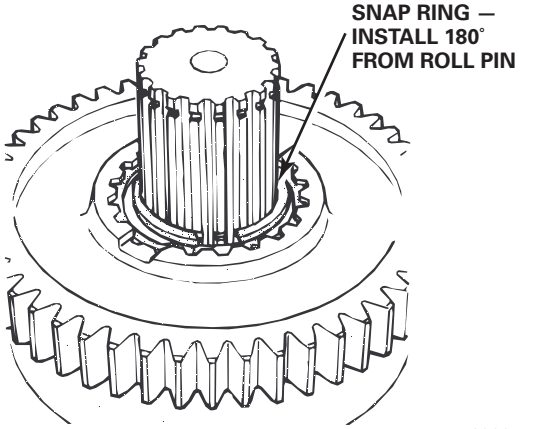
37. Install the reverse gear onto the shaft. The gear splines must engage the spacer teeth. The snap ring must be against the spacer. **Figure 10.21**.

Figure 10.21



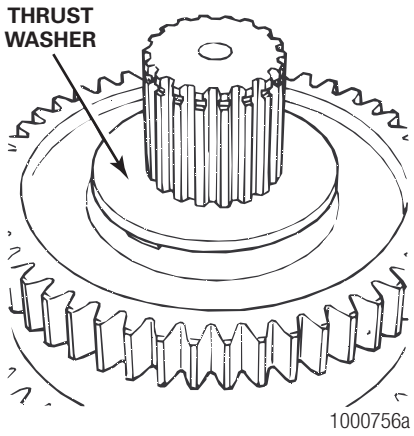
38. Install the snap ring into the second snap ring groove from the TOP of the mainshaft. The snap ring opening must be opposite, 180 degrees, the key. **Figure 10.22**.

Figure 10.22



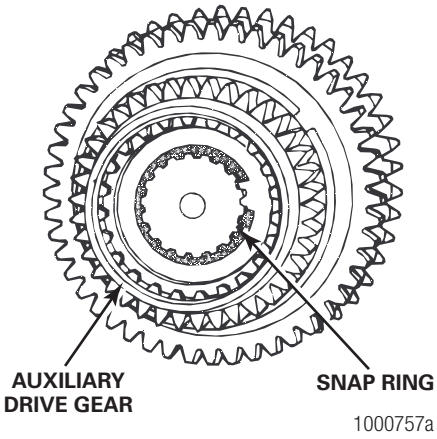
39. Install the thrust washer for the auxiliary drive gear onto the mainshaft in the second groove from the TOP of the mainshaft. **Figure 10.23**.

Figure 10.23



40. Install the auxiliary drive gear assembly onto the mainshaft. Install the bearing TOWARD the mainshaft. **Figure 10.24**.

Figure 10.24



41. Install the snap ring that secures the auxiliary drive gear to the mainshaft. **Figure 10.24**.

42. Use the following procedure to check the clearance between the auxiliary drive gear and the reverse gear.

    A. Lift on the auxiliary drive gear and push on the reverse gear. The auxiliary gear must be parallel to the reverse gear. Check that the snap rings are installed correctly. **Figure 10.25**.

    B. Install two feeler gauges between the hubs. The clearance must be 0.006-0.012-inch (0.152-0.304 mm). **Figure 10.26**.

    - **If the clearance is less than 0.006-inch (0.152 mm):** Install a thinner selective washer into the reverse gear.
    - **If the clearance is more than 0.012-inch (0.304 mm):** Install a thicker selective washer into the reverse gear.

Figure 10.25

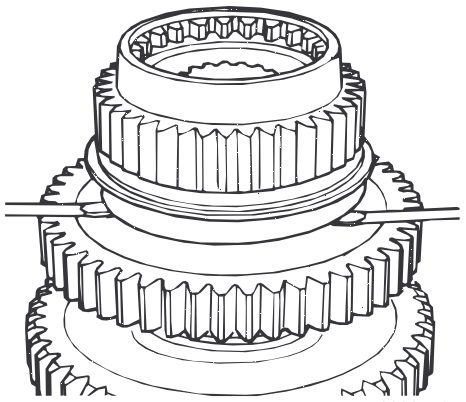


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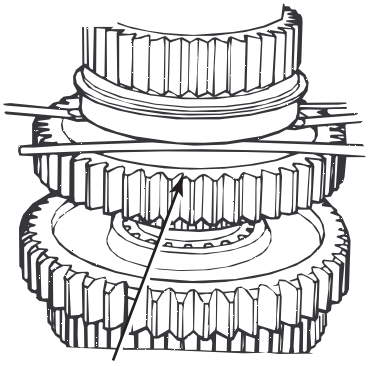
Figure 10.26



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CAUTION

Take care when you remove the mainshaft assembly from the vise. Gear movement can damage the washers.

43. Remove the mainshaft assembly from the vise.

44. Install the sliding collar over the roll pin on the TOP of the mainshaft.

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Overhaul

NOTE: Use the same procedures to service both the upper and lower main countershafts.

1. If necessary, use one of the following procedures to remove the FRONT and REAR countershaft bearings.
   A. **Puller Method/Rear Countershaft Bearing:** Place a step plate onto the countershaft. Install a puller tool so that the puller jaws are under the cone race. Remove and discard the cone. **Figure 11.1**.
   B. **Press Method/FRONT Countershaft Bearing:** Follow Steps 2 and 3 below.
   C. **Press Method/REAR Countershaft Bearing:** Install a splitter tool under the cone race. Support the countershaft on the splitter tool. Install a sleeve that fits the inside diameter of the countershaft. Press the countershaft from the cone. Discard the cone. **Figure 11.2**.

Figure 11.1

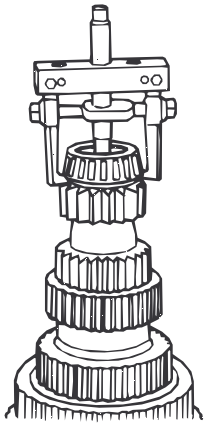

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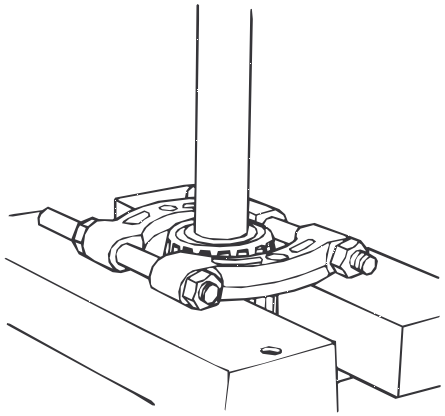
Figure 11.2



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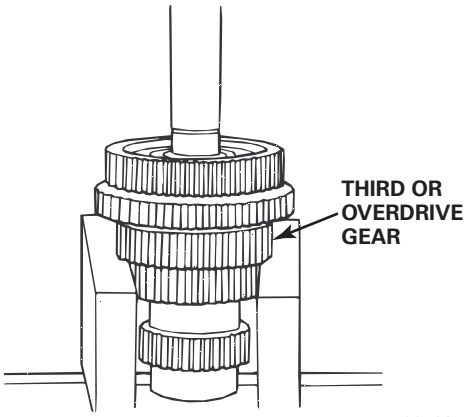
2. Place the countershaft in a press so that the main drive gear is toward the TOP of the press. Support the countershaft on the third or overdrive gear assembly. **Figure 11.3**.

Figure 11.3



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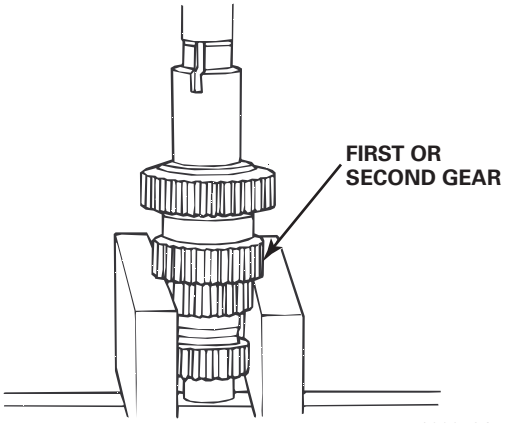
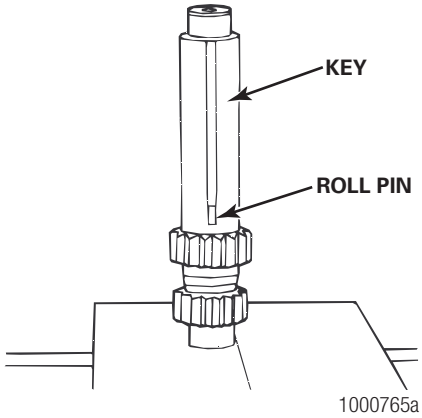
3. Install a sleeve on TOP of the shaft. Press the shaft from the third or the overdrive gear, the PTO gear and the main drive gear. **Figure 11.3**.
4. Support the countershaft on the first or second gear. Install a sleeve on the shaft. Press the shaft from the second or third gear, and the first and second gear. **Figure 11.4**.

Figure 11.4



5. Remove the key from the groove in the shaft. **Figure 11.5**.
6. Inspect all parts for wear and damage.

Figure 11.5



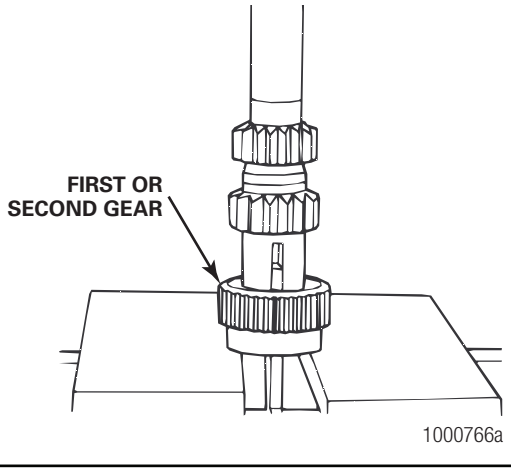
Assembly

Upper and Lower Main Countershafts

NOTE: Use the same procedures to service both the upper and lower main countershafts.

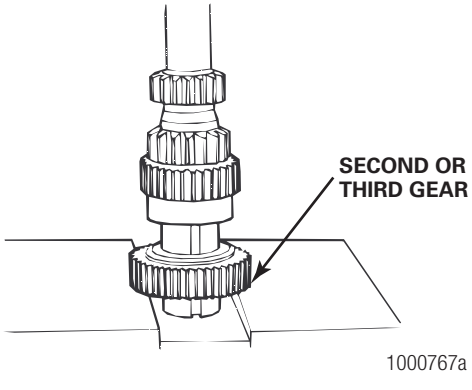
1. Lubricate all parts with new oil that is used in the transmission.
2. Use a punch and hammer to install the key into the groove.
3. Place the first or the second gear on a press, so that the hub is toward the BOTTOM of the press. The slot in the gear must align with the key in the shaft.
4. Install a sleeve on top of the countershaft. Press the shaft until the first gear touches the countershaft gear. **Figure 11.6**.

Figure 11.6



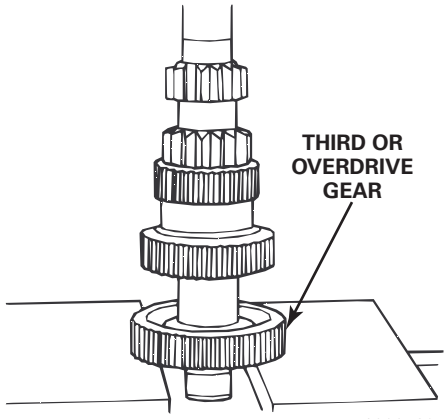
5. Place the second or third gear on a press. Install the shaft into the gear. The slot in the gear must align with the key in the shaft.
6. Install a sleeve on the countershaft. Press the shaft until the second gear hub touches the first gear hub. **Figure 11.7**.

Figure 11.7



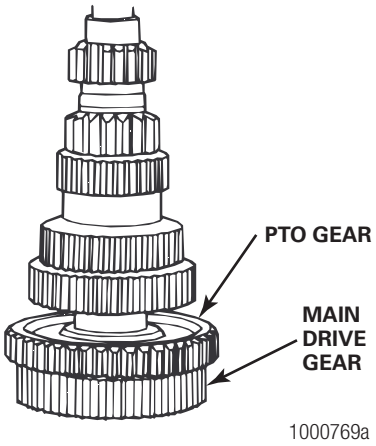
7. Install the third or overdrive gear on a press, so that the hub is away from the TOP of the press. Install the shaft into the gear. The slot in the gear must align with the key in the shaft.
8. Install a sleeve on the countershaft. Press the shaft until the third gear hub touches the second gear hub. **Figure 11.8**.

Figure 11.8



9. Install the PTO gear onto the press, so that the chamfered side of the teeth is toward the TOP of the press. The slot in the gear must align with the key in the shaft.
10. Press the PTO gear onto the shaft, until the PTO hub touches the third or overdrive gear hub.
11. Install the main drive gear onto a press, so that the large gear hub is TOWARD the PTO gear. Install the shaft into the gear. The slot in the gear must align with the key in the shaft.
12. Install a sleeve on the top of the shaft. Press the shaft into the gear, until the main drive gear hub touches the PTO gear hub. **Figure 11.9**.

Figure 11.9

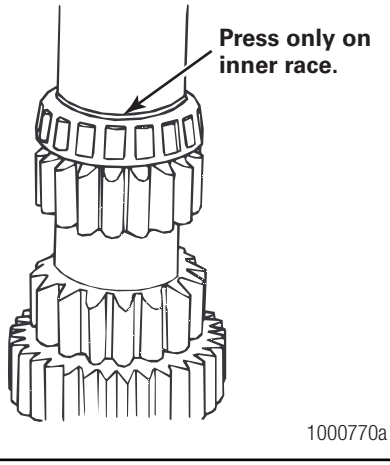


CAUTION

Use the bearing inner race when you install the bearing cones. If you apply pressure to the bearing cage, damage to the bearing can result.

13. Use one of the following procedures to install the front and rear countershaft bearing cones.
    A. Use a sleeve or bearing installation tool to install the cones. The bottoms of the cones must touch the shoulder on the shaft. **Figure 11.10**.
    B. Use a bearing heater to install the cones onto the countershaft. The bottoms of the cones must touch the shoulder on the shaft.

Figure 11.10



Section 12
Main Countershaft End Play Adjustment

WARNING

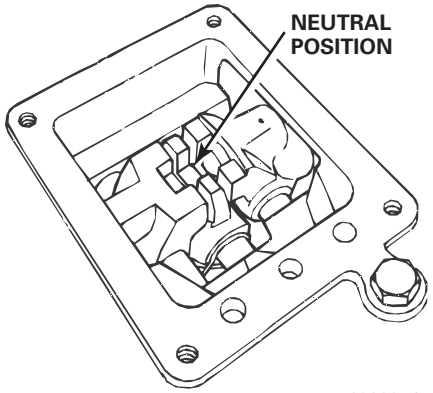
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Check and Adjust End Play

NOTE: Check end play on one countershaft at a time.

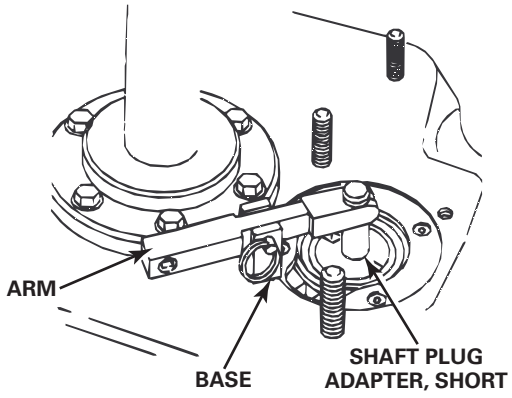
1. Place the transmission into Neutral. **Figure 12.1**.

Figure 12.1



2. Use the following procedure to install a countershaft end play checking tool, Meritor part number 3256-C-1043, or Kent-Moore tool number J-41335, onto the upper countershaft. To obtain these tools, refer to the Service Notes page on the front inside cover of this manual.
   A. Place the shaft plug adaptor into position on the countershaft. Install and tighten the screws that secure the adaptor to the countershaft. **Figure 12.2**.
   B. Install the short shaft plug with 5/16-inch threads into the adaptor. Tighten the plug.
   C. Install the 3/8-inch base into one of the clutch housing mounting holes.
   D. Install the actuator arm so that the forked end of the arm is in the shaft plug groove.
   E. Align the holes in the actuator arm with the hole in the base. Install the pivot pin.

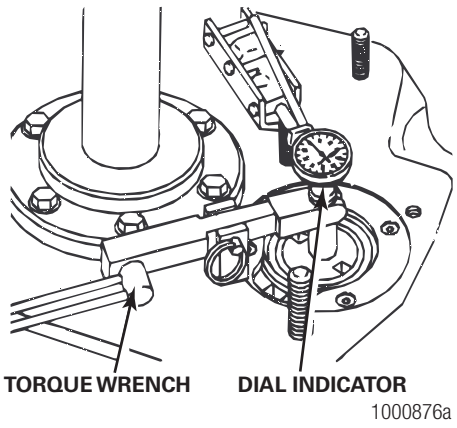
Figure 12.2



NOTE: When the dial indicator and countershaft end play checking tool are installed correctly, runout measurement will not occur when you rotate the output shaft. If runout occurs, check that the tip of the dial indicator aligns with the alignment mark on the shaft plug.

3. Install a dial indicator so that the tip of the indicator is in the CENTER of the shaft plug. The tip of the dial indicator must also align with the alignment mark on the shaft plug. **Figure 12.3**.

Figure 12.3

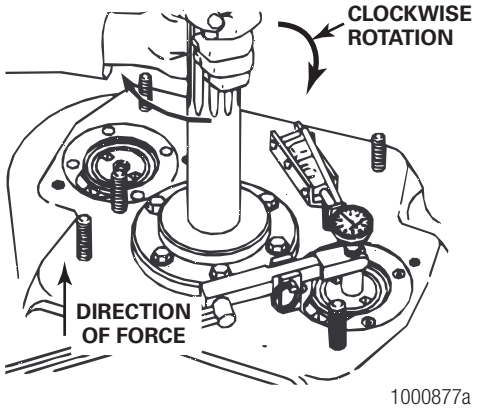


4. Install a torque wrench into the end of the actuator arm. Check that the torque wrench is in a straight line with the actuator arm. **Figure 12.3**.

5. Use the following procedure to measure UPPER countershaft end play.

   A. Use the torque wrench to apply a force of 25 lb-ft or 300 lb-in (34 N•m) in one direction. **Figure 12.4**.

Figure 12.4



   B. Place reference marks on the input shaft and main case.

NOTE: When you rotate the input shaft in this procedure, the starting and stopping positions must be in the same location.

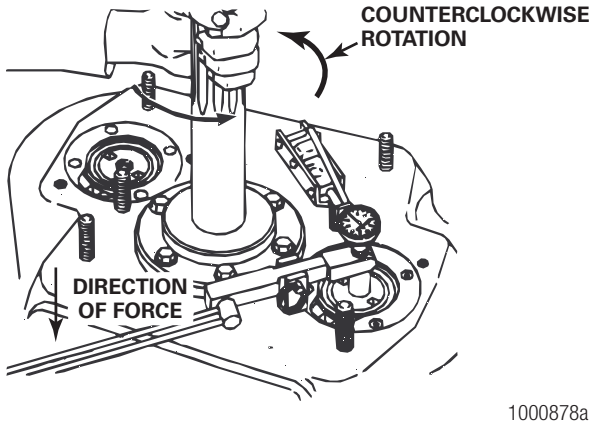
   C. Rotate the input shaft at least four complete turns in a CLOCKWISE direction. Check that the starting and stopping positions are in the same location. **Figure 12.4**.

   D. Set the dial indicator to ZERO.

   E. Change the direction of force applied in Step A to the opposite direction.

   F. Rotate the input shaft at least four complete turns COUNTERCLOCKWISE. Check that the starting and stopping positions are in the same location. **Figure 12.5**.

Figure 12.5



   G. Record the reading on the dial indicator. The correct end play specification is 0.002-0.006-inch (0.050-0.152 mm).

Repeat Steps A-E to ensure that end play is correct.

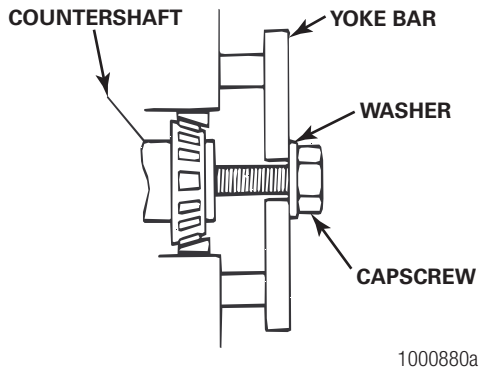
- **When end play is correct:** Go to Step 11.

6. **If the reading is less than 0.002-inch (0.050 mm), or there is no reading:** Use the following procedure to move the cup 0.125-inch (3 mm) toward the OUTER surface of the case.

   A. Remove the Allen-head capscrews. Remove the retainer.

   B. Use a yoke bar or puller bridge, washer and a 5/16-inch x 18 capscrew to move the cup. **Figure 12.6**.

Figure 12.6



C. After you move the cup, proceed to Step 10.

7. **If the reading is 0.007-0.010-inch (0.177-0.279 mm):** Use the following procedure to remove the shim.

   A. Remove the Allen-head capscrews. Remove the retainer.

   B. Remove the 0.005-inch (0.127 mm) shim, Meritor part number 2803-R-2826.

   C. Install the retainer. Install the Allen-head capscrews. Alternately and evenly tighten the capscrews to 120-140 lb-in (14-16 N•m).

   D. Repeat Steps A-E to ensure that end play is correct.

8. **If the reading is 0.012-0.014-inch (0.280-0.355 mm):** Use the following procedure to remove the shim.

   A. Remove the Allen-head capscrews. Remove the retainer.

   B. Remove the 0.075-inch (0.190 mm) shim, Meritor part number 2803-R-2827.

   C. Install the retainer. Install the Allen-head capscrews. Alternately and evenly tighten the capscrews to 120-140 lb-in (14-16 N•m).

   D. Repeat Steps A-E to ensure that end play is correct.

9. **If the reading is 0.015-0.019-inch (0.356-0.482 mm):** Use the following procedure to remove the shims.

   A. Remove the Allen-head capscrews. Remove the retainer.

   B. Remove the 0.005-inch (0.127 mm) shim, Meritor part number 2803-R-2827.

   C. Remove the 0.0075-inch (0.190 mm) shim, Meritor part number 2803-S-2827.

   D. Install the retainer. Install the Allen-head capscrews. Alternately and evenly tighten the capscrews to 120-140 lb-in (14-16 N•m).

   E. Repeat Steps A-E to ensure that end play is correct.

10. **If the reading is 0.020-inch (0.483 mm) or more:** Use the following procedure to remove the shims.

    A. Remove the Allen-head capscrews. Remove the retainer.

    B. Remove and discard all the shims, including the original shims.

    C. Install shim KIT 5364 into the bore for the FRONT countershaft bearing. Check that the oil passage slots align with the oil passage hole.

    Shim Kit Contents

Shim Size/Inch (mm)	How Many
0.0050 (0.127)	2
0.0075 (0.190)	2
0.0175 (0.444)	1
0.0325 (0.825)	1
Total Shim Pack Thickness = 0.075 (1.903)	

    D. Install the retainer for the FRONT countershaft bearings. Install the Allen-head capscrews. Alternately and evenly tighten the capscrews to 120-140 lb-in (14-16 N•m).

    E. Repeat Steps A-E to ensure that end play is correct.

    F. Refer to the Main Countershaft End Play Chart for Shim KIT 5364. Find the end play measurement you determined in **Figure 12.4**. Remove shims to obtain the specified end play of 0.002-0.006-inch (0.050-0.152 mm).

    G. Check end play again. Verify that the front cup touches the retainer. If the reading is 0.002-0.006-inch (0.050-0.152 mm), the end play is correct. Proceed to Step 11.

11. Repeat Steps A-E to check the end play of the other main countershaft.

Main Countershaft End Play Chart for Shim KIT 5364

End Play Measurement		Remove These Shims			
inches	mm	2803-R-2826 (0.0050-inch or 0.127 mm)	2803-S-2827 (0.0075-inch or 0.190 mm)	2803-W-2831 (0.0175-inch or 0.444 mm)	2803-C-2837 (0.0325-inch or 0.825 mm)
0.002-0.007	0.050-0.177	- - - -	- - - -	- - - -	- - - -
0.008-0.010	0.178-0.254	1	- - - -	- - - -	- - - -
0.011-0.012	0.255-0.304	- - - -	1	- - - -	- - - -
0.013-0.015	0.305-0.381	2	- - - -	- - - -	- - - -
0.016-0.017	0.382-0.431	1	1	- - - -	- - - -
0.018-0.020	0.432-0.508	2	- - - -	- - - -	- - - -
0.021-0.022	0.509-0.558	- - - -	- - - -	1	- - - -
0.023-0.025	0.559-0.635	2	2	- - - -	- - - -
0.026-0.027	0.636-0.685	1	1	- - - -	- - - -
0.028-0.030	0.686-0.762	- - - -	1	1	- - - -
0.031-0.032	0.763-0.812	1	- - - -	1	- - - -
0.033-0.035	0.813-0.889	1	1	1	- - - -
0.036-0.037	0.890-0.939	- - - -	- - - -	- - - -	1
0.038-0.040	0.940-1.016	2	1	1	- - - -
0.041-0.042	1.017-1.066	1	- - - -	- - - -	1
0.043-0.045	1.067-1.143	- - - -	1	- - - -	1
0.046-0.047	1.144-1.193	2	- - - -	- - - -	1
0.048-0.050	1.194-1.270	1	1	- - - -	1
0.051-0.052	1.271-1.320	- - - -	1	- - - -	2
0.053-0.055	1.321-1.397	- - - -	- - - -	1	1
0.056-0.057	1.398-1.447	1	2	- - - -	1
0.058-0.060	1.448-1.524	1	- - - -	1	1
0.061-0.062	1.525-1.574	- - - -	1	1	1
0.063-0.065	1.575-1.651	2	- - - -	1	1
0.066-0.067	1.652-1.701	1	1	1	1
0.068-0.070	1.702-1.778	- - - -	2	1	1
0.071-0.072	1.779-1.828	2	1	1	1
0.073-0.075	1.829-1.905	1	2	1	1
0.076 and above	1.906 and above	2	2	1	1

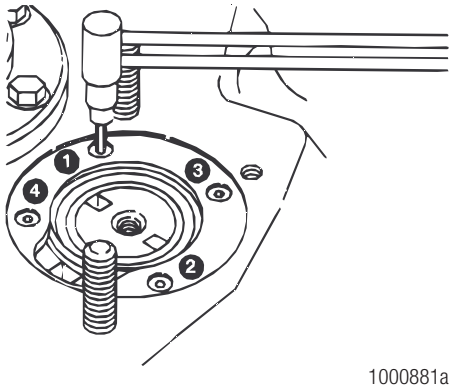
12. **When end play is 0.002-0.006-inch (0.050-0.152 mm) on each countershaft:** Use the following procedure.

    A. Remove the Allen-head capscrews that secure the retainer to the main case.

    B. Apply Loctite® 222 Threadlocker or equivalent to the capscrew threads.

    C. Install the capscrews. Alternately and evenly tighten the capscrews to 120-140 lb-in (14-16 N•m). **Figure 12.7**.

Figure 12.7



    D. Repeat Steps A-E to verify that end play is correct.

    - **If end play is correct:** Return to Install the Mainshaft in Section 9.
    - **If end play is not correct:** Repeat the adjustment procedure.

⚠ WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Removal

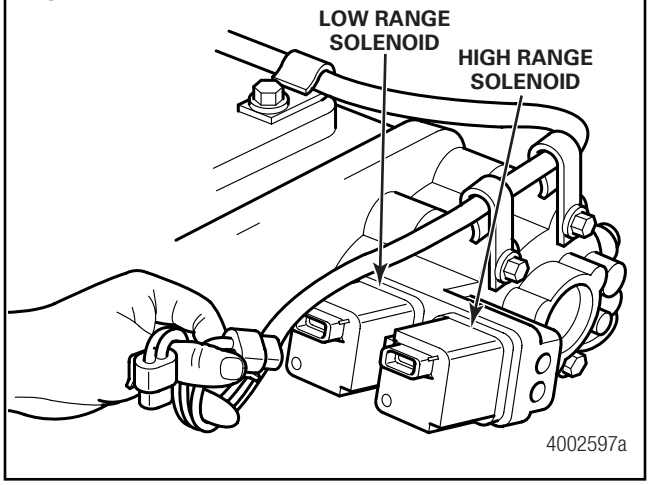
NOTE: You can remove the auxiliary case from the transmission without removing the entire transmission from the vehicle. If it is necessary to remove the transmission, refer to the vehicle manufacturer's recommendations and to Maintenance Manual 26A. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.

1. Park the vehicle on a level surface. Place the transmission in low gear. Turn the engine OFF.
2. Block the wheels to prevent the vehicle from moving.
3. Place a large container under the transmission. Remove both drain plugs. Drain and discard the oil. Use correct disposal procedures.

NOTE: Remove the output yoke only when you replace the seal, or when removing the yoke is necessary for the repair.

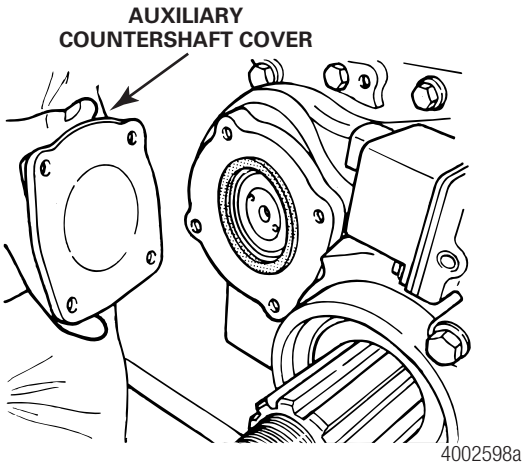
4. Remove the output yoke, if necessary.
5. Disconnect and mark the wiring from the high and low solenoids. **Figure 13.1**.

Figure 13.1



6. Disconnect the air supply line from the piston housing.
7. Disconnect the wiring harness from the speed sensor.
8. Use a 9/16-inch wrench to remove the capscrews from the auxiliary countershaft covers. **Figure 13.2**.

Figure 13.2



9. Remove the covers.

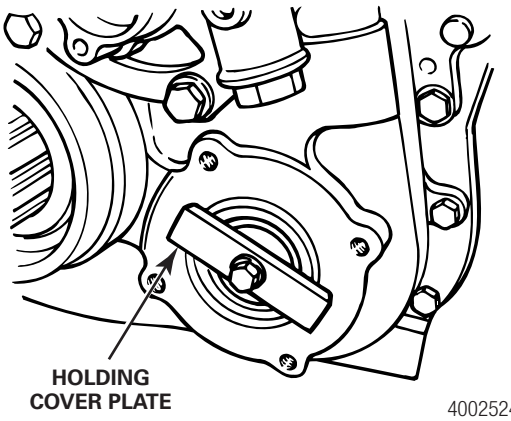
⚠ CAUTION

Install holding cover plates or lift brackets onto the auxiliary case and main case countershafts to prevent the countershafts from falling when you remove the case. Damage to components can result.

NOTE: A holding cover template is included in Section 21 of this manual.

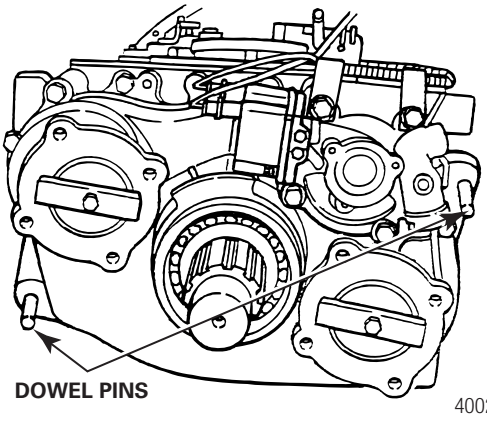
10. Install holding cover plates onto each countershaft. Use one of the auxiliary case cover capscrews to fasten the holding cover plates to the countershafts. **Figure 13.3**.

Figure 13.3



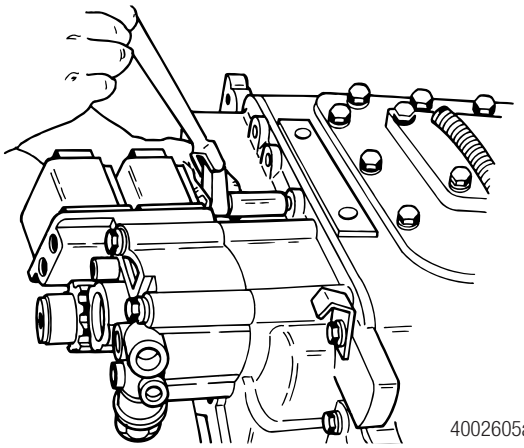
11. Check the dowel pins for damage. Replace damaged pins after you remove the auxiliary case. **Figure 13.4**.

Figure 13.4



12. Clean the dowel pins. Remove paint, rust and dirt from the pins, so that you can easily remove the auxiliary case.
13. Lubricate the dowel pins with new transmission oil.
14. Use a 9/16-inch wrench to remove the mounting capscrews and washers from the auxiliary case. **Figure 13.5**.

Figure 13.5



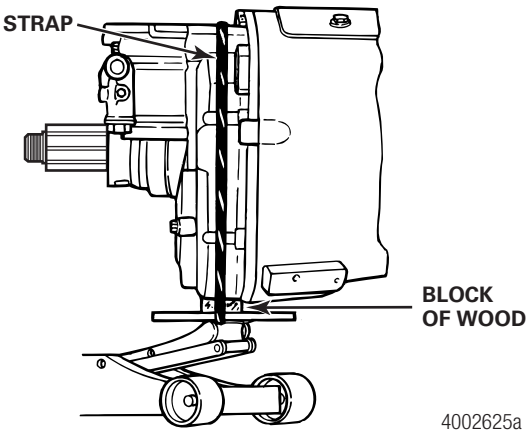
WARNING

Support the auxiliary case with a transmission jack or chain fall when you remove the auxiliary case from the transmission. Without support, the auxiliary case can fall from the transmission. Serious personal injury and damage to components can result.

NOTE: You can use a chain fall to support the auxiliary case on cab-over-engine vehicles.

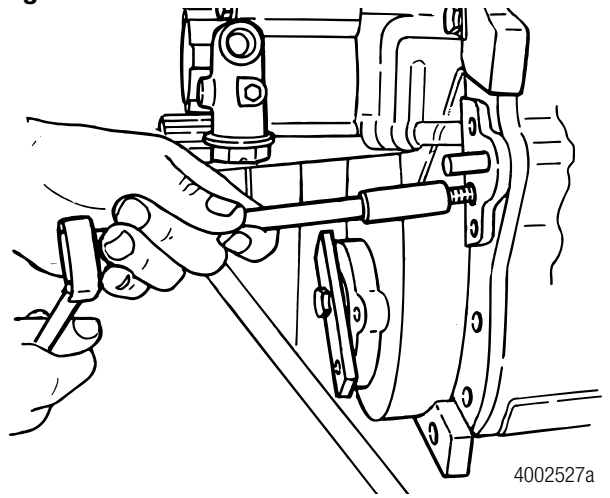
15. Support the auxiliary case with a transmission jack or chain fall. Place a block of wood between the auxiliary case and the jack. **Figure 13.6**.

Figure 13.6



16. Use a strap to secure the auxiliary case to the jack. **Figure 13.6.**
17. Clean the puller holes in the auxiliary case.
18. Install 3/8-16-inch x 1-1/2-inch UNC capscrews into the three puller holes. Evenly tighten each capscrew to separate the auxiliary case from the main case. **Figure 13.7**.

Figure 13.7



19. Remove the auxiliary case.

If the Auxiliary Case Is Difficult to Remove

WARNING

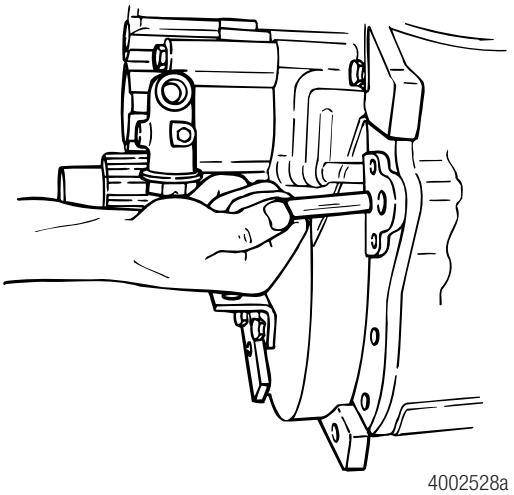
When you use a hammer and steel drift, verify that the tools are in good condition. Do not use worn or damaged tools, which can break or shatter components. Serious personal injury can result.

CAUTION

If you remove dowel pins when you disassemble the auxiliary case, you must discard the pins when you remove them from the case. Install new pins when you reassemble the auxiliary case to prevent damage to components.

1. Secure the auxiliary case.
2. Use a hammer and steel drift to remove both of the dowel pins from the auxiliary and main cases. Drive the dowel pins TOWARD the yoke.
3. Discard the dowel pins. **Figure 13.8.**

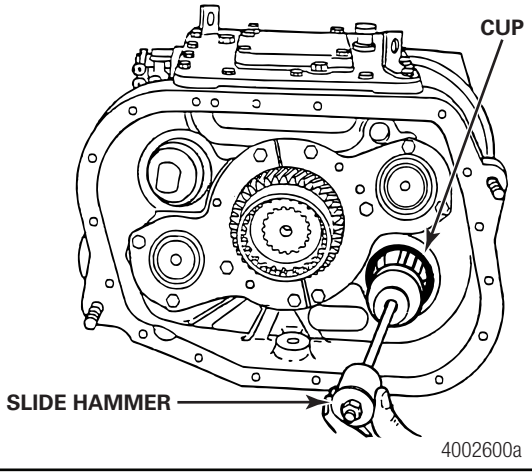
Figure 13.8



If You Are Replacing the Bearing Cups and Cones

1. Use a slide hammer and puller to remove the auxiliary countershaft bearing cups from the main case. **Figure 13.9**.

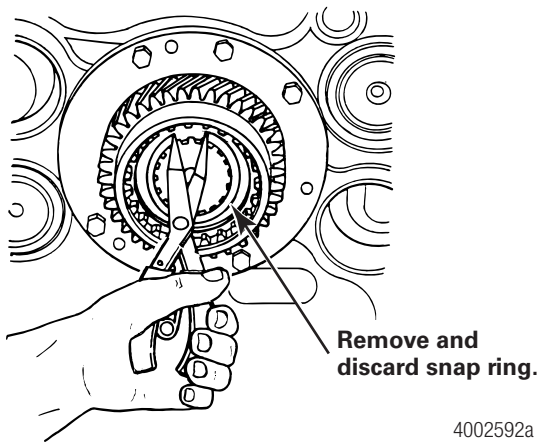
Figure 13.9



2. Remove the capscrews that fasten the auxiliary drive bearing retainer to the transmission case.

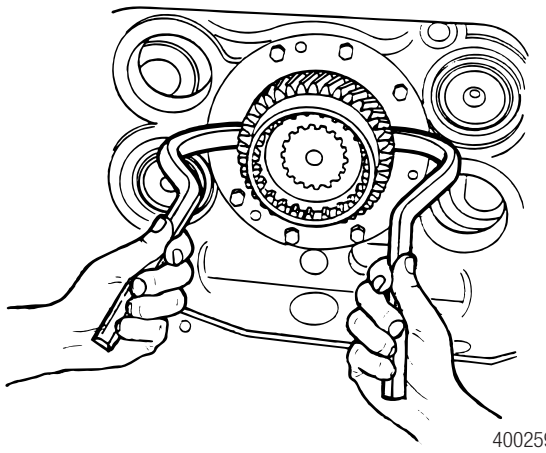
3. Remove and discard the snap ring that fastens the auxiliary drive gear to the mainshaft. **Figure 13.10**.

Figure 13.10



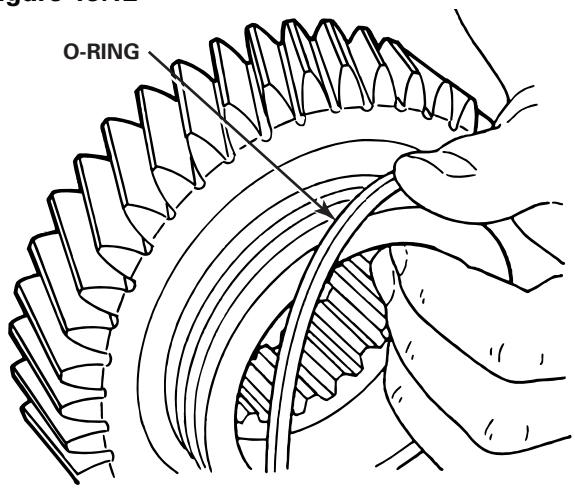
4. Use a pry bar to separate the auxiliary drive gear from the mainshaft.
5. Remove the gear.
   - **If a two-piece retainer is used for the auxiliary drive gear:** Use pry bars to separate the auxiliary drive gear from the mainshaft. **Figure 13.11**. Remove the gear. Remove the two-piece retainer.

Figure 13.11

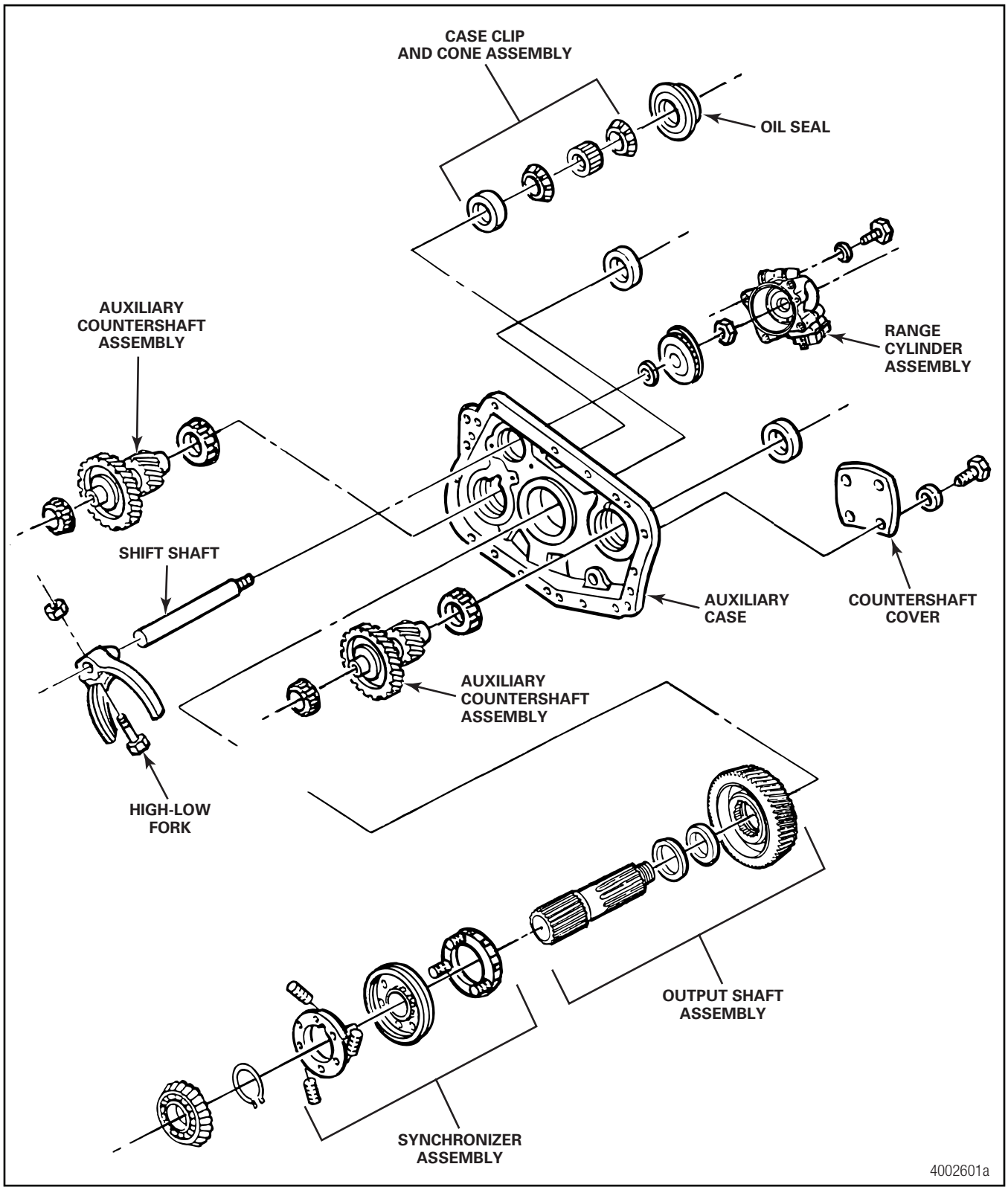


6. Remove and discard the two O-rings from the gear. **Figure 13.12**.

Figure 13.12



Disassembly

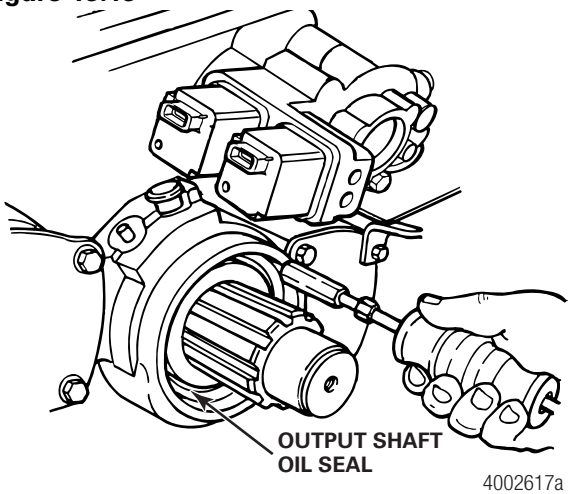


CAUTION

When you disassemble the auxiliary case, you must discard the output shaft oil seal when you remove it from the retainer. Install a new seal when you reassemble the auxiliary case. Do not reuse the seal. Lubricant can leak from the seal and damage components.

1. Use a slide hammer to remove the output shaft oil seal from the retainer. **Figure 13.13**.

Figure 13.13

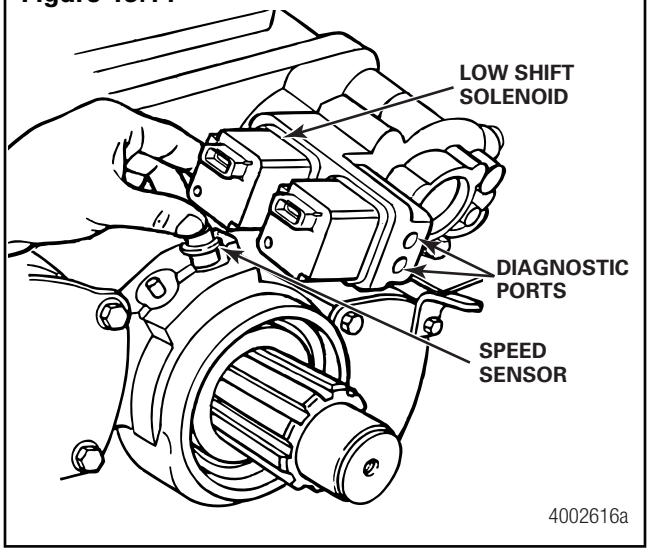


2. Discard the seal. Use a new seal when you reassemble the auxiliary case.
3. If you will service the output shaft, remove the speed sensor from the output bearing housing.

NOTE: Remove the high and low shift solenoids only if you will replace the solenoids or service a 12 o'clock-position speed sensor.

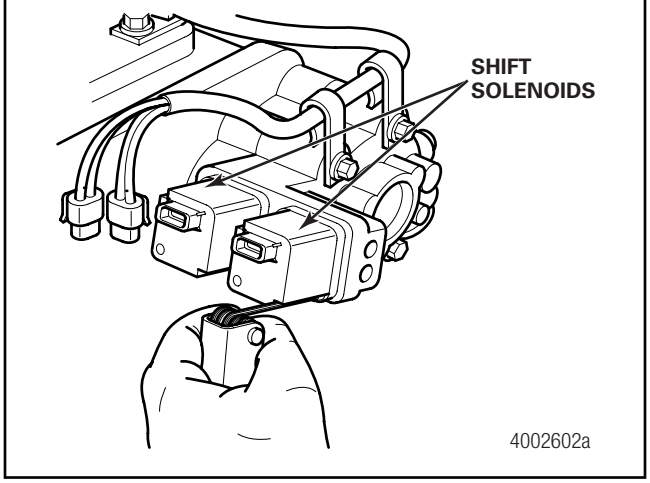
4. To remove the 12 o'clock-position speed sensor, you must first remove the low shift solenoid. **Figure 13.14**.

Figure 13.14



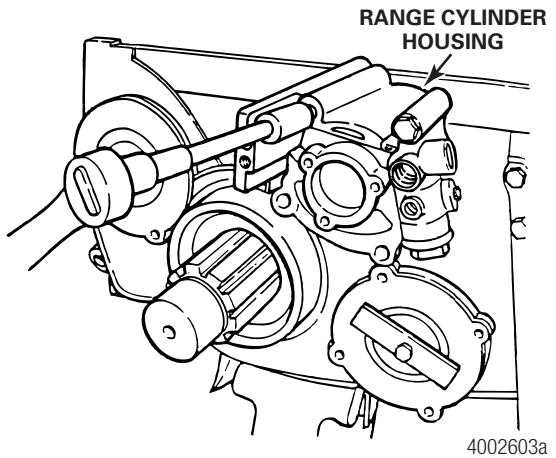
5. Only remove the high and low shift solenoids when you will perform one of the following procedures:
   A. Replace the high and low shift solenoids. **Figure 13.15**.
   B. Service the 12 o'clock-position speed sensor.

Figure 13.15



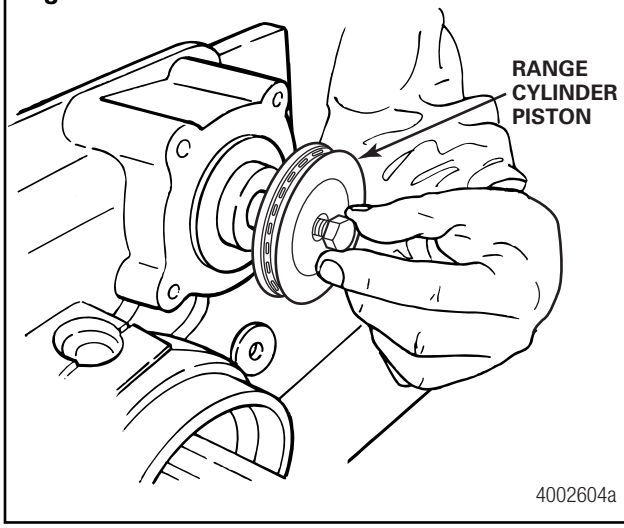
6. Use a 9/16-inch wrench to remove the mounting screws from the range cylinder housing. **Figure 13.16**.

Figure 13.16



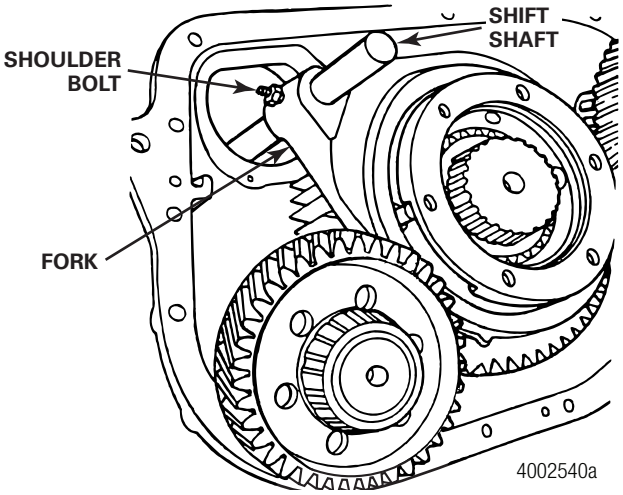
7. Remove the range cylinder housing from the auxiliary case.
8. Inspect the range cylinder housing, especially the bore, for wear and damage.
   - **If the bore is worn or damaged:** Replace the piston and housing as an assembly.
9. Discard the range cylinder housing O-ring.
10. Use an 11/16-inch wrench to remove the nut that secures the piston to the high-low shaft. **Figure 13.17**.

Figure 13.17



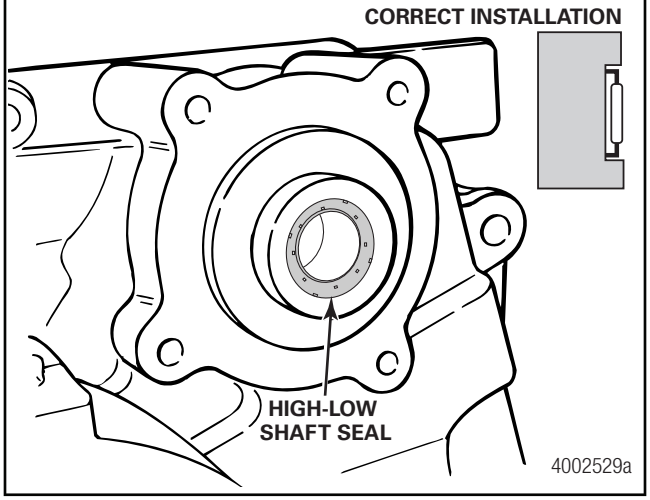
11. Remove the piston from the shaft.
12. Inspect the piston, especially the outer diameter, for wear and damage.
    - **If the piston is worn or damaged:** Replace the piston and the range cylinder housing as an assembly.
13. Remove the shoulder bolt and the nut that fastens the high-low fork to the shift shaft. **Figure 13.18**.

Figure 13.18



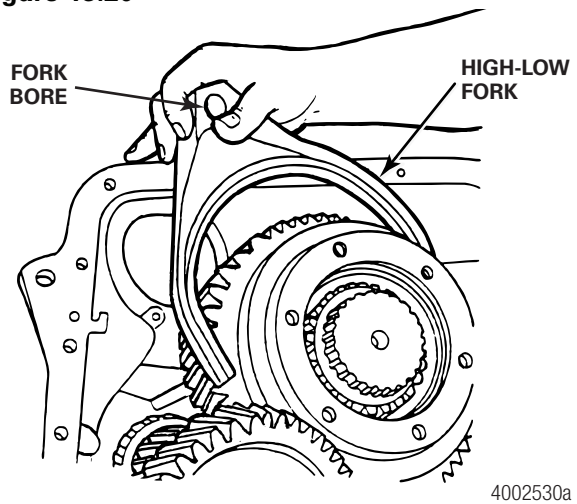
14. Use a 9/16-inch wrench to remove the high-low shaft from the high-low fork.
15. Remove the high-low shift shaft seal. Discard the seal. **Figure 13.19**.

Figure 13.19



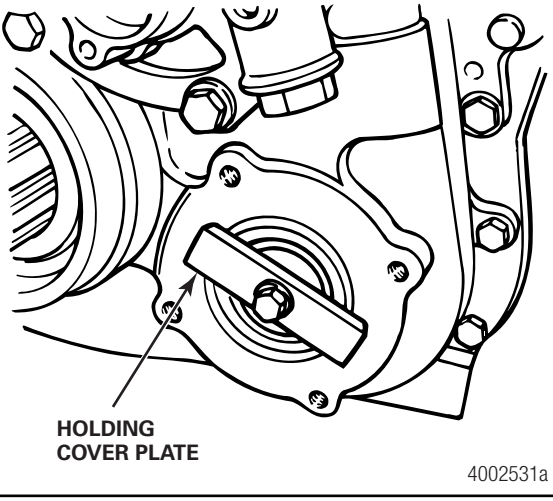
16. Remove the high-low fork from the synchronizer collar. **Figure 13.20**.

Figure 13.20



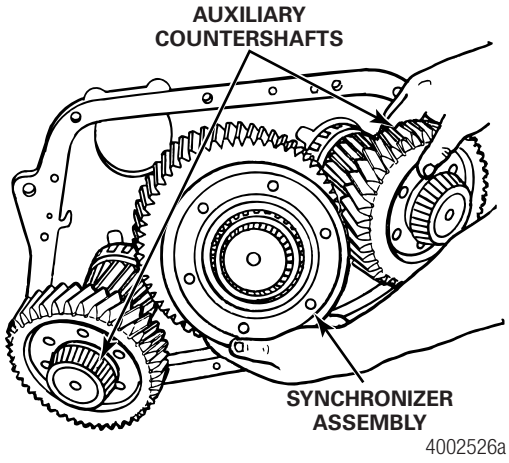
17. Remove the holding cover plates from the first auxiliary countershaft. **Figure 13.21**. Remove the spacer washers from the countershaft.

Figure 13.21



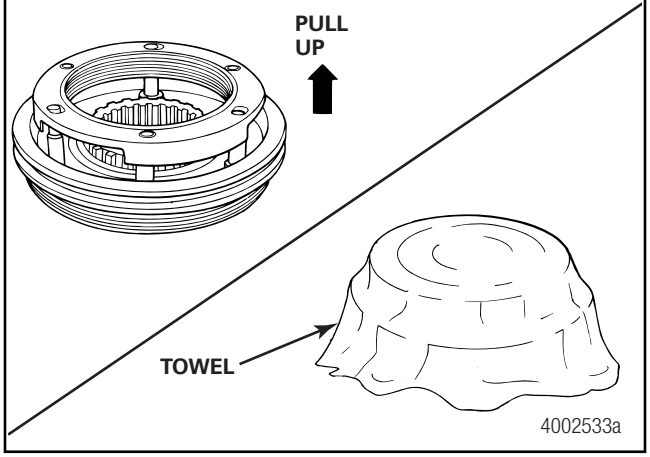
18. Mark the spacer washers so that you can reinstall them onto the same countershaft during reassembly.
19. Use the procedures above to remove the cover plate on the second auxiliary countershaft.
20. Spread the UPPER and LOWER auxiliary countershafts. **Figure 13.22**.

Figure 13.22



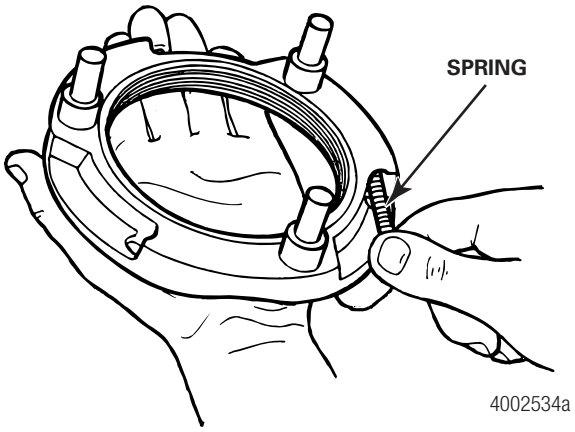
21. Remove the synchronizer assembly from the output shaft. **Figure 13.22**.
    - **If the synchronizer assembly is worn or damaged:** Disassemble the assembly. Refer to Steps 23-26 below.
    - **If you are only servicing the synchronizer:** Temporarily install the holding cover plates to support the countershafts and prevent bearing damage.
22. Mark the countershaft bearing cups for reassembly with the same cone.
23. Pull UP on the high synchronizer to separate it from the low synchronizer. Place a towel over the synchronizers to prevent the springs from releasing suddenly. **Figure 13.23**. Take care that you do not lose the springs.

Figure 13.23



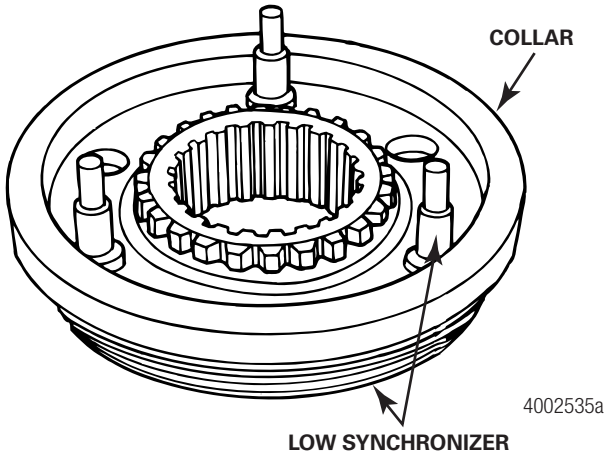
24. Use a punch to loosen the bearing cups and cones. Remove the upper and lower auxiliary countershafts from the cover.
    - **Alternate method:** Use a punch to drive the output shaft FORWARD until there is clearance between the bearing cone and low range gear.
25. Remove the springs from the high synchronizer. **Figure 13.24**.

Figure 13.24



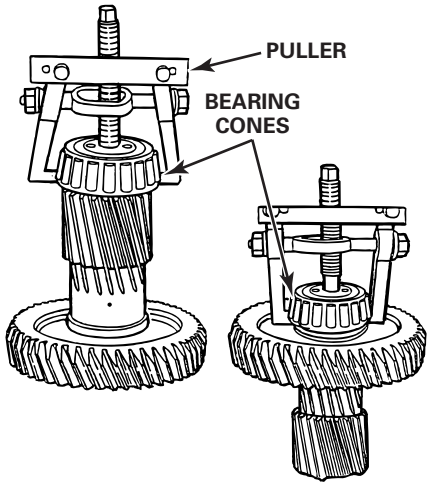
26. Remove the collar from the low synchronizer. **Figure 13.25**.

Figure 13.25



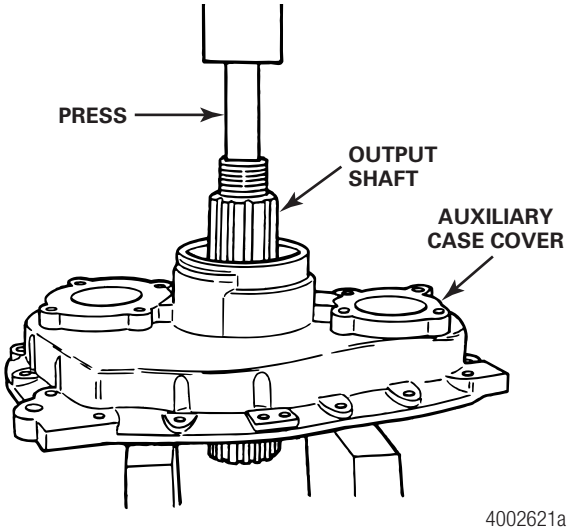
27. Check the FRONT and REAR bearing cones in the UPPER and LOWER auxiliary countershafts.
    - **If a FRONT or REAR bearing cone is damaged:** Use a puller to remove the damaged bearing cone from the auxiliary countershaft. The jaw of the puller must be under the bearing races. **Figure 13.26**. Discard the cone and its cup.

Figure 13.26



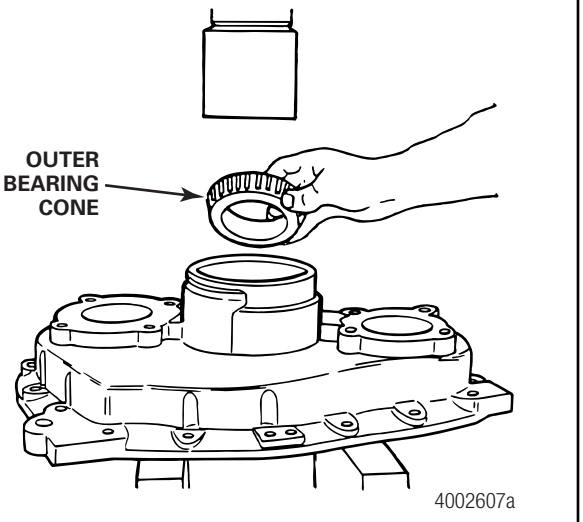
28. If the output shaft bearings require service, follow these procedures to remove the output shaft and low gear assembly from the auxiliary cover. **Figure 13.27**.
    A. Use a press to support the low gear auxiliary cover. The output shaft must be toward the TOP of the press.
    B. Place a sleeve on TOP of the output shaft. Press the output shaft from the low gear assembly and the cover.

Figure 13.27



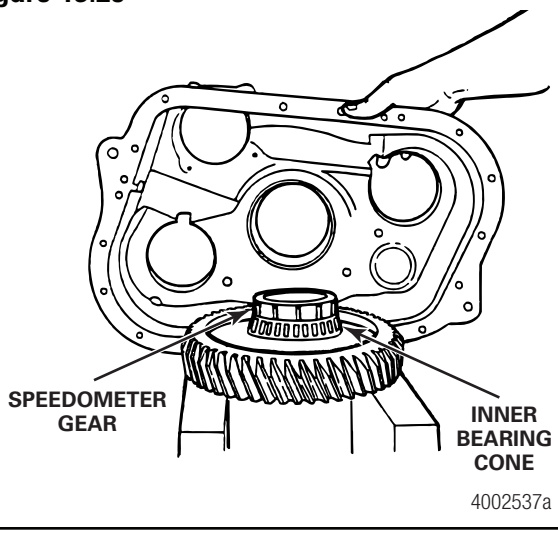
29. Remove the outer bearing cone from the cover. **Figure 13.28**.

Figure 13.28



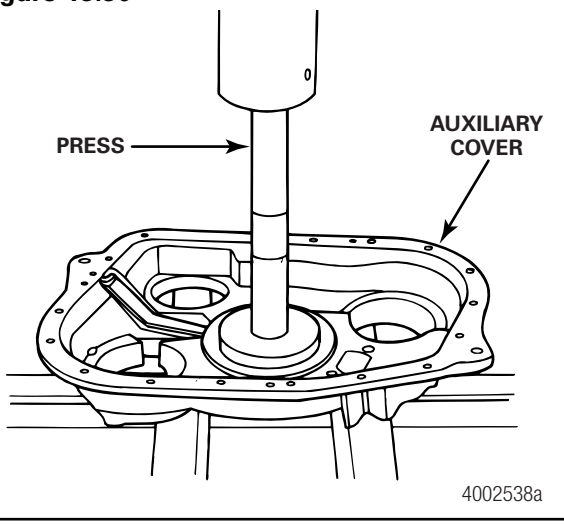
30. Remove the cover from the press. **Figure 13.29**.

Figure 13.29



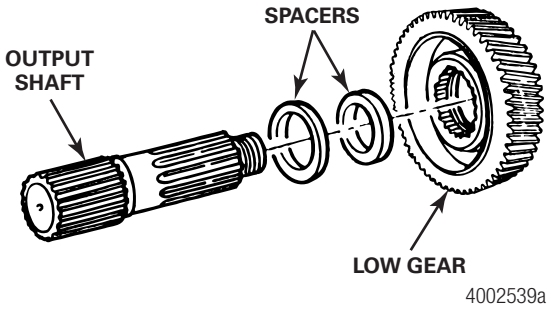
31. Remove the speedometer gear and INNER bearing cone from the low gear. **Figure 13.29**.
32. Follow these procedures to remove the output shaft INNER and OUTER bearing cups from the auxiliary cover. **Figure 13.30**.
    A. Support the auxiliary case. The INNER surface of the auxiliary case must be toward the TOP of the press.
    B. Place a sleeve on the OUTER race of the INNER bearing cup.
    C. Press the INNER and OUTER bearing cups from the cover. Discard the cups.

Figure 13.30

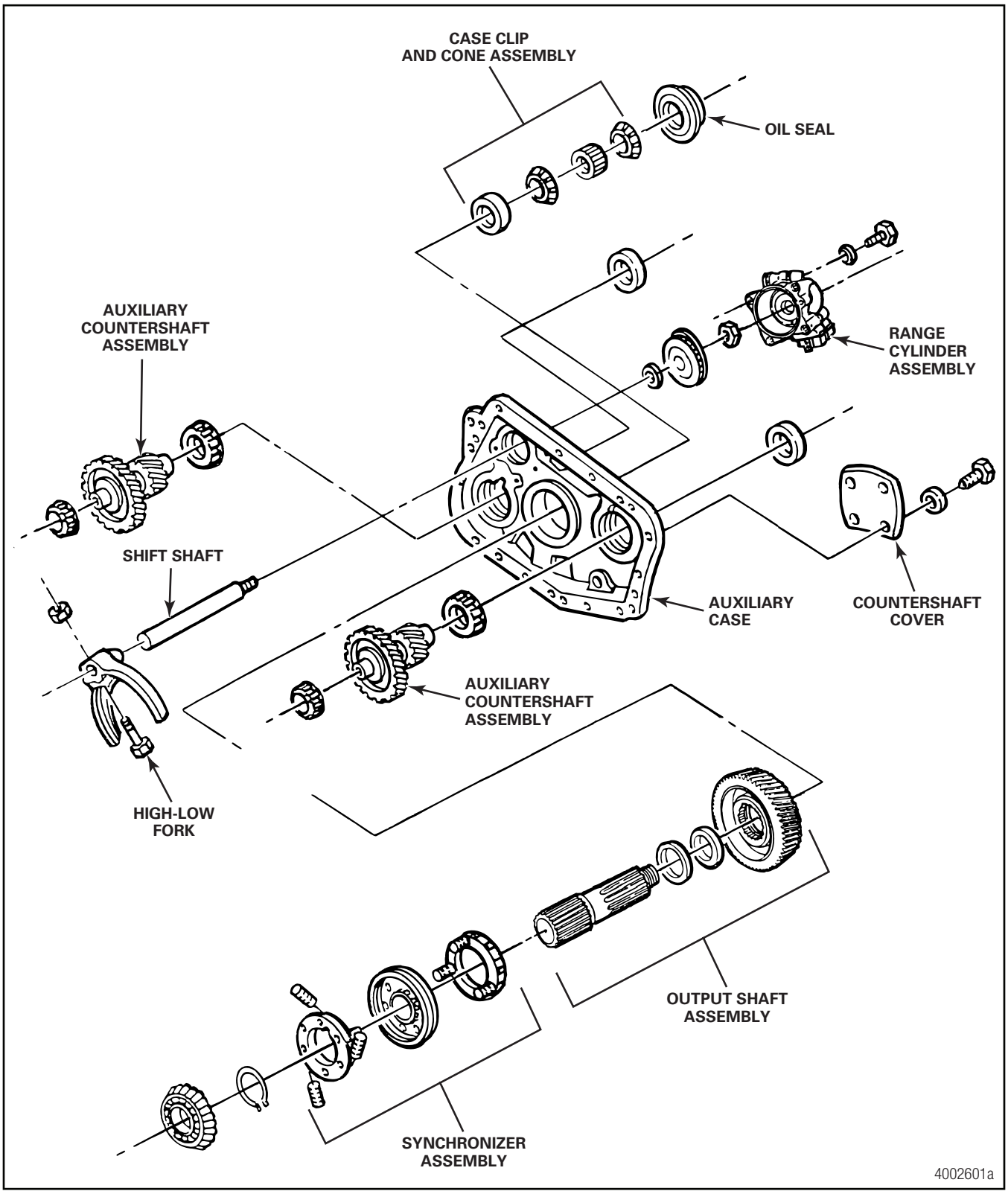


33. Remove the two spacers from the top of the output shaft. **Figure 13.31**.
34. Inspect all parts for wear and damage.
35. Use a scraper to remove the gasket material on the auxiliary case, main case and countershaft covers.

Figure 13.31

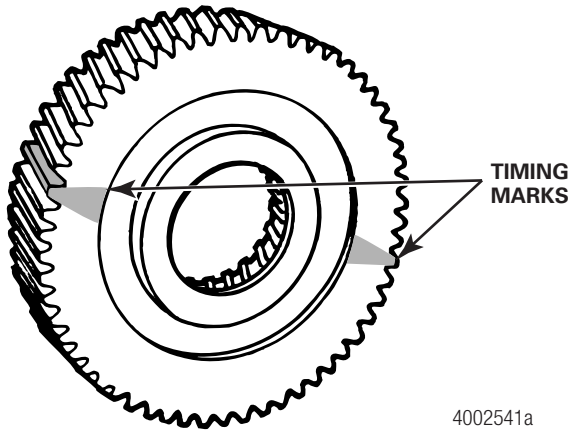


Assembly



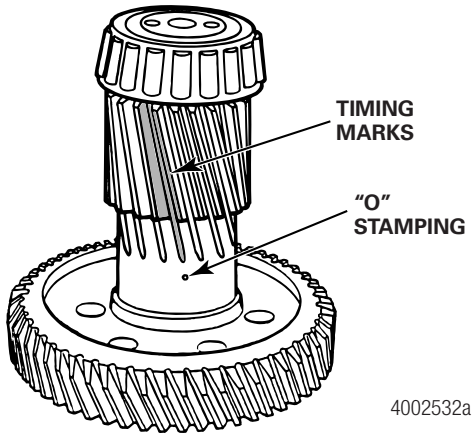
1. Follow these procedures to add timing marks on the auxiliary low gear.
   A. Mark one gear tooth with paint.
   B. Mark a second gear tooth 180 degrees opposite of the first tooth you marked. **Figure 13.32**.

Figure 13.32



2. Mark each low gear countershaft. Use paint to add timing marks on two teeth that are next to each other. The marks must align with the "O" stamping on the countershaft. **Figure 13.33**.

Figure 13.33

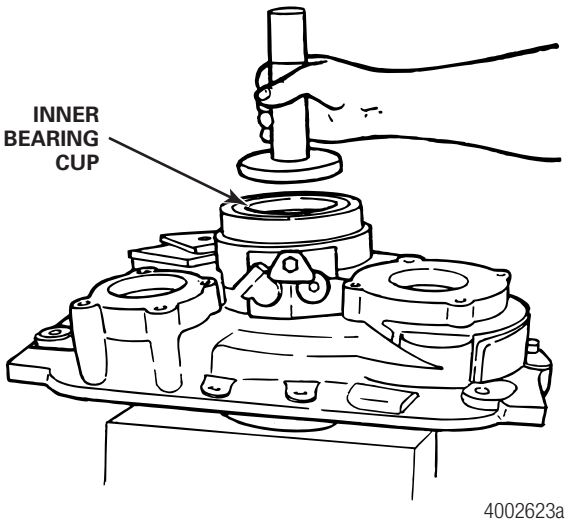


CAUTION

Replace the bearing cup and the bearing cone as an assembly. Replace the cup and cone assembly as a matched set from the same manufacturer. Do not replace the cup or cone separately. Damage to components can result.

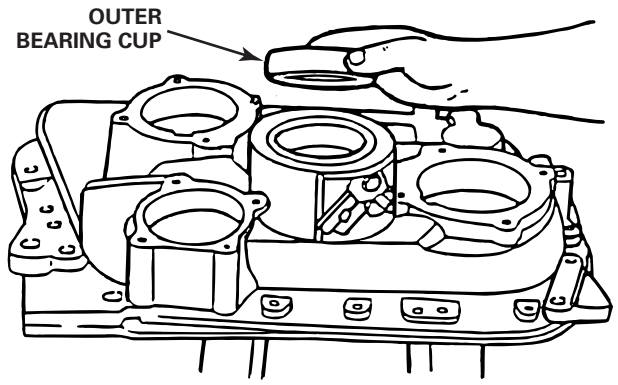
3. If removed, follow these procedures to install the bearing cups for the auxiliary cover output shaft.
   A. Place the auxiliary cover in the press, so that the OUTSIDE of the cover is toward the TOP of the press. Support the auxiliary cover under the output shaft bore.
   B. Place the INNER bearing cup in the cover with the letters on the cup facing TOWARD you. Install a sleeve or bearing installation tool on the bearing race. **Figure 13.34**.

Figure 13.34



   C. Press the INNER bearing cup into the cover. **Figure 13.34**.
   D. Place the OUTER cup on top of the INNER cup with the letters on the cup facing DOWN. **Figure 13.35**.

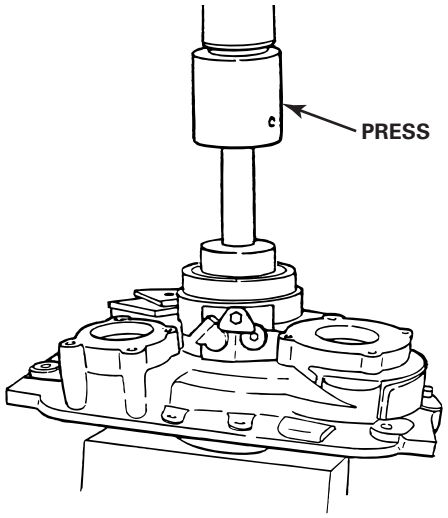
Figure 13.35



E. Place a sleeve or installation tool on the TOP of the OUTER cup. **Figure 13.36**.

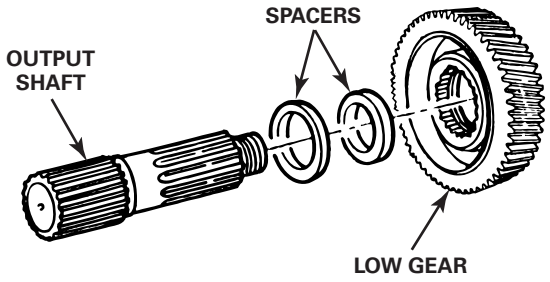
F. Use a press to install both cups into the bore. **Figure 13.36**. The bearing cups are installed correctly when the OUTER cup touches the shoulder in the cover bore.

Figure 13.36



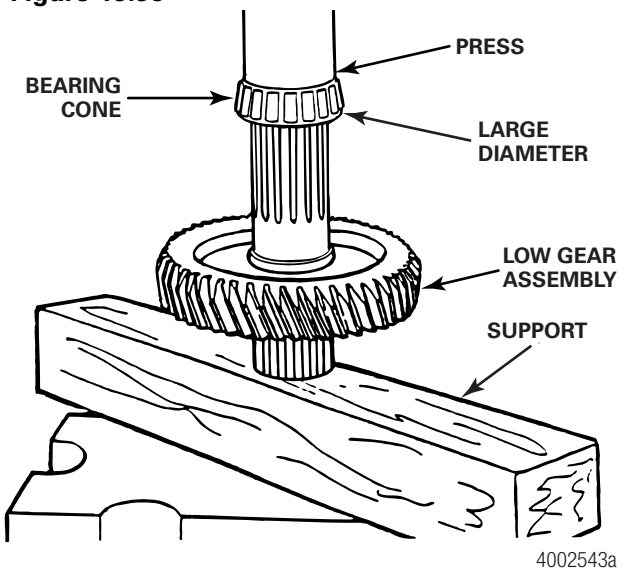
4. Place the two spacers on the output shaft. **Figure 13.37**.

Figure 13.37



5. Install the auxiliary low gear onto the output shaft. **Figure 13.37**.
6. Place the output shaft and low gear assembly on a press. The output shaft threads must be TOWARD the top of the press. Support the bottom of the output shaft. **Figure 13.38**.
7. Install a bearing cone onto the output shaft. **Figure 13.38**. The large diameter of the cone must be TOWARD the low gear.

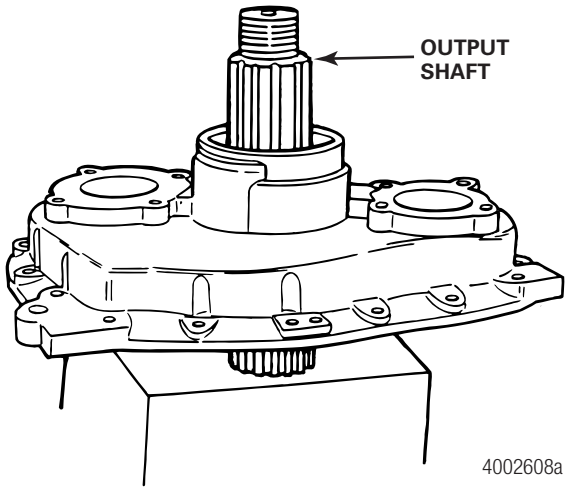
Figure 13.38



8. Place a sleeve onto the bearing cone. Press the cone onto the shaft until the cone touches the low gear assembly. Check that the gear and bearing cone rotate on the shaft.
9. Release the press.
10. Install the speedometer ring onto the shaft.

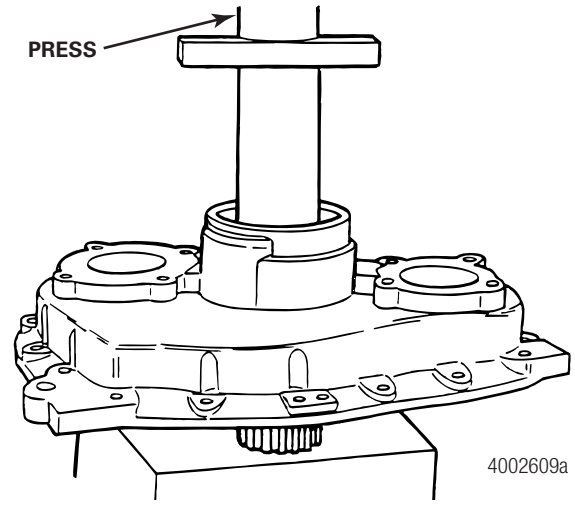
11. Place the output shaft and low gear assembly in the press. The output shaft threads must be TOWARD the top of the press.
12. Place the auxiliary cover on the output shaft low gear assembly. **Figure 13.39**.

Figure 13.39



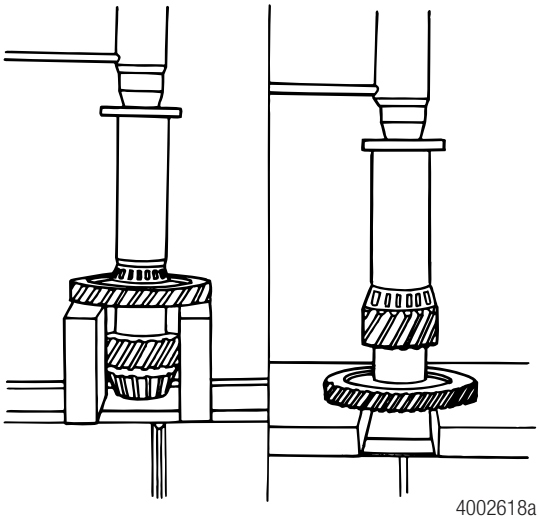
13. Install the outer bearing cone onto the output shaft. The letters on the cone must be TOWARD the TOP of the press.
14. Install a sleeve on the outer bearing cone.
15. Press the bearing cone onto the shaft and into the cover bore. **Figure 13.40**.

Figure 13.40



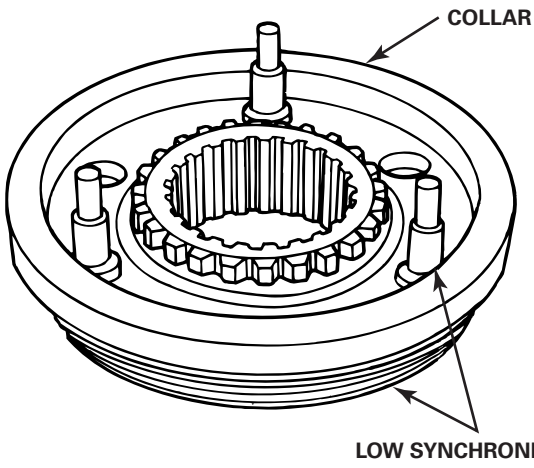
16. Release the press.
17. If the auxiliary countershaft bearing cones have been removed, use the following installation procedures:
    A. Place the countershaft in a press. The FRONT of the countershaft must be toward the TOP of the press. Support the countershaft on the gear. **Figure 13.41**.

Figure 13.41



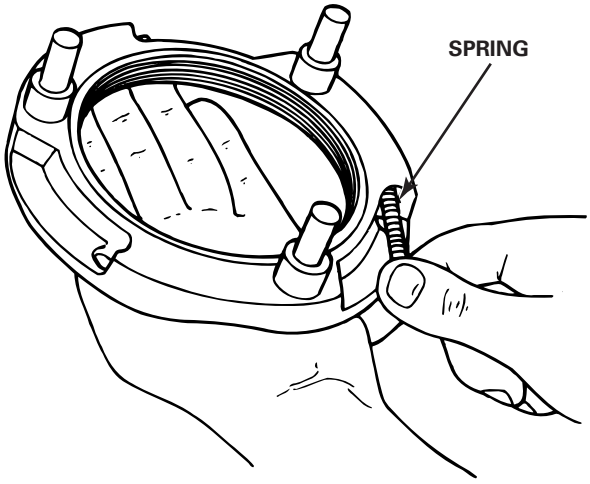
    B. Place the FRONT cone on the countershaft. The BOTTOM of the cone must be toward the gear.
    C. Place a sleeve on the inner race of the cone. Press the cone onto the countershaft. **Figure 13.41**. The cone is installed correctly when the BOTTOM of the cone touches the gear.
    D. Turn over the shaft. The opposite end must be toward the TOP of the press. Repeat Steps A-C to install the rear cone.
18. If the synchronizer assembly is disassembled, use the following assembly procedures:
    A. Place the low synchronizer on a table with the pins TOWARD you.
    B. Install the synchronizer collar over the low synchronizer pins, so that the chamfered holes in the collar are over the pins and toward the low synchronizer. The low synchronizer must touch the collar. **Figure 13.42**.

Figure 13.42



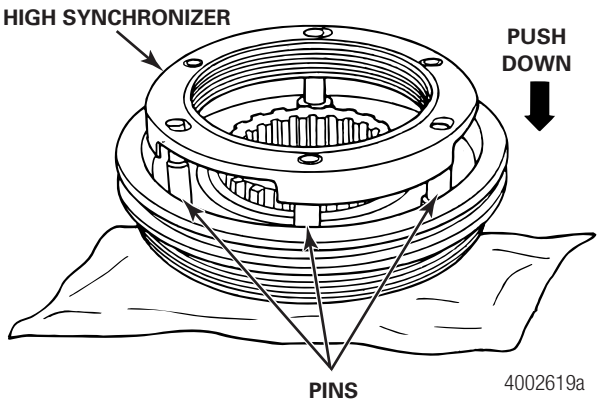
19. Install the springs into the holes in the high synchronizer. **Figure 13.43**. Lubricate the springs with multipurpose grease to retain the springs.

Figure 13.43



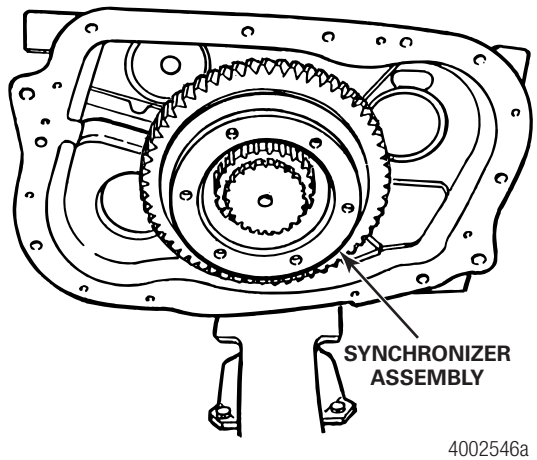
20. Install the high synchronizer onto the pins of the low synchronizer. Rotate the high synchronizer, so that the springs are against the side of the low synchronizer pins.
21. Place a towel under the low synchronizer to prevent the assembly from moving when you install the high synchronizer.
22. Place the towel over the assembly.
23. Push DOWN on the high synchronizer and rotate the synchronizer CLOCKWISE, so that the low synchronizer pins install into the holes in the high synchronizer. **Figure 13.44**.

Figure 13.44



24. Place the auxiliary case assembly UPRIGHT in a vise.
25. Install the synchronizer assembly onto the output shaft inside of the auxiliary cover. **Figure 13.45**. The high synchronizer must be TOWARD you.

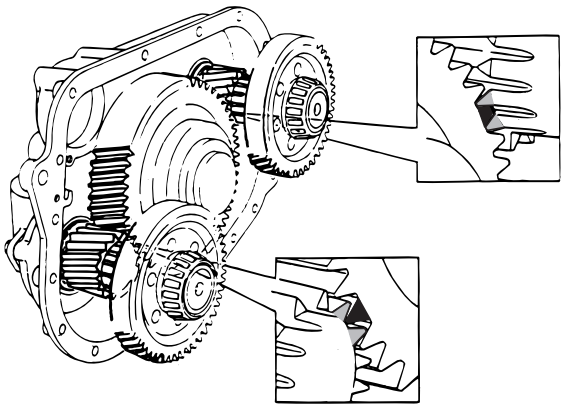
Figure 13.45



26. Install the auxiliary countershafts into the case.

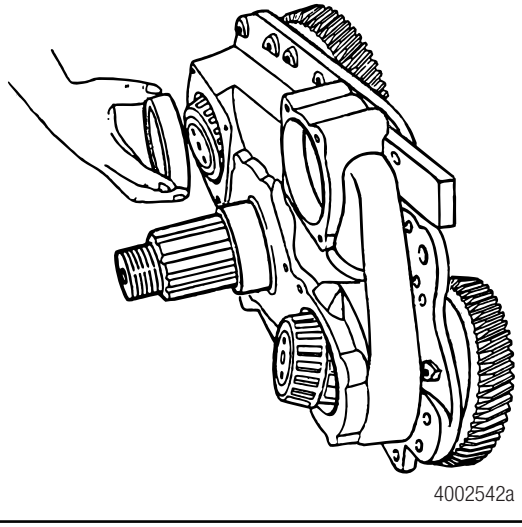
27. Align the timing marks on each countershaft with the timing marks on the low gear. **Figure 13.46**.

Figure 13.46



28. Install the correct countershaft bearing cup into the auxiliary case countershaft bores. **Figure 13.47**. You must keep each cup and cone as a matched set.

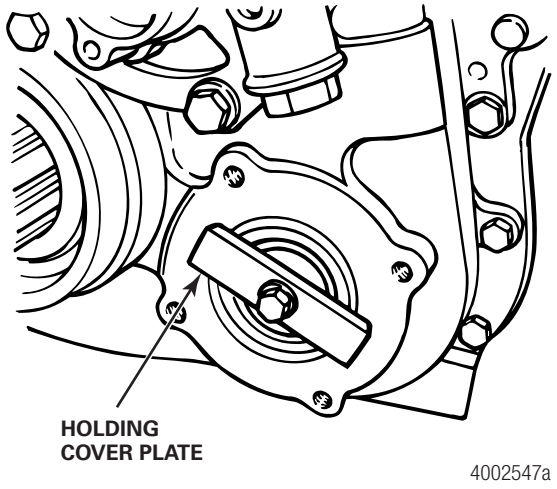
Figure 13.47



29. Install the holding cover plates onto each countershaft. **Figure 13.48**.

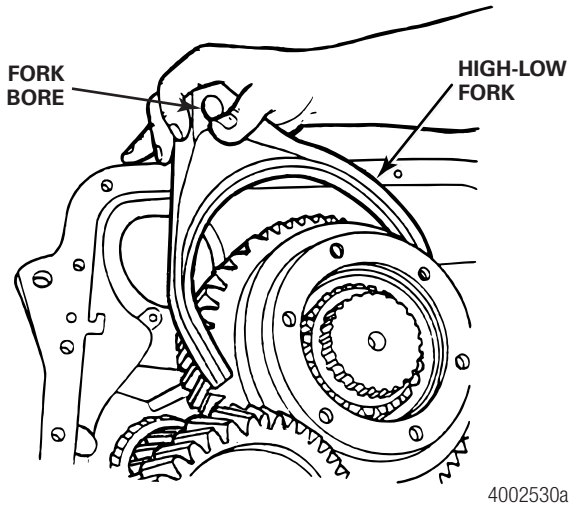
30. Tighten the bolts by hand to hold the countershafts firmly into place. The cover plates are correctly installed when the countershafts do not sag and can rotate.

Figure 13.48



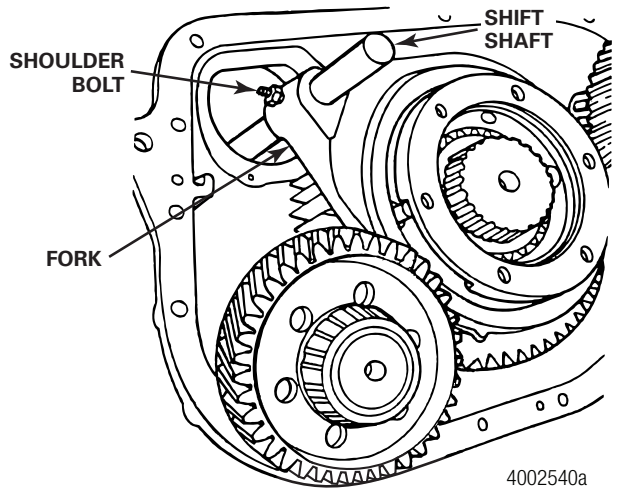
31. Install the high-low fork onto the synchronizer collar, so that the hole in the fork is AWAY from the cover and the fork bore aligns with the range cylinder bore. **Figure 13.49**.
    - Only install the threaded end of the range cylinder piston into the high-low shaft seal when you assemble the auxiliary case. Do not install the opposite end of the piston, which has a scalloped edge that will tear the seal. Damage to components will result.

Figure 13.49



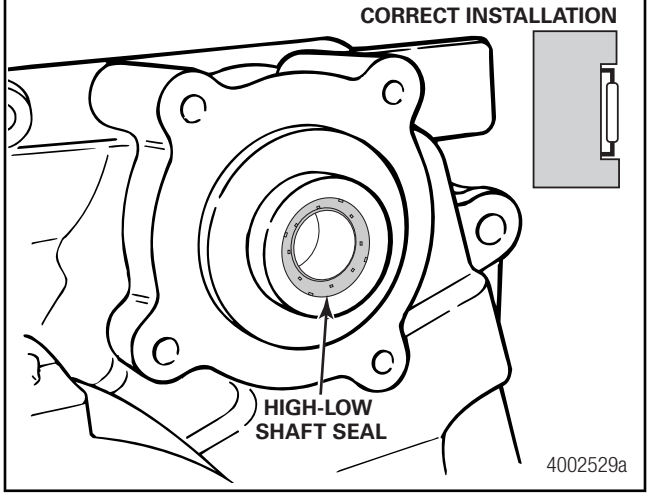
32. Install the threaded end of the high-low shaft into the high-low fork from the INSIDE of the auxiliary case.
33. Align the hole in the high-low shaft with the hole in the high-low fork. **Figure 13.50**.

Figure 13.50



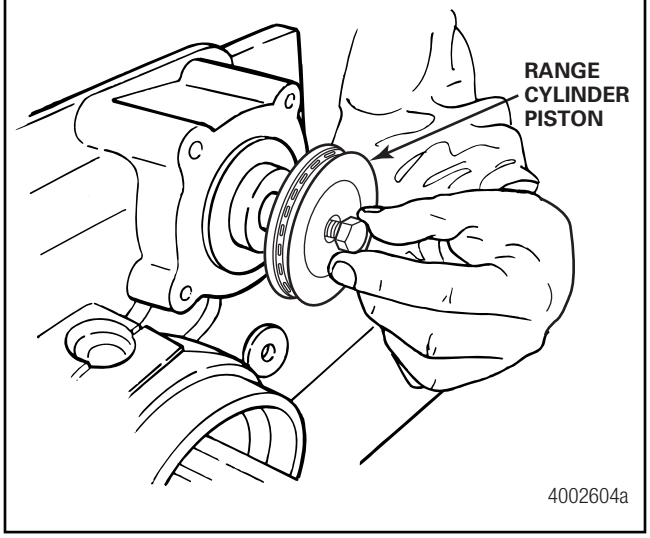
34. Use 1/2-inch and 9/16-inch wrenches to install the shoulder bolt and nut. The bolt is correctly installed when the nut is on TOP and tightened to the bolt shoulder. **Figure 13.50**. The bolt will be loose in the bore.
35. Tighten the nut to 8-12 lb-ft (11-16 N•m).
36. Install a new high-low shaft seal. Use an 11/16-inch socket to fully seat the seal. **Figure 13.51**.

Figure 13.51



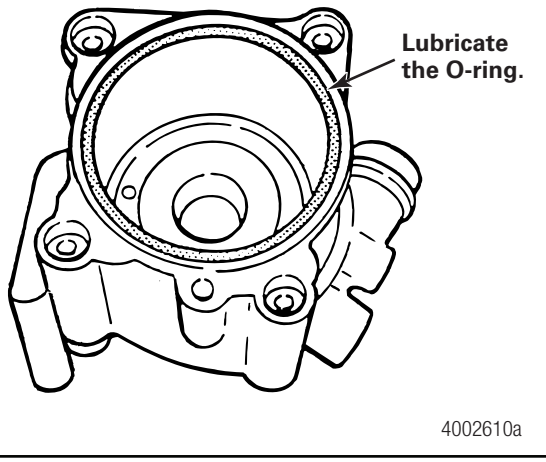
37. Apply a silicone lubricant, such as Dow Corning 3451 grease or equivalent, to the outside diameter of the range cylinder piston.
38. Use a slight back-and-forth rotary motion to install the piston onto the high-low shaft. Use an 11/16-inch wrench to install the nut that fastens the piston to the shaft. **Figure 13.52**.

Figure 13.52



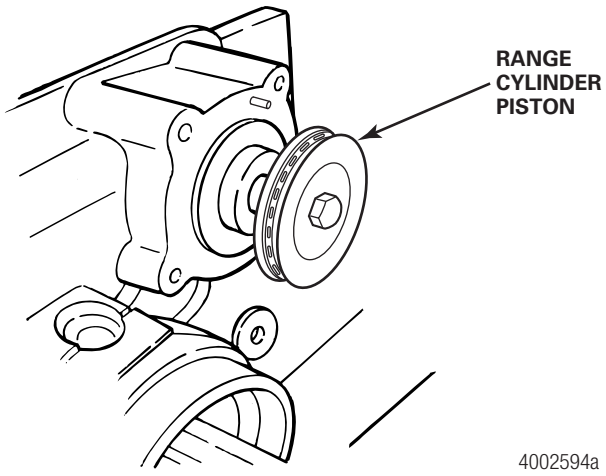
39. Tighten the nut to 35-50 lb-ft (48-67 N•m).
40. Inspect the range cylinder piston, especially the outer diameter, for wear and damage.
    - **If the range cylinder piston is worn or damaged:** Replace the piston and the range cylinder housing as an assembly.
41. Lubricate the range cylinder housing O-ring bore with a silicone lubricant, such as Dow Corning 3451 grease or equivalent. **Figure 13.53**.

Figure 13.53



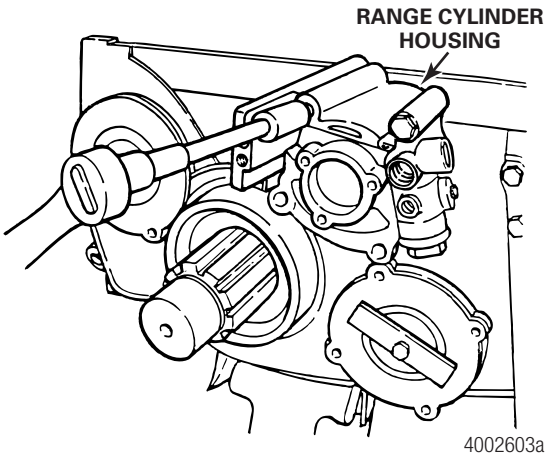
42. Install a new O-ring into the range cylinder housing bore.
43. Use guide pins to locate the range cylinder housing while assembling it over the piston. **Figure 13.54**.

Figure 13.54



44. Install the range cylinder housing. Use a 9/16-inch wrench to install the capscrews that fasten the range cylinder housing to the auxiliary cover. **Figure 13.55**.

Figure 13.55

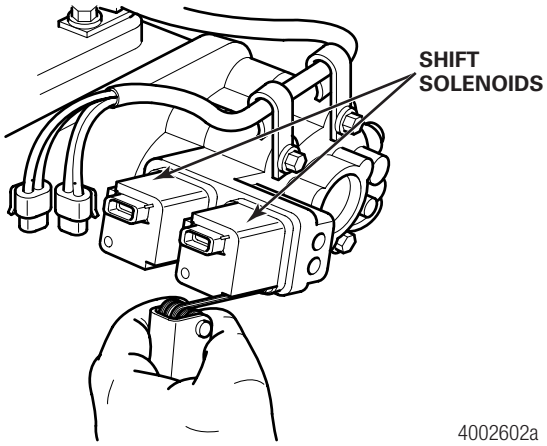


45. Tighten the capscrews to 35-45 lb-ft (48-61 N•m). T
46. Place the auxiliary cover into low range.

NOTE: Install the mounting bolts before you install the low solenoid. Install a 12 o'clock-position sensor before you install the low range solenoid.

47. If removed, install the high-low shift solenoids onto the range housing. **Figure 13.56**. Apply a silicone lubricant, such as Dow Corning 3451 grease or equivalent, to the solenoid O-rings prior to installation.

Figure 13.56

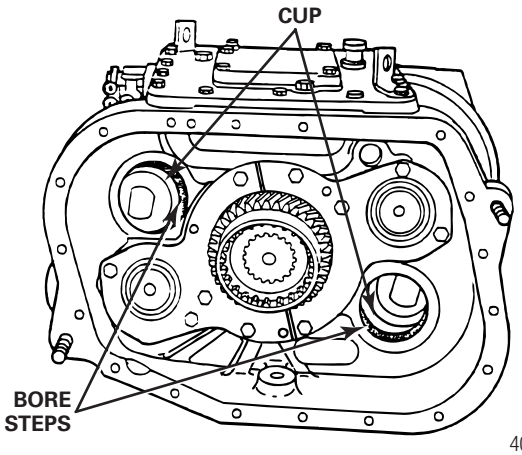


48. Tighten the mounting bolts to 50 lb-in (6 N•m).

Installation

1. If the bearing cups were removed, clean the outer diameter of the cups.
2. Install the auxiliary countershaft bearing cups into the bores in the main case. The cups must be against the steps in the bores. **Figure 13.57**.

Figure 13.57



WARNING

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin.

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

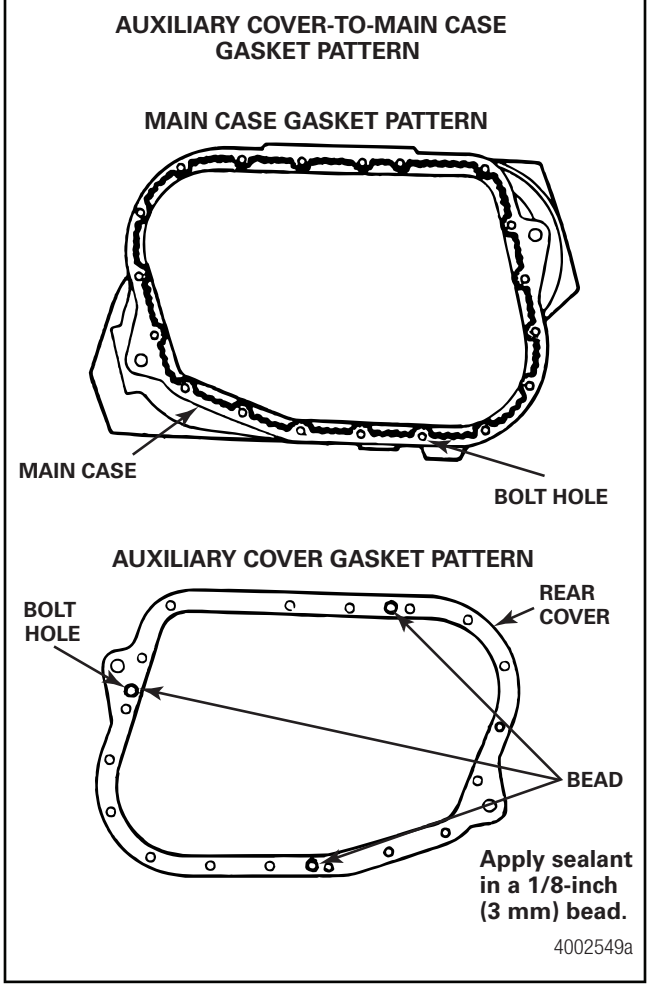
3. Clean the mounting surfaces with a chlorinated solvent such as Loctite® Safety Solvent or equivalent.
4. Use a scraper to remove all sealant material from the surface of the gasket.

CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

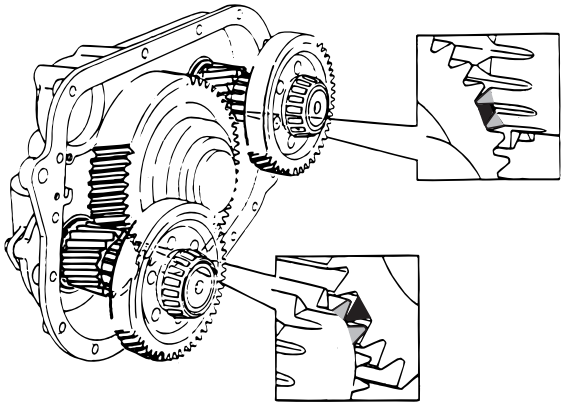
5. Use a gasket sealant dispenser and Loctite® Ultra Grey RTV Silicone Adhesive, Loctite® part number #18581, Meritor part number 2297-A-7021, to apply a 1/8-inch (3 mm) bead of sealant to the auxiliary cover on the main case. Apply the sealant in a continuous pattern and around any fastener holes. **Figure 13.58**.

Figure 13.58



6. Apply sealant around each puller hole on the auxiliary case.
7. Refer to for more information on gasket sealant and patterns.
8. Before you install the auxiliary case onto the main case, check that the timing marks on each countershaft align with the timing marks on the low gear. **Figure 13.59**.

Figure 13.59



TIMING MARKS ON AUXILIARY LOW GEAR
TIMING MARKS ON COUNTERSHAFT LOW GEARS
4002620a

WARNING

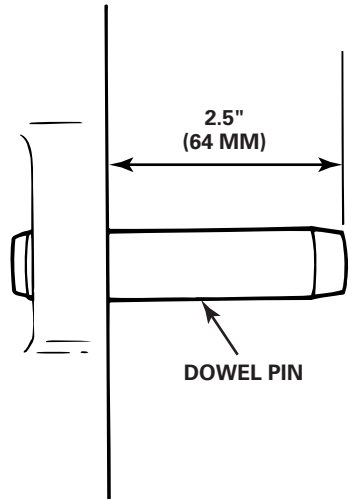
When you use a hammer and steel drift, verify that the tools are in good condition. Do not use worn or damaged tools, which can break or shatter components. Serious personal injury can result.

CAUTION

If you removed the dowel pins from the auxiliary case, you must install new dowel pins before you reinstall the case to prevent damage to components.

9. If the dowels have been removed, use a steel drift and hammer to install new dowels from the BACK of the main case flange. Before you use the steel drift and hammer, check that these tools are in good condition.
10. Install the dowels until the ends are 2.5-inches (64 mm) from the flange. **Figure 13.60**.

Figure 13.60



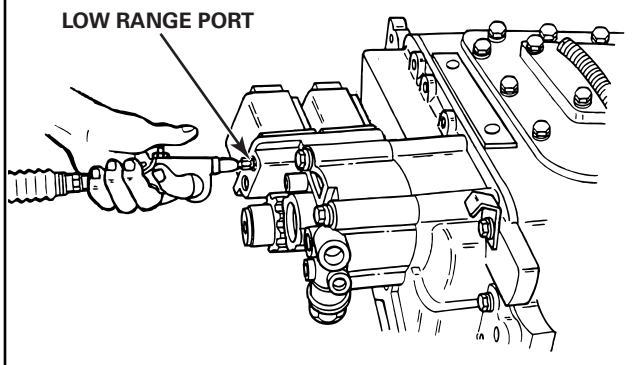
4002550a

WARNING

You must shift the synchronizer/clutch collar into LOW range before you install the auxiliary box onto the main case to ensure a correct installation. If the collar is not in low range, incorrect auxiliary drive plane and end play settings, and gear and bearing burnup can occur. Also the transmission can "jump" out of range, which can result in serious personal injury and damage to components.

11. Shift the synchronizer/clutch collar into low range by applying compressed air to the low range diagnostic port. **Figure 13.61**.

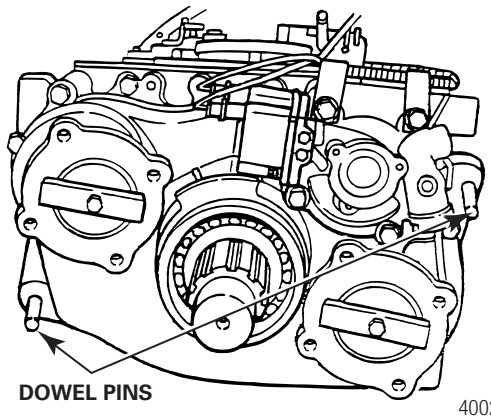
Figure 13.61



4002595a

12. Use a transmission jack to evenly install the auxiliary case onto the dowels in the main case. The dowel holes in the auxiliary case must align with the dowels in the main case. **Figure 13.62**.

Figure 13.62



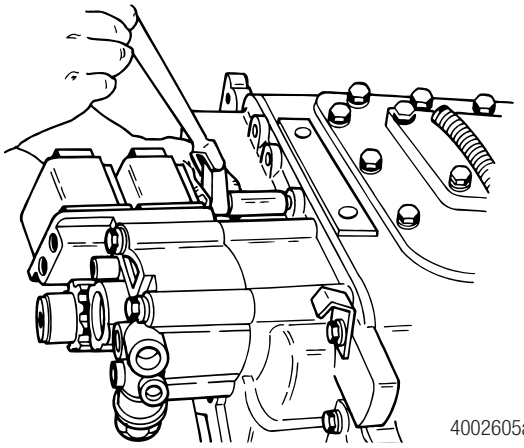
13. Rotate the input shaft, so that the teeth on the auxiliary drive gear align with the teeth on the countershaft driven gears.

WARNING

Use a brass, or leather mallet for assembly and disassembly procedures. Do not hit steel parts with a steel hammer. Pieces of a part can break off and cause serious personal injury.

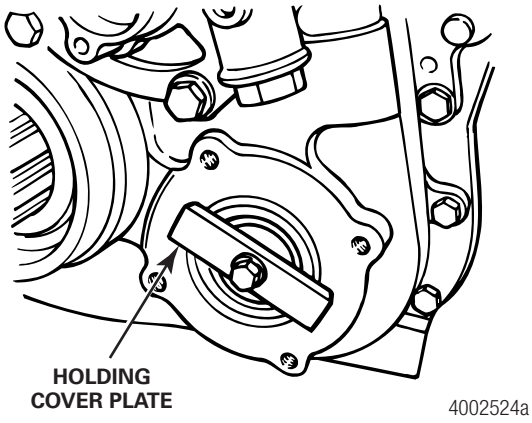
14. Install the auxiliary case against the main case. If necessary, use a brass, leather or rubber mallet to push the auxiliary case against the main case.
15. Use a 9/16-inch wrench to install the auxiliary case mounting capscrews and washers. **Figure 13.63**.

Figure 13.63



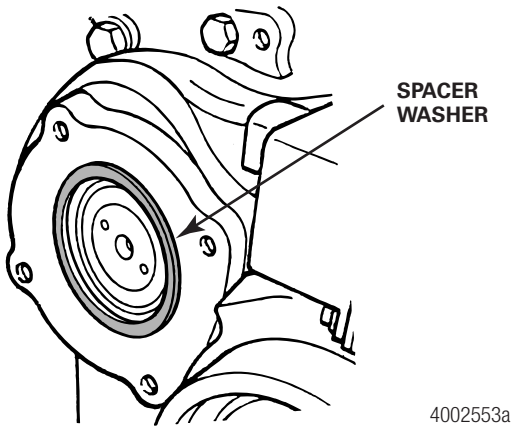
16. Tighten the capscrews to 35-45 lb-ft (47-61 N•m).
17. Use a 9/16-inch wrench to remove the holding cover plates from each countershaft. **Figure 13.64**.

Figure 13.64



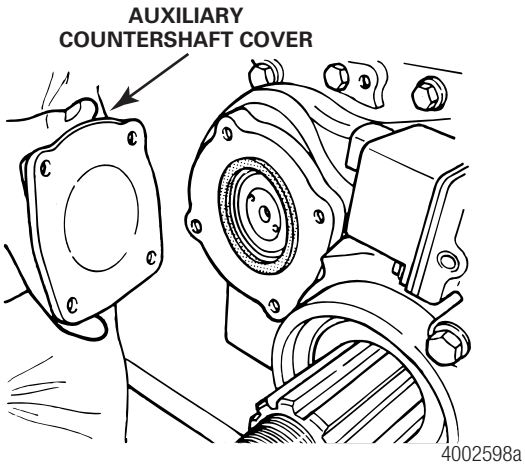
18. If you reuse the cups and cones, reinstall the spacer washers on the countershafts. **Figure 13.65**. You must match the washers to the countershaft from which they were removed.

Figure 13.65



19. Install the auxiliary countershaft covers to seat the spacer washers and bearing cups into the countershaft bore. **Figure 13.66**.

Figure 13.66



20. Remove the auxiliary countershaft covers.
21. Check that the end play of each countershaft is 0.002-0.006-inch (0.050-0.152 mm). Refer to Section 15 for procedures on how to check and adjust end play.
    - **When the end play is within the correct specification:** Proceed to Step 22.

⚠ WARNING

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin.

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

22. Clean the mounting surfaces with a chlorinated solvent, such as Loctite® Safety Solvent or equivalent.
23. Use a scraper to remove all sealant material from the surface of the gasket.

⚠ CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

24. Use a gasket sealant dispenser and Loctite® Ultra Grey RTV Silicone Adhesive, Loctite® part number #18581, Meritor part number 2297-A-7021, to apply a 1/8-inch (3 mm) bead of sealant to the auxiliary countershaft covers and the auxiliary case. **Figure 13.67**.
25. Apply the sealant onto the gasket in a continuous pattern and around any fastener holes. Refer to Section 17 for more information on gasket sealant and patterns.
26. Use a 9/16-inch wrench to install the auxiliary countershaft cover onto the auxiliary case. Install the capscrews and washers.
27. Alternately and evenly tighten the capscrews to 25-35 lb-ft (34-47 N•m). **Figure 13.68**. T

Figure 13.67

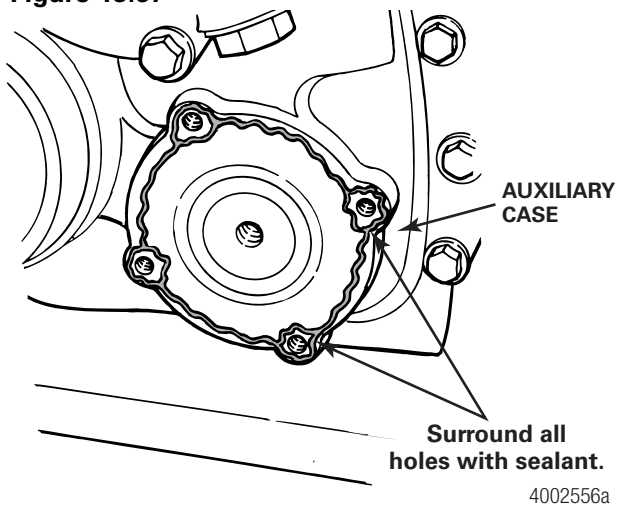
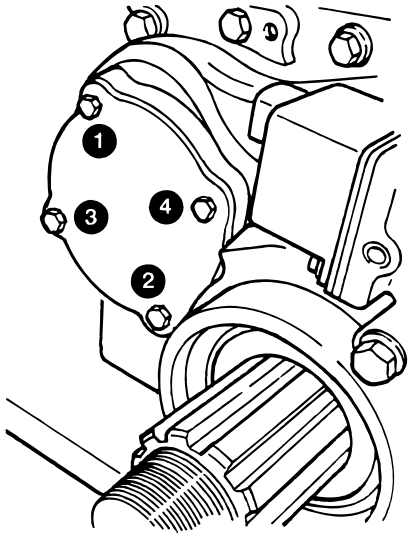


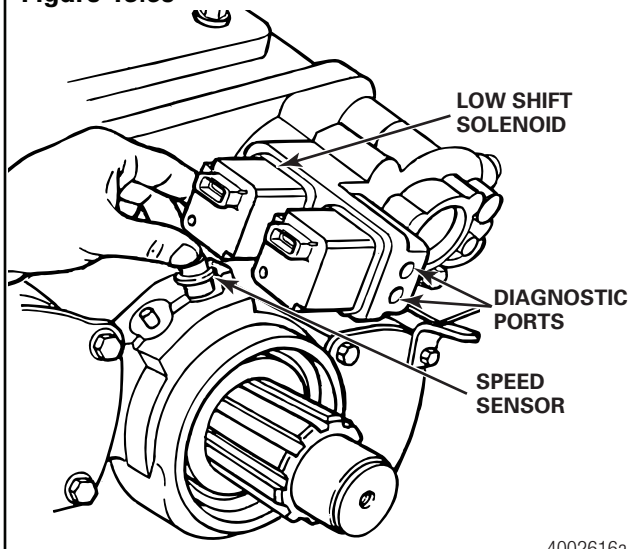
Figure 13.68



NOTE: Install a 12 o'clock-position speed sensor before you install the low range solenoid. **Figure 13.69**.

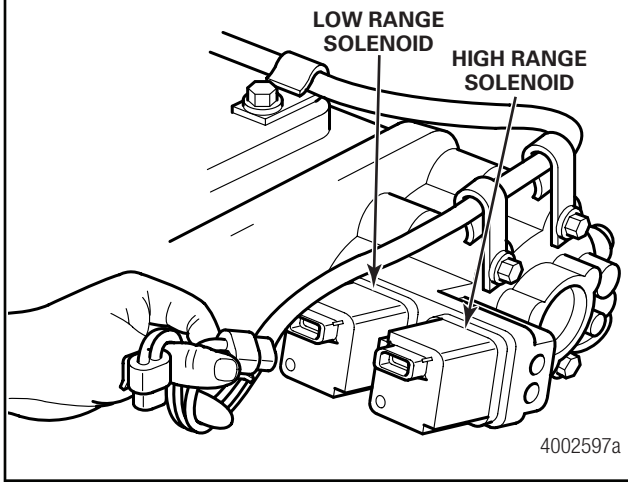
28. Apply a silicone lubricant, such as Dow Corning 3451 grease or equivalent, to the speed sensor bore in the output bearing housing. Install the speed sensor into the bore.

Figure 13.69



29. Fasten the speed sensor retainer so that the tabs overlap the shoulders of the speed sensor.
30. Connect the supply air line to the piston housing.
31. Connect the wiring harness to the high and low solenoids. **Figure 13.70**.

Figure 13.70



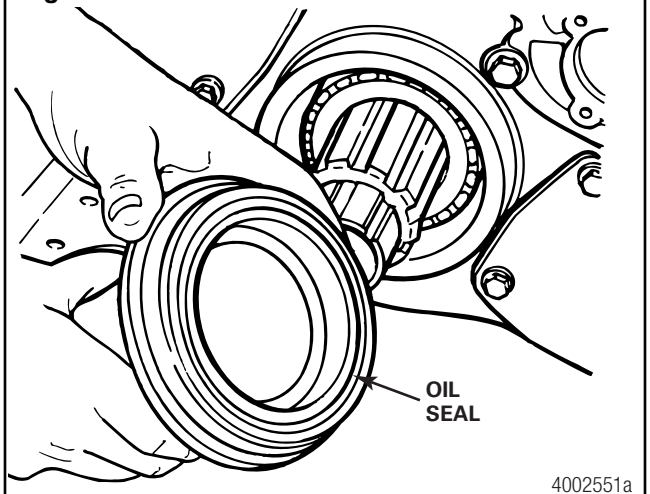
WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Installation

1. Position the new output shaft oil seal on the seal driver tool, tool number J-39161-A, so that the seal is flat against the surface of the tool. **Figure 14.1**. To obtain this tool, refer to the Service Notes page on the front inside cover of this manual.

Figure 14.1

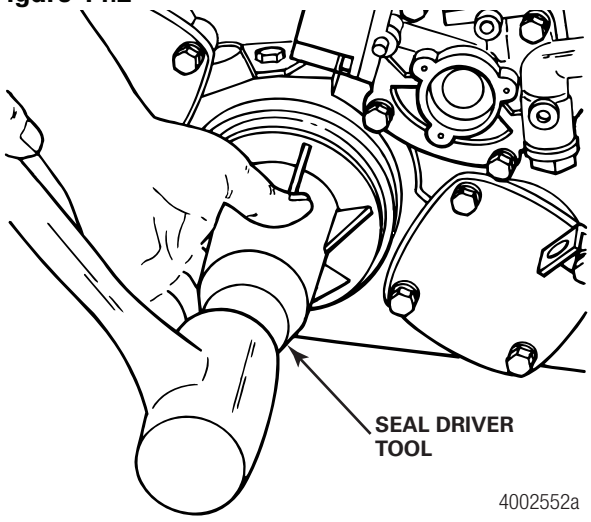


CAUTION

The oil seal flange must rest flush against the retainer. The seal can leak if gaps exist between the seal flange and retainer. Damage to components can result.

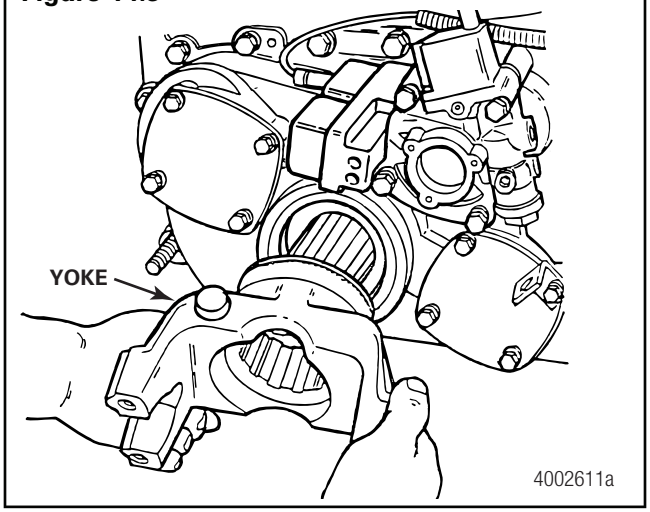
2. Use the seal driver to drive the oil seal into the retainer, until the seal flange rests flush against the retainer. **Figure 14.2**.

Figure 14.2



3. Clean the yoke. Inspect the yoke for wear or damage. Replace the yoke when the journal is rusted, burred or nicked.
4. Lightly lubricate the output shaft splines with new transmission oil.
5. Install the yoke onto the output shaft. **Figure 14.3**. Use a flange and yoke holding tool to secure the yoke.

Figure 14.3

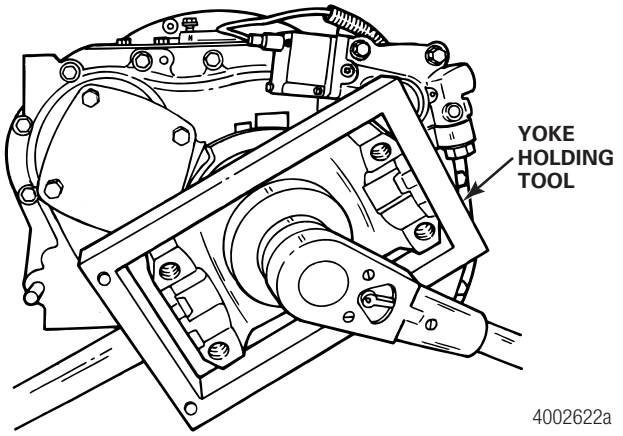


CAUTION

Use a torque wrench to tighten the output shaft yoke retaining nut to 450-500 lb-ft (610-677 N•m). Do not tighten the retaining nut to a torque higher than this specification. Damage to the output bearing can result.

6. Install the output shaft yoke retaining nut. **Figure 14.4**. Use a torque wrench to tighten the nut to 450-500 lb-ft (610-677 N•m).

Figure 14.4



7. Install the transmission. Refer to Section 4 of Maintenance Manual 26A. To obtain this publication, refer to the Service Notes page on the front inside cover of this manual.
8. Fill the transmission to the specified level with the correct oil. Refer to Section 2 of Maintenance Manual 26A.

WARNING

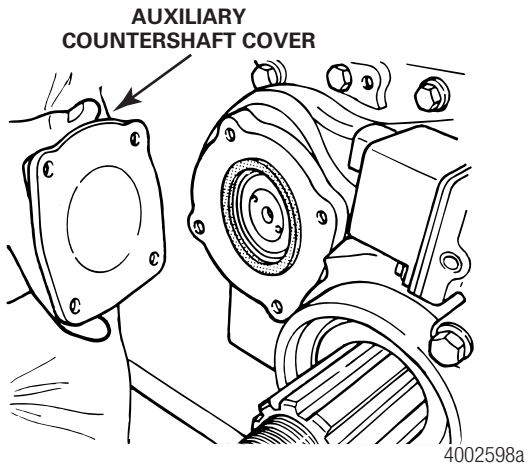
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Check and Adjust End Play

NOTE: Check end play on one countershaft at a time.

1. If not previously done, install the auxiliary case onto the main case. Refer to Section 13.
2. Remove the capscrews and washers that secure the holding cover plates and lift brackets on the countershaft and cover. **Figure 15.1**. Remove the cover tool.

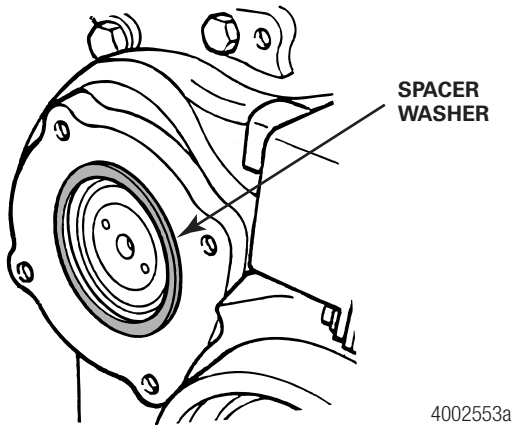
Figure 15.1



NOTE: Only use the BLUE spacer washer, Meritor part number 1229-N-4538, to check auxiliary countershaft end play. If you do not use this washer, the end play reading will be incorrect.

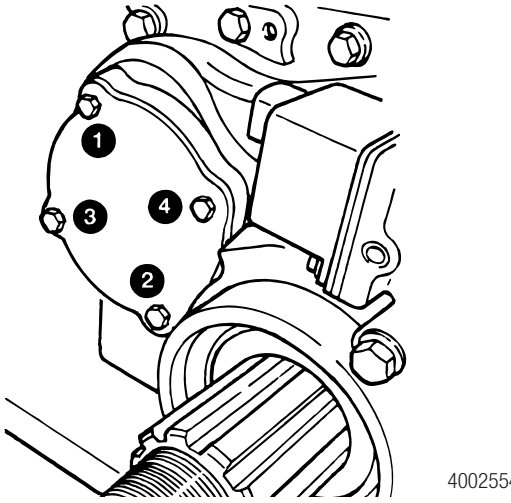
3. Install the thinnest BLUE spacer washer, Meritor part number 1229-N-4538, into the bore on top of the cup. Check that the washer tab aligns with the slot in the case. **Figure 15.2**.

Figure 15.2



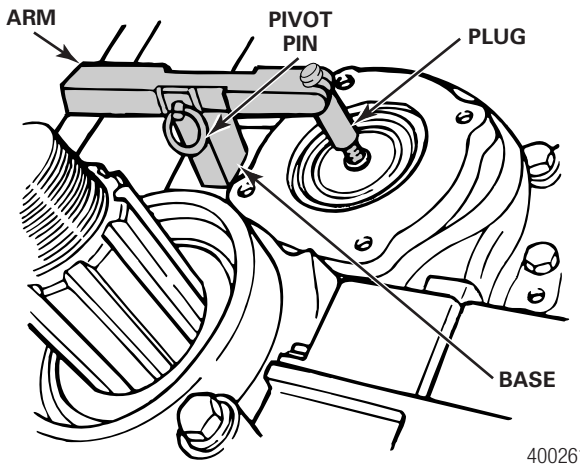
4. Use the following procedure to verify that the bearing cup and spacer washers are in the correct position.
   A. Install the auxiliary countershaft cover.
   B. Install the capscrews and washers that secure the cover to the auxiliary case.
   C. Alternately and evenly tighten the capscrews to 25-35 lb-ft (34-47 N•m). **Figure 15.3**. T1
   D. Remove the capscrews, washers and countershaft cover.

Figure 15.3 TIGHTENING SEQUENCE



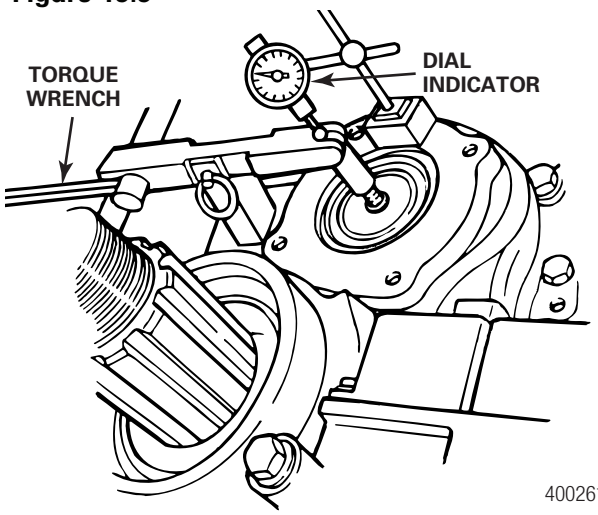
5. Use the following procedure to install the countershaft end play checking tool, Meritor part number 3256-C-1043 or Kent-Moore part number J-41335. **Figure 15.4**. To obtain these tools, refer to the Service Notes page on the front inside cover of this manual.
   A. Install the short shaft plug with 3/8-inch threads into the countershaft. Tighten the plug securely.
   B. Install the single-holed, 3/8-inch countershaft base into one of the mounting holes for the countershaft cover.
   C. Install the actuator arm. The forked end of the arm must be in the shaft plug groove.
   D. Align the actuator arm mounting holes with the countershaft base. Install the pivot pin.

Figure 15.4 CHECKING TOOL



6. Center the tip of the dial indicator in the shaft plug. **Figure 15.5**.
7. Align the tip of the dial indicator with the alignment mark on the shaft plug.
8. Install a torque wrench into the end of the actuator arm. The wrench must be parallel with the actuator arm. **Figure 15.5**.

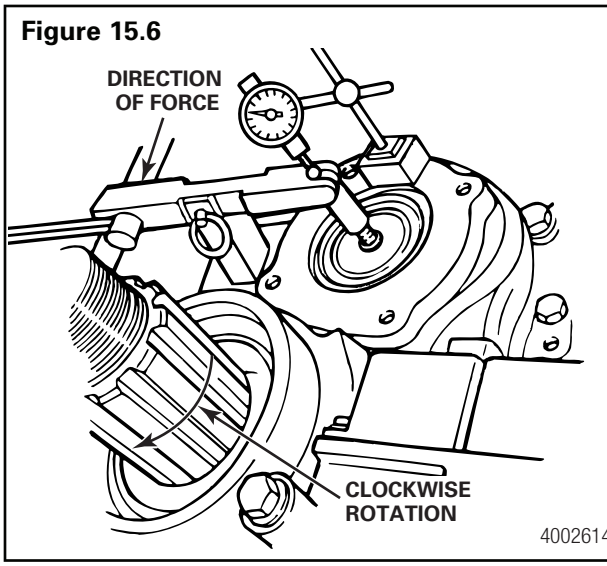
Figure 15.5



NOTE: Continuously apply 25 lb-ft (34 N•m) or 300 lb-in (34 N•m) of force to the actuator arm, until you have checked the auxiliary countershaft end play. If you release force before you read the dial indicator, the end play will not be correct, and you must repeat the procedure. T

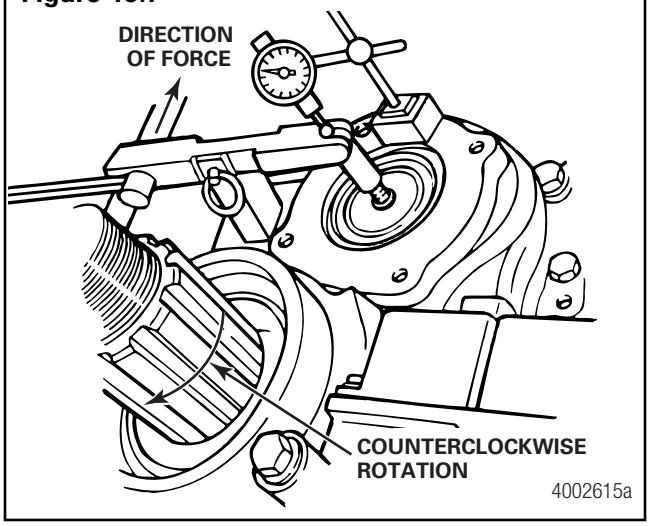
9. Use a torque wrench to continuously apply 25 lb-ft (34 N•m) or 300 lb-in (34 N•m) of force in one direction to the actuator arm. **Figure 15.6**. T

Figure 15.6



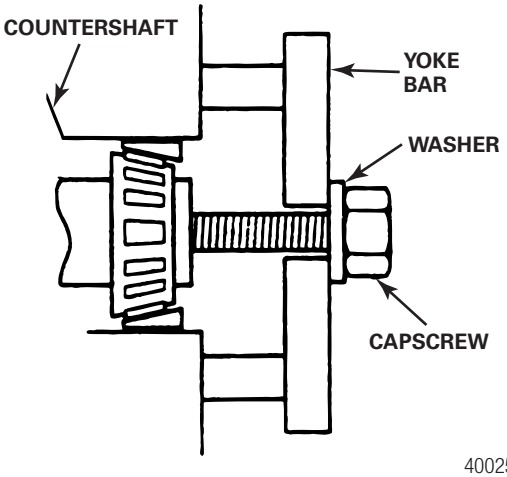
10. Place reference marks on the output shaft and the auxiliary case.
11. Rotate the output shaft CLOCKWISE at least four complete turns. **Figure 15.6**. Verify that the START and STOP positions are at the same location.
12. Set the dial indicator to ZERO.
13. Change the direction of force from the direction you applied in Step 9 to the opposite direction. **Figure 15.7**.

Figure 15.7



14. Rotate the output shaft COUNTERCLOCKWISE at least four complete turns. **Figure 15.7**. Verify that the START and STOP positions are at the same location.
    - **If the end play reading is less than 0.002-inch (0.050 mm), or there is no reading on the dial indicator:** Refer to Step 15.
    - **If the end play reading is more than 0.007-inch (0.177 mm):** Refer to Step 16.
    - **If the end play reading is 0.002-0.006-inch (0.050-0.152 mm):** The end play is correct. Refer to Step 17.
15. If the end play reading is less than 0.002-inch (0.050 mm) or no reading, use the following procedure.
    A. Move the bearing cup 1/8-inch (3 mm) TOWARD the OUTER surface of the auxiliary case. Use a yoke bar or puller bridge, washer and a 5/16-inch x 18 capscrew. **Figure 15.8**.

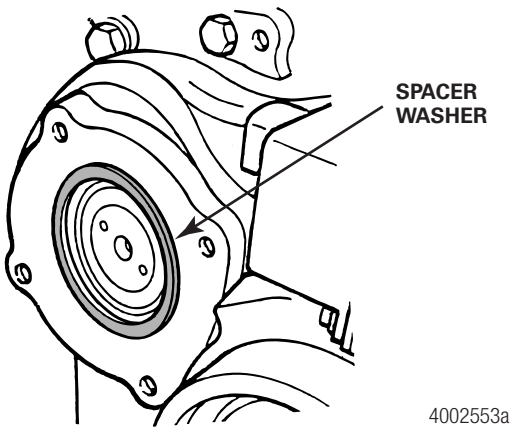
Figure 15.8



    B. Inspect the auxiliary countershaft cover for damage. Replace a damaged cover. Check end play again.
    C. Inspect for dirt or other contaminants between the rear bearing cup and the auxiliary case. Check end play again.
    D. Remove the auxiliary case. Check that the front bearing cup for the auxiliary countershaft is correctly installed in the bore.
    E. Check that the bearing cup is installed correctly.
    F. Check end play again.
16. If the end play reading is more than 0.007-inch (0.177 mm), use the following procedure.
    A. Choose the correct GREEN spacer washer, Meritor part number 1229-P-4540. Refer to the table at the end of this section.
    B. Remove the countershaft end play checking tool.

C. Remove the GREEN spacer washer that you used to check end play. **Figure 15.9**.

Figure 15.9



D. Install the correct spacer washer into the bore on the top of the bearing cup. Align the spacer washer tab with the slot in the main case. **Figure 15.9**.

E. Install the auxiliary countershaft cover.

F. Install the capscrews and washers that fasten the cover to the auxiliary case.

CAUTION

Use a torque wrench to tighten the capscrews and washers that fasten the cover to the auxiliary case to a maximum of 35 lb-ft (47 N•m). Do not exceed this torque specification. Overtightening can cause leaks. Damage to components can result. T

G. Use a torque wrench to alternately and evenly tighten the capscrews until the countershaft cover touches the auxiliary cover. Do not exceed the maximum torque specification of 35 lb-ft (47 N•m). T

H. Remove the capscrews, washers and countershaft cover. Check end play again.

I. Check the auxiliary countershaft end play again. Refer to Steps 1-14.

WARNING

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin.

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

17. Clean the mounting surfaces with a chlorinated solvent, such as Loctite® Safety Solvent or equivalent.

18. Use a scraper to remove all sealant material from the surface of the gasket.

CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

19. Use a gasket sealant dispenser and Loctite® Ultra Grey RTV Silicone Adhesive, Loctite® part number #18581, Meritor part number 2297-A-7021, to apply a 1/8-inch (3 mm) bead of sealant to the auxiliary case cover and the transmission case. **Figure 15.10**.

20. Apply the sealant onto the gasket in a continuous pattern and around any fastener holes. Refer to Section 17 for more information on gasket sealant and patterns.

21. Use a 9/16-inch wrench to install the auxiliary countershaft cover onto the auxiliary case. Install the capscrews and washers. Alternately and evenly tighten the capscrews to 25-35 lb-ft (34-47 N•m). **Figure 15.11**. T

Figure 15.10

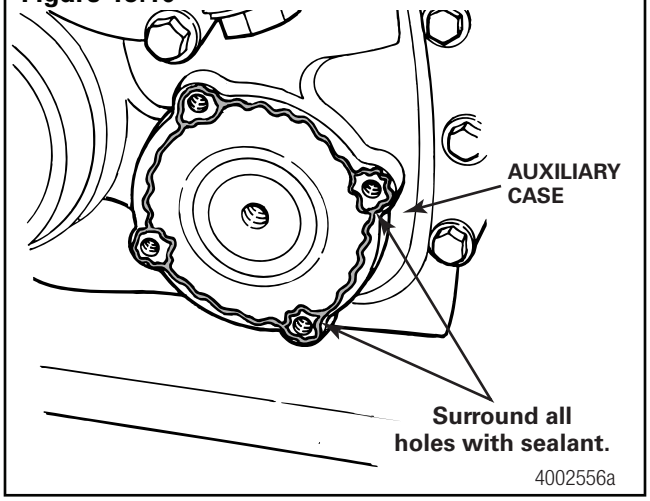
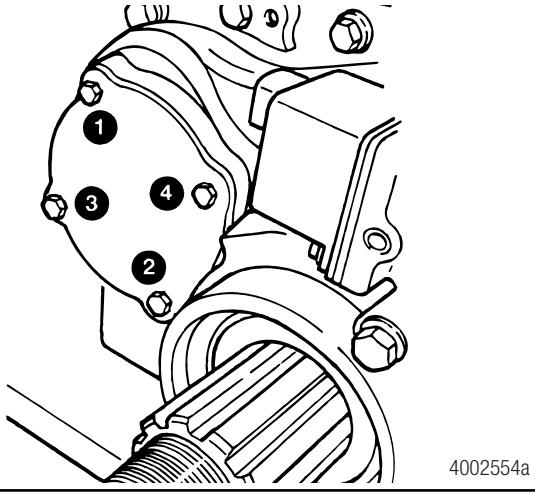


Figure 15.11



NOTE: Each auxiliary countershaft can have a different end play measurement. This is a usual occurrence.

22. Follow Steps 1-18 to check the end play of the other auxiliary countershaft.
23. Obtain the correct end play specification of 0.002-0.006-inch (0.050-0.152 mm) for both auxiliary countershafts.
24. When end play is correct for both auxiliary countershafts, connect the wiring to the high-low solenoids.

NOTE: If the end play reading is 0.059-inch (1.498 mm), or there is no reading, check the following:

A. Remove the auxiliary case. Check that the front bearing cup for the auxiliary countershaft is correctly installed in the main case.

B. Check that the bearing cup is installed correctly. Check end play again.

Choose the Correct Spacer Washer

End Play Measurement		Spacer Washer Color	Spacer Washer Thickness		Spacer Washer Part Number
Inch	mm		Inch	mm	
0.002-0.006	0.050-0.176	BLUE	0.253	6.426	1229-N-4538
0.007-0.012	0.177-0.329	GREEN	0.258	6.553	1229-P-4540
0.013-0.017	0.330-0.456	YELLOW	0.264	6.705	1229-Q-4541
0.018-0.022	0.457-0.583	WHITE	0.269	6.832	1229-R-4542
0.023-0.027	0.584-0.710	PURPLE	0.274	6.956	1229-S-4543
0.028-0.032	0.711-0.837	ORANGE	0.279	7.086	1229-T-4544
0.033-0.038	0.838-0.989	WHITE/BLUE	0.284	7.213	1229-U-4545
0.039-0.043	0.990-1.116	WHITE/GREEN	0.290	7.366	1229-V-4546
0.044-0.048	1.117-1.243	WHITE/YELLOW	0.295	7.493	1229-W-4547
0.049-0.053	1.244-1.370	WHITE/PURPLE	0.300	7.620	1229-X-4548
0.054-0.058	1.371-1.497	WHITE/ORANGE	0.305	7.747	1229-Y-4549
0.059 and above	1.498 and above	Refer to the note above.	—	—	—

Section 16
Remove and Install the Clutch Housing

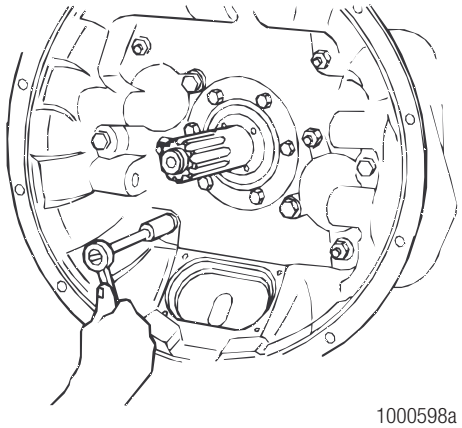
WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Removal

1. Remove the transmission from the vehicle.
2. Remove the nuts, capscrews and washers that secure the clutch housing to the main case.
3. Remove the clutch housing. **Figure 16.1**.
4. Use a scraper to remove all sealant material from the clutch housing and main case.

Figure 16.1



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Installation

WARNING

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

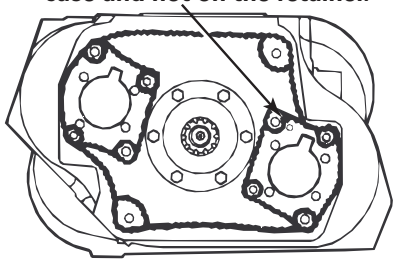
1. Use Loctite® Ultra Grey Adhesive/Sealant 18581, Meritor part number 2297-A-7021, or equivalent to apply a new sealant pattern on the transmission case. You must apply the sealant in the pattern shown in **Figure 16.2**.

Figure 16.2

CLUTCH HOUSING-TO-TRANSMISSION CASE GASKET PATTERN

• Apply the pattern on the transmission case.

The pattern must be on the transmission case and not on the retainer.



NOTE: Apply sealant in a 1/8-inch (3 mm) bead.

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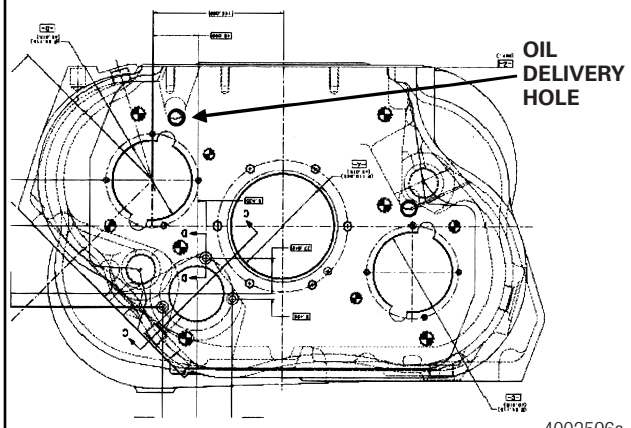
2. Install the clutch housing onto the transmission case.

3. Install the mounting nuts and washers on the clutch housing studs. Tighten the nuts to 150-190 lb-ft (204-257 N•m).
4. Apply Loctite® number 222 Threadlocker, Meritor part number 2297-B-6112, or equivalent to the threads of the capscrews that secure the clutch housing to the main case.
5. Install the mounting capscrews and washers and tighten them to 65-85 lb-ft (89-115 N•m).
6. Install the transmission.
7. This oil delivery hole in the front wall of the main case is a hole that was added to deliver oil to the upper C/S bearing on 1850 lb-ft transmissions. **Figure 16.3**. In order for it to function correctly, a clutch housing with an oil passage is required. All torque ratings will have this feature, but it is only required on 1850 lb-ft transmissions. A REMAN transmission, with a new case will have this oil delivery hole. If the old clutch housing is used, it is NOT RECOMMENDED that the clutch housing be modified to allow for oil to flow.

Figure 16.3



Section 17
Gasket Sealant and Patterns

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin.

When you apply some silicone gasket materials, a small amount of acid vapor is present. To prevent serious personal injury, ensure that the work area is well-ventilated. Read the manufacturer's instructions before using a silicone gasket material, then carefully follow the instructions. If a silicone gasket material gets into your eyes, follow the manufacturer's emergency procedures. Have your eyes checked by a physician as soon as possible.

CAUTION

Apply gasket sealant in a 1/8-inch (3 mm) bead. If you use more than this amount, sealant can extend over the edge of the gasket and can break off and plug oil passages. Damage to components can result.

Use the Correct Gasket Sealant Product

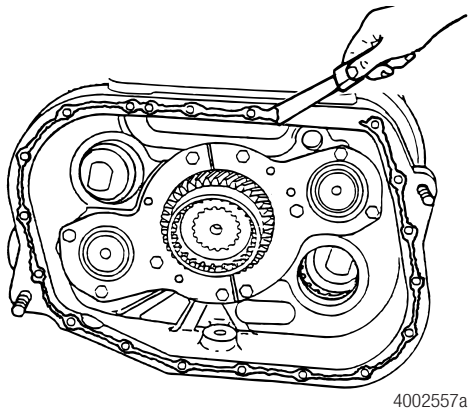
Use a gasket sealant dispenser and Loctite® Ultra Grey RTV Silicone Adhesive, Loctite® part number 18581, Meritor part number 2297-A-7021, on the following components.

- Clutch housing and main case
- PTO covers and main case
- Top cover and main case
- Auxiliary case and main case
- Auxiliary countershaft covers and auxiliary case
- Output bearing retainer on the auxiliary case
- Input bearing retainer on the main case
- Range piston housing to the auxiliary case

How to Apply Gasket Sealant

1. Remove the component. Follow the procedures in the section of this manual that applies to the component you will remove.
2. Use a scraper to remove all sealant material from the surface of the gasket. **Figure 17.1**.
3. Clean the mounting surfaces with a chlorinated solvent, such as Loctite® Safety Solvent or equivalent.

Figure 17.1



CAUTION

Only use Loctite® Ultra Grey RTV Silicone Adhesive, Loctite® part number 18581, Meritor part number 2297-A-7021, on transmission components. The use of any other product or a corrosive sealant can cause the transmission to leak. Damage to components can result.

4. Use a gasket sealant dispenser, **Figure 17.2**, and Loctite® Ultra Grey RTV Silicone Adhesive, Loctite® part number 18581, Meritor part number 2297-A-7021, to apply a 1/8-inch (3 mm) bead of sealant to one surface. Apply the sealant in a continuous pattern and around any fastener holes. **Figures 17.3 through 17.5**.
5. Install the component as described in the correct section of this manual.

Figure 17.2

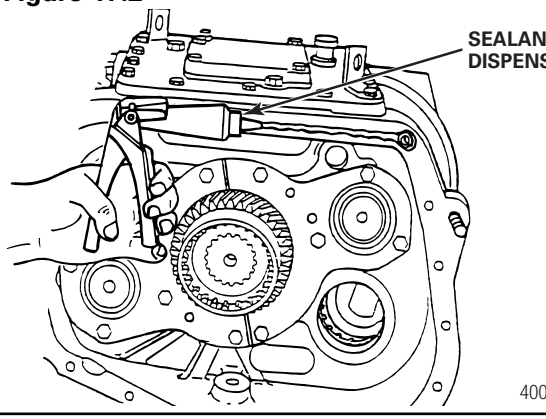


Figure 17.3

AUXILIARY COVER-TO-TRANSMISSION CASE GASKET PATTERN

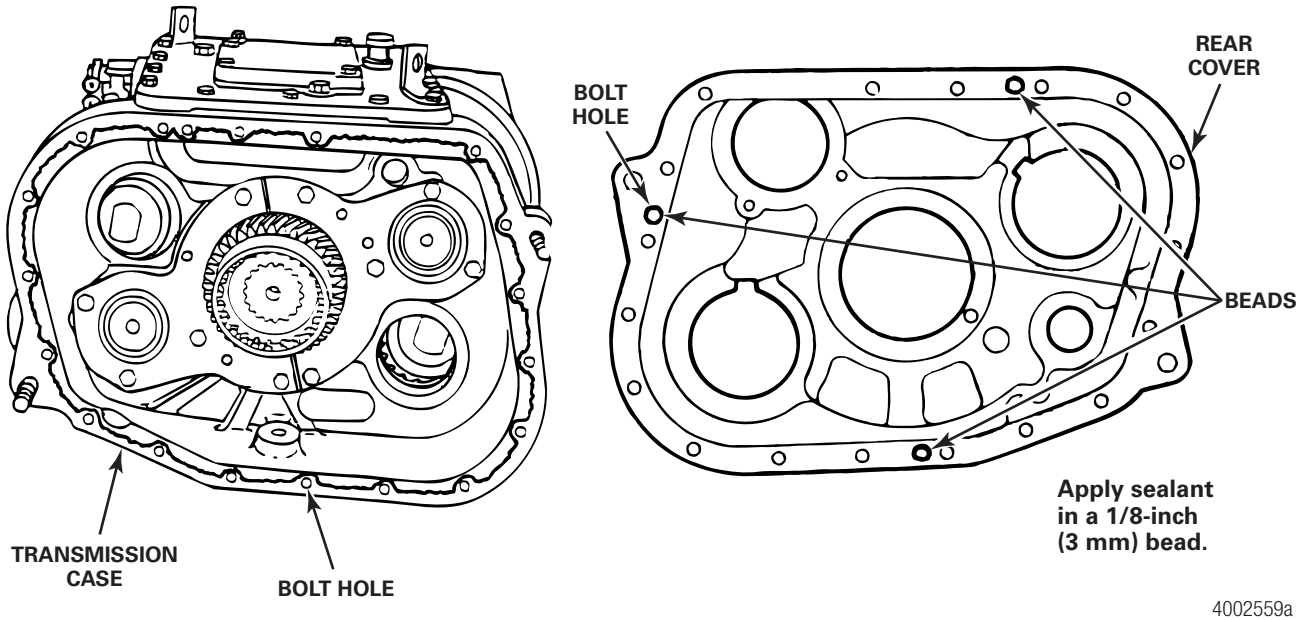


Figure 17.4

SHIFT BAR HOUSING-TO-TRANSMISSION CASE GEAR PATTERN

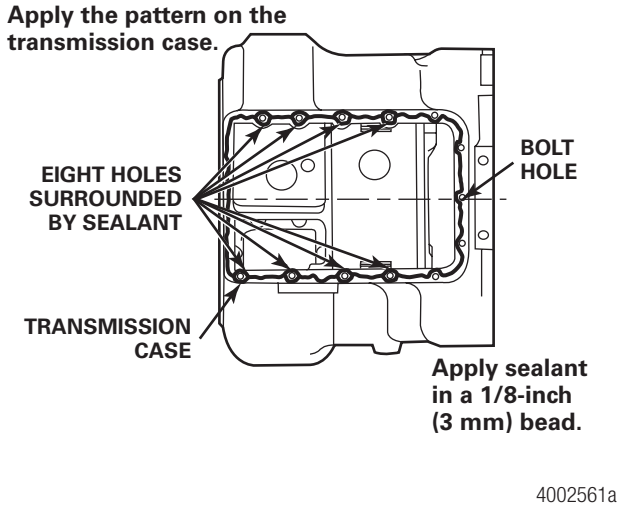
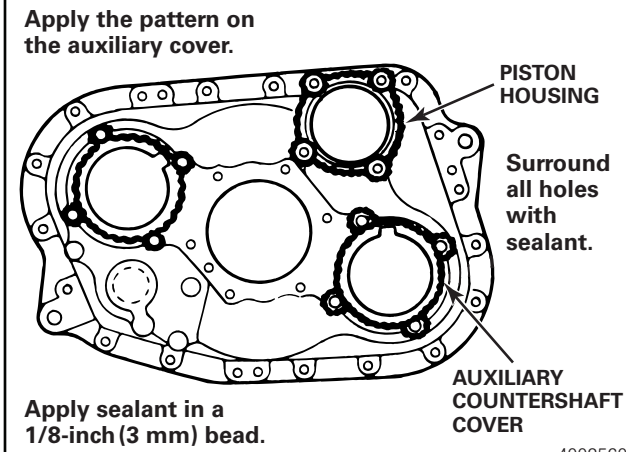


Figure 17.5

AUXILIARY COUNTERSHAFT COVERS AND RANGE PISTON HOUSINGS-TO-AUXILIARY COVER GASKET PATTERN (9- AND 10-SPEED TRANSMISSIONS)



Section 18
Testing System Components

WARNING

To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

When you work on an electrical system, the possibility of electrical shock exists, and sparks can ignite flammable substances. You must always disconnect the battery ground cable before you work on an electrical system to prevent serious personal injury and damage to components.

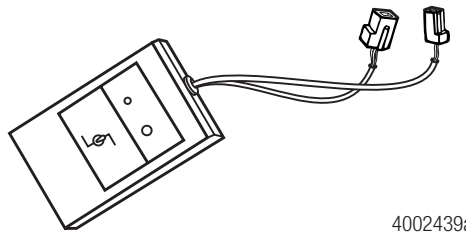
How to Test EOA Range Shift System Components

NOTE: EOA components are not serviceable. Replace components that do not function correctly.

Use a volt-ohm meter (VOM) and 12 VDC power to test components. A tester, Meritor part number 3256-J-1102 or Kent-Moore part number J-44356, is also available for the shift knob. **Figure 18.1**. To obtain these tools, refer to the Service Notes page on the front inside cover of this manual. If erratic readings occur when you perform electrical circuit tests, follow the guidelines below.

1. Verify that the connections are tight and the terminals are clean.
2. Retest the circuit.

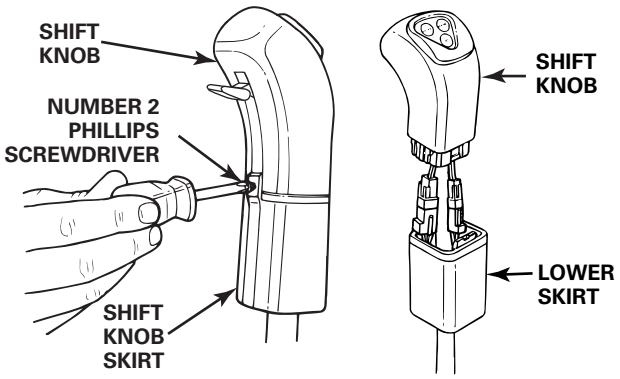
Figure 18.1



Shift Knob Using a Shift Knob Tester

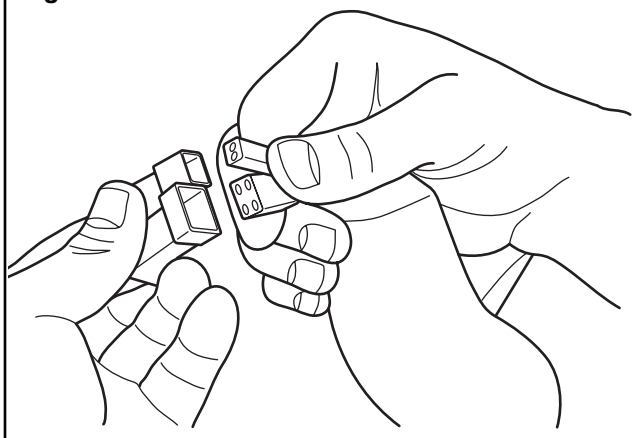
1. Use a number 2 Phillips-head screwdriver to remove the screw that attaches the shift knob skirt to the shift knob housing. **Figure 18.2**.

Figure 18.2



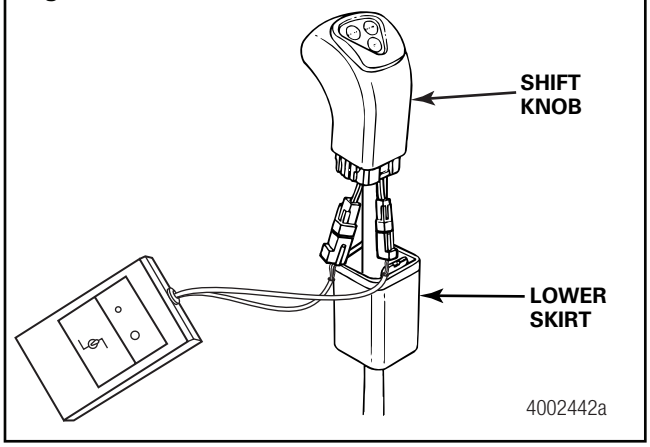
2. Separate the shift knob skirt from the shift knob assembly to expose the electrical connectors.
3. Disconnect the two EOA female connectors, which lead into the shift knob, from the wiring harness connector. **Figure 18.3**.

Figure 18.3



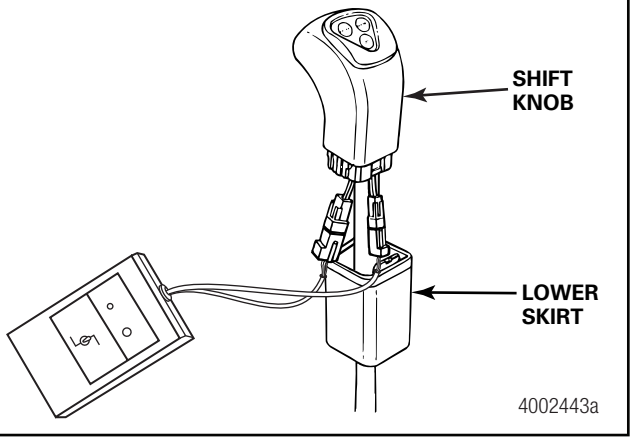
4. Plug the shift knob tester into the EOA female connectors. **Figure 18.4**.

Figure 18.4



5. Follow the directions on the tester to verify that the shift knob functions correctly. **Figure 18.5**.
   - **If the shift knob does not function correctly**: Replace the shift knob. Refer to Section 20 for removal and installation procedures.

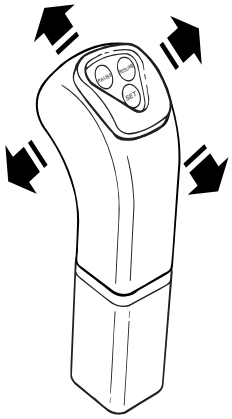
Figure 18.5



Shift Knob Testing Using a Volt-Ohm Meter (VOM)

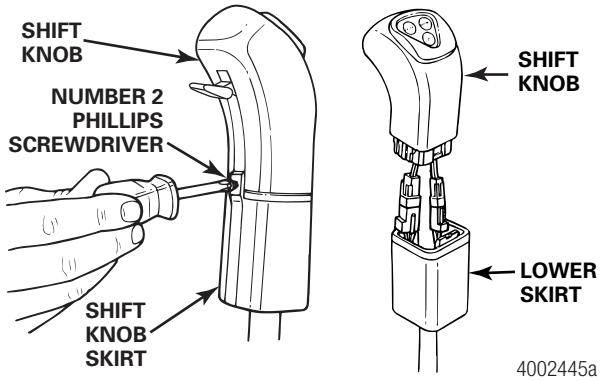
1. With the key ON and the engine OFF, place the transmission in Neutral (N). Preselect low (LO) range. **Figure 18.6**.

Figure 18.6



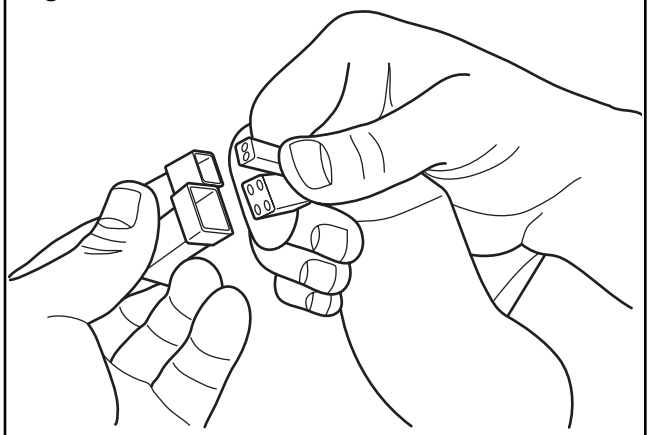
2. Use a number 2 Phillips-head screwdriver to remove the screw that attaches the shift knob skirt to the shift knob housing. **Figure 18.7**.
3. Separate the shift knob skirt from the shift knob assembly to expose the electrical connectors.

Figure 18.7



4. Disconnect the two EOA female connectors, which lead into the shift knob, from the wiring harness connector. **Figure 18.8**.

Figure 18.8



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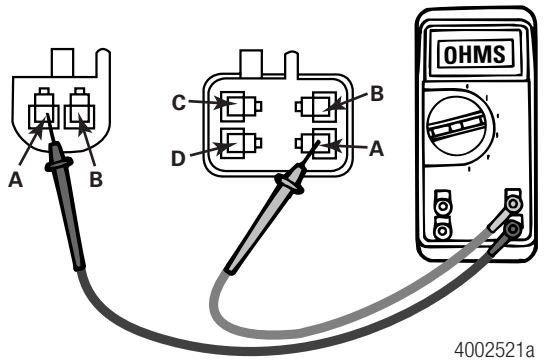
5. Use a volt-ohm meter to measure the resistance across pin "A" of the four-pin connector and pin "A" of the two-pin connector. **Figure 18.9**.

   Is resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the shift knob. Refer to Section 20.**

Figure 18.9



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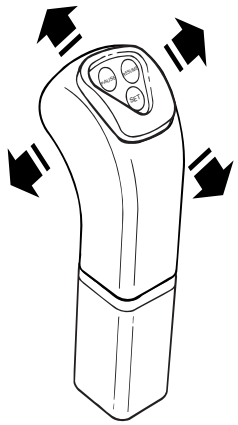
6. Reconnect the two EOA connectors, place the shift lever in Neutral (N), and preselect high range. **Figure 18.10**.

Figure 18.10



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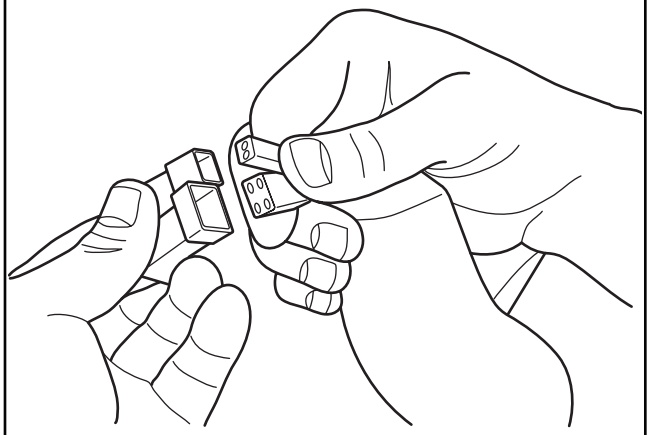
7. Disconnect the two EOA female connectors leading into the shift knob. **Figure 18.11**.

Figure 18.11



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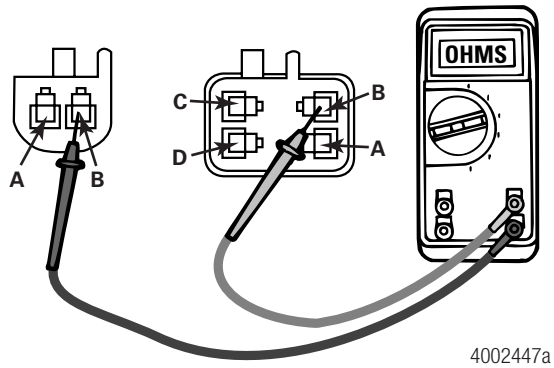
8. Use a volt-ohm meter to measure the resistance across pin "B" of the four-pin connector and pin "B" of the two-pin connector. **Figure 18.12**.

   Is resistance at or below 0.5 ohms?

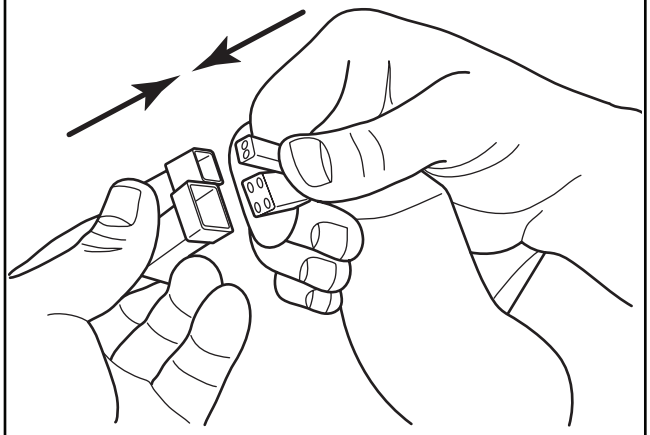
   - **YES → The shift knob functions correctly.**
   - **NO → Replace the shift knob. Refer to Section 20.**

Figure 18.12



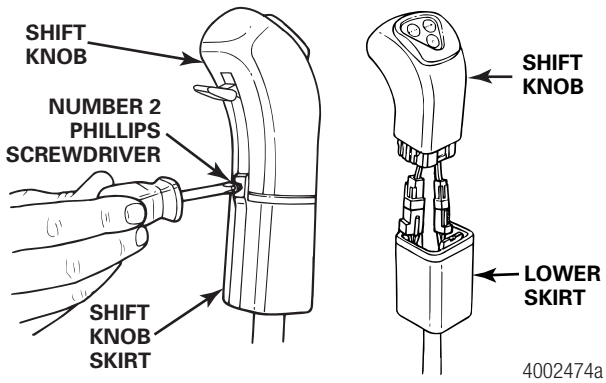
9. Reconnect the two EOA female connectors. Push the connectors together until the tabs are engaged. **Figure 18.13**.

Figure 18.13



10. Slide the shift knob skirt back into position to cover the exposed electrical connector. Replace the screw. Tighten it with a number 2 Phillips-head screwdriver. **Figure 18.14**.

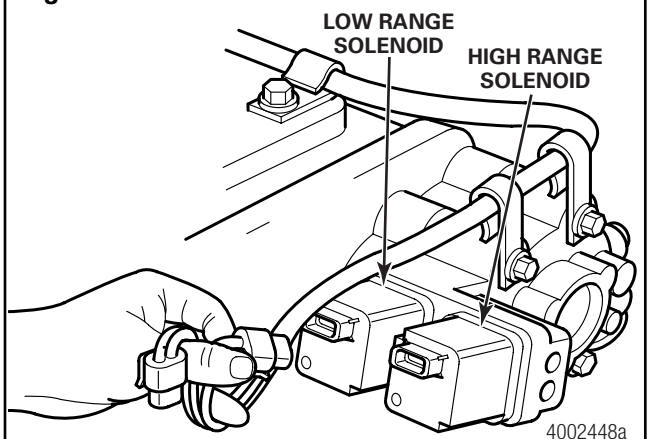
Figure 18.14



EOA Range Shift Solenoids

1. Disconnect the two pin connectors from the range shift solenoids. **Figure 18.15**.

Figure 18.15

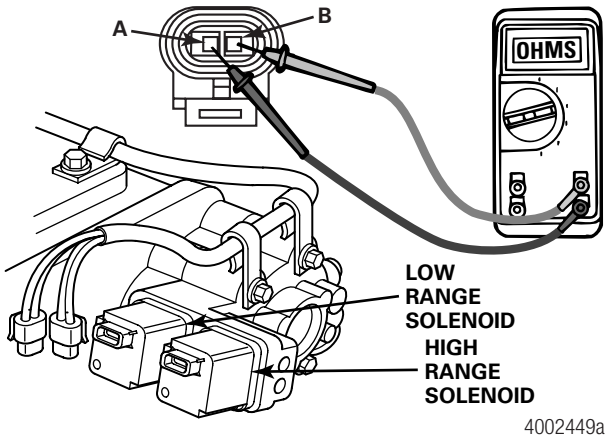


2. Check the resistance at the low range solenoid pins. The key must be OFF for all resistance tests. **Figure 18.16**.

   Is the resistance 11-21 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the low range solenoid. Refer to Section 20.**

Figure 18.16

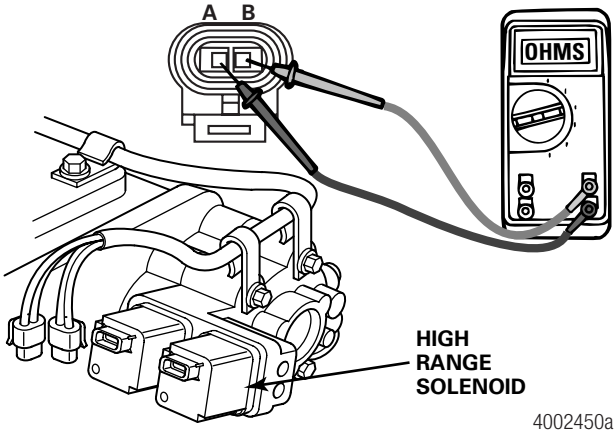


3. Check the resistance at the high range solenoid pins. The key must be OFF for all resistance tests. **Figure 18.17**.

   Is the resistance 11-21 ohms?

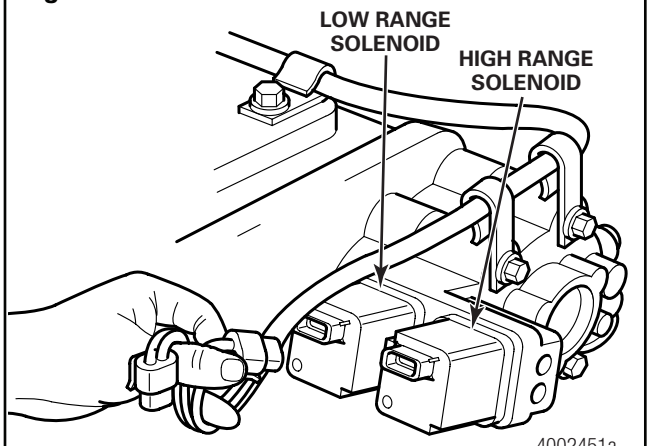
   - **YES → Both range shift solenoids function correctly. Go to the next step.**
   - **NO → Replace the low range solenoid. Refer to Section 20.**

Figure 18.17



4. Reconnect the two solenoid connectors. **Figure 18.18**.

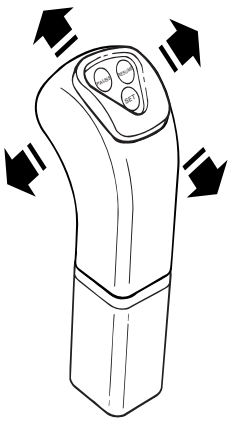
Figure 18.18



EOA Neutral Switch

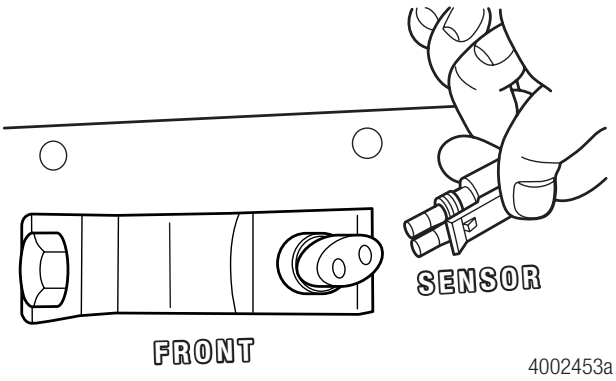
1. With the key ON and engine OFF, place the transmission in Neutral (N) and preselect low (LO) range. **Figure 18.19**.

Figure 18.19



2. Disconnect the neutral switch connector. **Figure 18.20**.

Figure 18.20

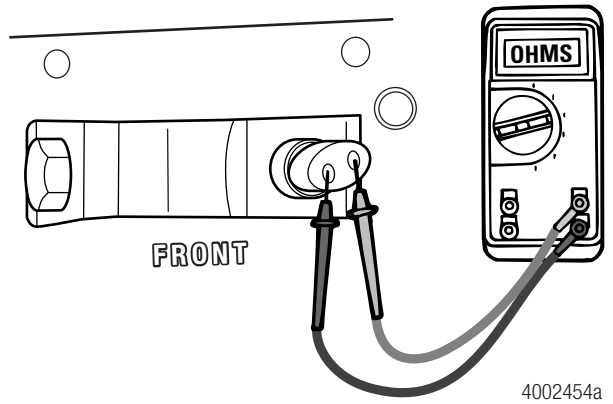


3. Use a volt-ohm meter to measure the resistance across the neutral switch pins. **Figure 18.21**.

   Is the resistance at or below 0.5 ohms?

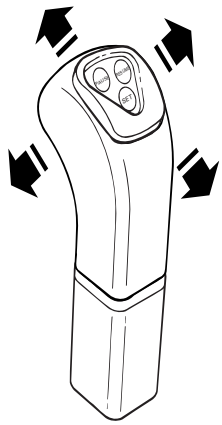
   - **YES → Go to the next step.**
   - **NO → Replace the neutral switch. Refer to Section 20.**

Figure 18.21



4. With the key ON and engine OFF, place the transmission in gear. **Figure 18.22**.

Figure 18.22

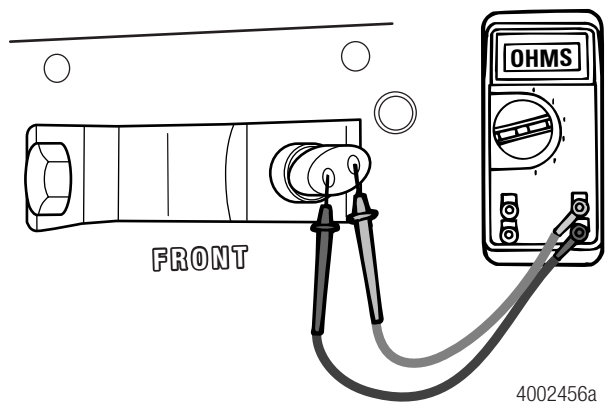


5. Use a volt-ohm meter to measure the resistance across the neutral switch pins. **Figure 18.23**.

   Is there an open circuit?

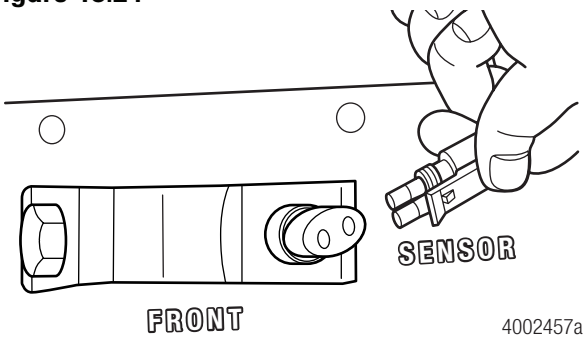
   - **YES → The neutral switch functions correctly. Go to the next step.**
   - **NO → Replace the neutral switch. Refer to Section 20.**

Figure 18.23



6. Reconnect the neutral switch connector. **Figure 18.24**.

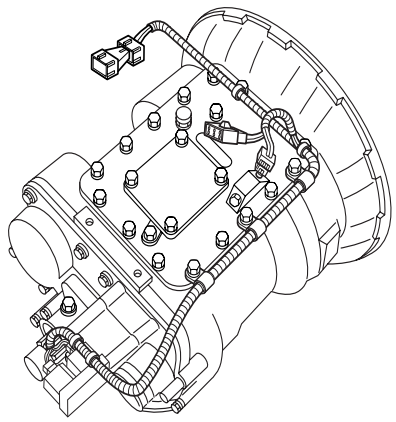
Figure 18.24



EOA Transmission Wiring Harness

1. Disconnect the shift lever, neutral switch, high solenoid, low solenoid and power connectors to remove the transmission wiring harness from the transmission. **Figure 18.25**.

Figure 18.25

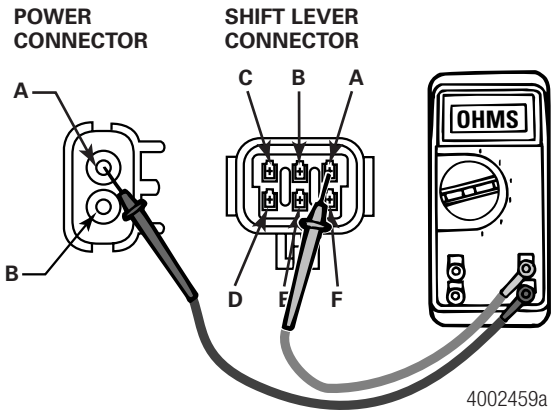


2. Use a volt-ohm meter to measure the resistance across pin "A" of the power connector and pin "A" of the shift lever connector. **Figure 18.26**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.26

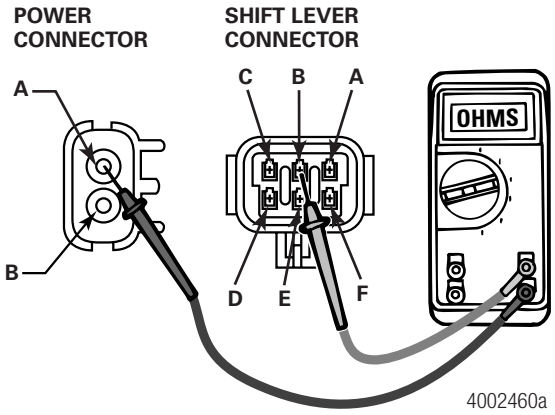


3. Use a volt-ohm meter to measure the resistance across pin "A" of the power connector and pin "B" of the shift lever connector. **Figure 18.27**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.27

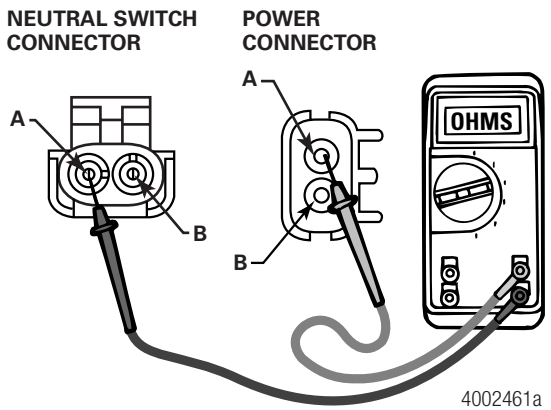


4. Use a volt-ohm meter to measure the resistance across pin "A" of the power connector and pin "A" of the neutral switch connector. **Figure 18.28**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.28

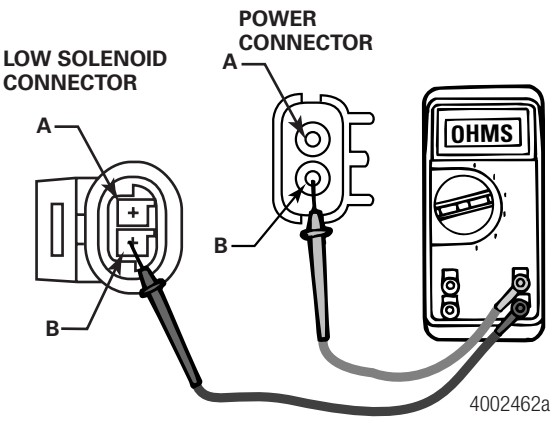


5. Use a volt-ohm meter to measure the resistance across pin "B" of the power connector and pin "B" of the low solenoid connector. **Figure 18.29**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.29

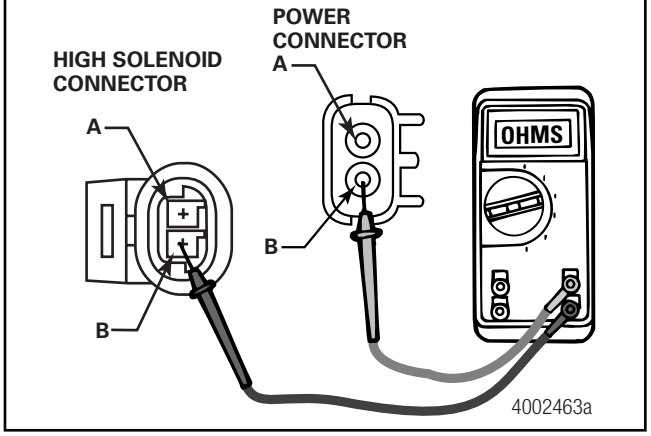


6. Use a volt-ohm meter to measure the resistance across pin "B" of the power connector and pin "B" of the high solenoid connector. **Figure 18.30**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.30

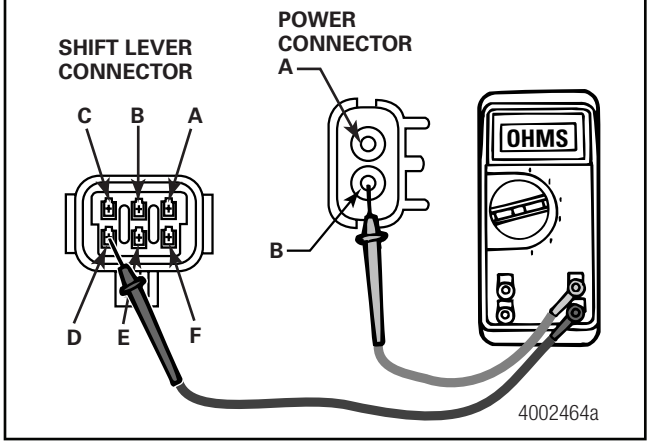


7. Use a volt-ohm meter to measure the resistance across pin "B" of the power connector and pin "D" of the shift lever connector. **Figure 18.31**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.31

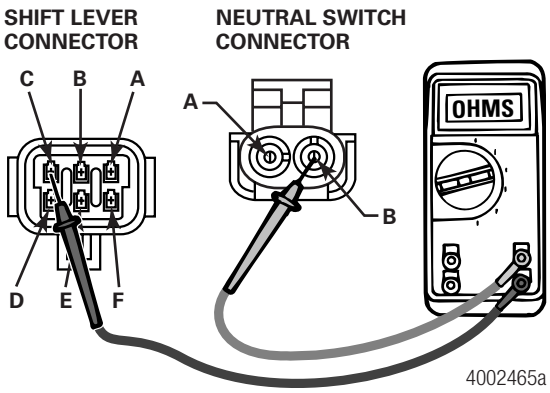


8. Use a volt-ohm meter to measure the resistance across pin "C" of the shift lever connector and pin "B" of the neutral switch connector. **Figure 18.32**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.32

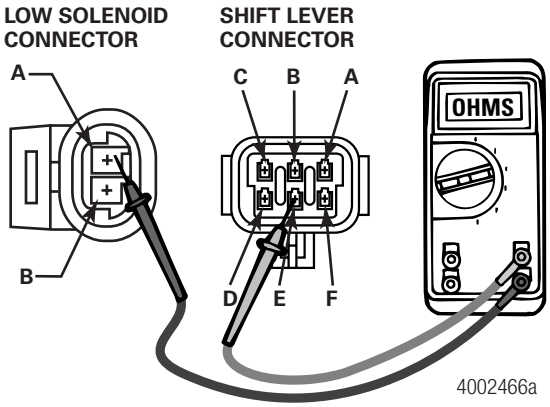


9. Use a volt-ohm meter to measure the resistance across pin "E" of the shift lever connector and pin "A" of the low solenoid connector. **Figure 18.33**.

   Is the resistance at or below 0.5 ohms?

   - **YES → Go to the next step.**
   - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.33

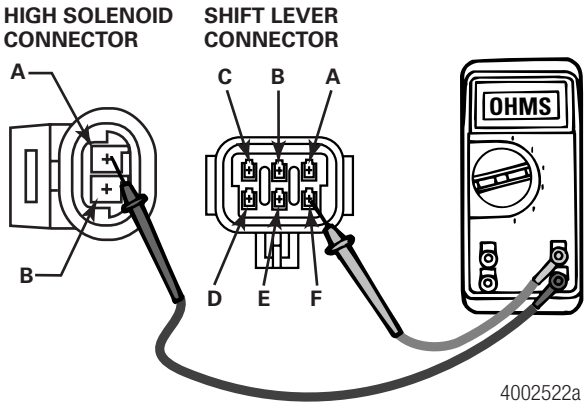


10. Use a volt-ohm meter to measure the resistance across pin "F" of the shift lever connector and pin "A" of the high solenoid connector. **Figure 18.34**.

    Is the resistance at or below 0.5 ohms?

    - **YES → Go to the next step.**
    - **NO → Replace the wiring harness. Refer to Section 20.**

Figure 18.34

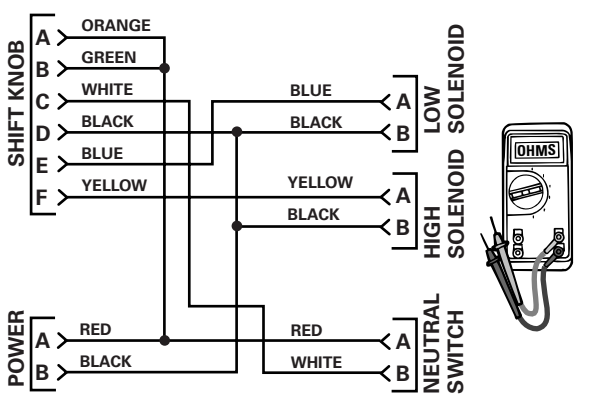


11. All circuits are intact. Use a volt-ohm meter to check for shorts between the separate circuits. **Figure 18.35**.

    Are any of the circuits shorted to another?

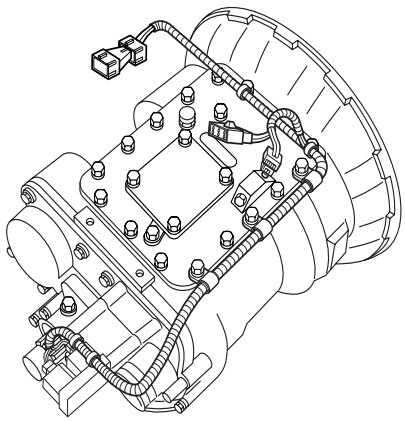
    - **YES → Replace the wiring harness. Refer to Section 20.**
    - **NO → The wiring harness functions correctly. Go to the next step.**

Figure 18.35



12. Connect the shift lever, neutral switch, high solenoid, low solenoid and power connectors to reinstall the wiring harness. **Figure 18.36**.

Figure 18.36

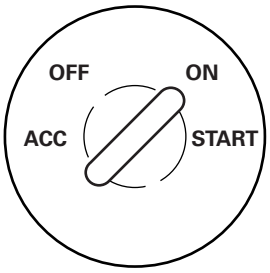


4002468a

OEM Power Supply

1. Turn the key ON and the engine OFF. **Figure 18.37**.

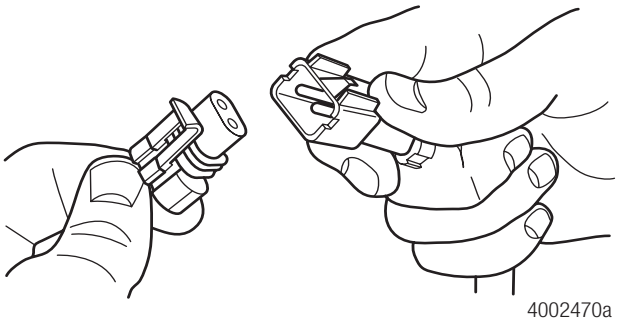
Figure 18.37



4002469a

2. Disconnect the OEM power supply from the EOA transmission wiring harness. **Figure 18.38**.

Figure 18.38



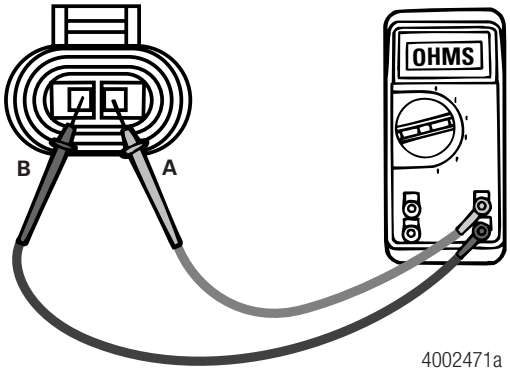
4002470a

3. Use a volt-ohm meter to measure the DC voltage across pins "A" and "B" of the power connector. **Figure 18.39**.

   Is the voltage greater than or equal to 9VDC?

   - **YES → Go to the next step.**
   - **NO → Fix the OEM power circuit. If necessary, consult the OEM.**

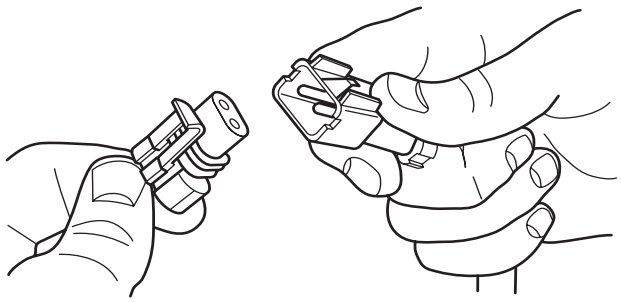
Figure 18.39



4002471a

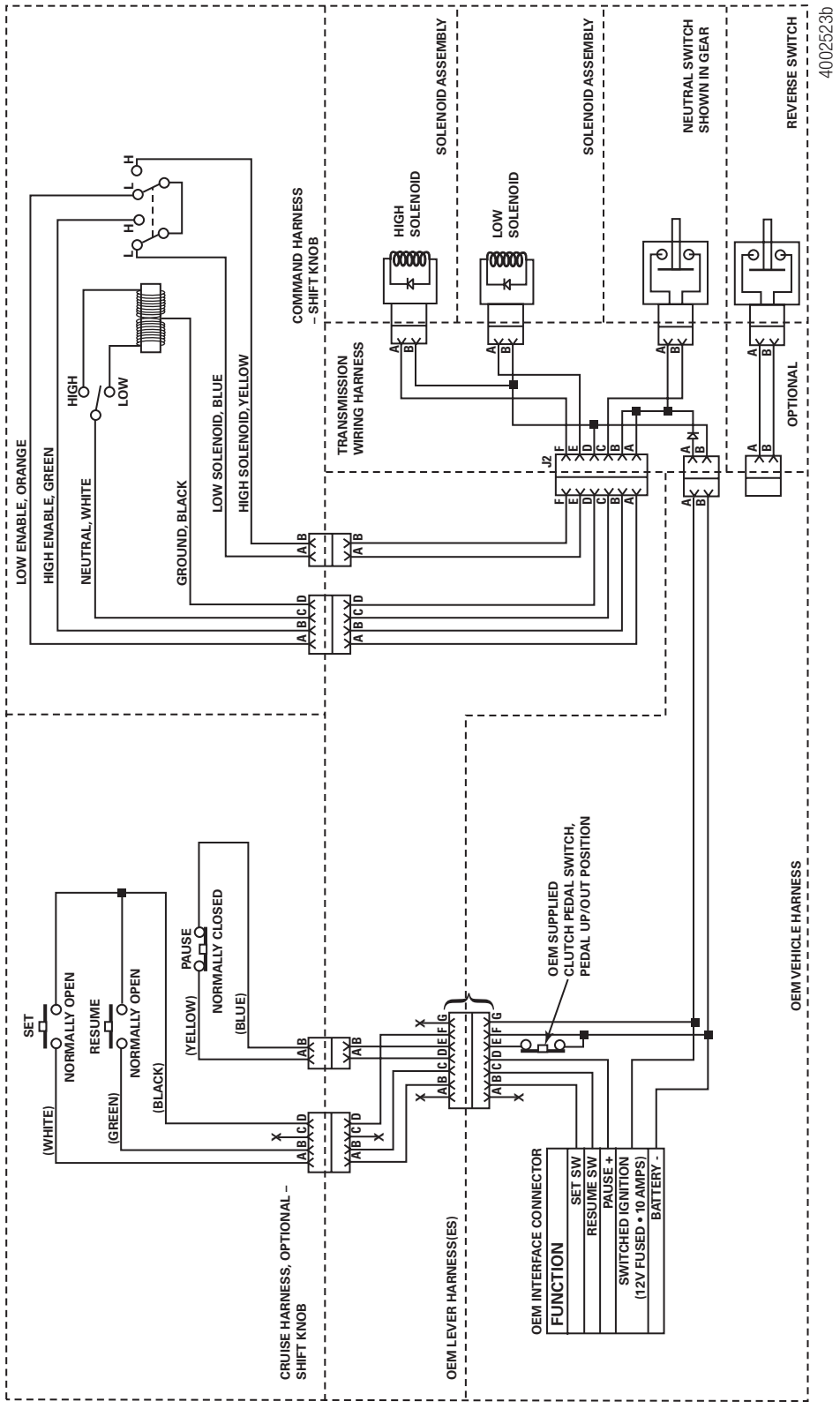
4. Connect the OEM power supply to the EOA transmission wiring harness. **Figure 18.40**.

Figure 18.40



4002472a

Platform G Range Shift System



What to Check

NOTE: EOA components are not serviceable. Replace components that do not function correctly.

The EOA range shift system does not use fault code diagnostics. Refer to the table below for troubleshooting suggestions.

Condition	Check
The transmission will not perform high or low range shifts or "sticks" in a range.	12VDC switched power is available. Air tank pressure is correct. The neutral switch operates correctly: Resistance is 0.0-0.5 ohms when in neutral and open circuit when in gear. Resistance is 11.0-21.0 ohms across the range solenoids. Wiring harness connections are solid. The shift knob functions correctly.
The transmission intermittently "sticks" in high or low range.	Wiring harness connections are solid.
Transmission changes range once operator moves preselect switch, even if the main box is in gear.	The neutral switch operates correctly: Resistance at 0.0-0.5 ohms when in neutral and open circuit when in gear. The shift knob functions correctly.
Transmission changes range while in neutral without operator input.	The shift knob functions correctly.

Tools You'll Need

- Volt-ohm meter
- Pressure gauge
- SPX Kent-Moore shift knob tester J-44356. Call the company's service center at 800-345-2233 to obtain the tester.

Diagnostics

NOTE: EOA components are not serviceable. Replace components that do not function correctly.

The EOA transmission range shift system does not use fault code diagnostics.

These flowcharts provide diagnostic information for Meritor's Platform "G" transmission range shift systems. When using diagnostics to troubleshoot system faults, it's important to follow these flowcharts step-by-step and use the following diagnostic procedures in the sequence outlined below.

1. **Mechanical Checks:** Follow the mechanical checks flowchart to verify that all mechanical systems function correctly. Repair all mechanical issues **before** you perform electrical checks. **Figure 19.1**.
2. **Low Range Electrical Checks:** Follow the low range electrical checks flowchart to verify that the low electrical system functions correctly. Perform low range electrical checks **after** mechanical checks and **before** high range electrical checks. **Figure 19.2**.
3. **High Range Electrical Checks:** Follow the high range electrical checks flowchart to verify that the high electrical system functions correctly. Perform high range electrical checks **after** mechanical checks and low range electrical checks. **Figure 19.3**.

When you find the fault, follow recommended service procedures to repair it, and then test the system. If a fault still exists, or if you find a new one, repeat Step 1 through Step 3 above, until you've repaired all faults.

Section 19
EOA Wiring Diagram/Troubleshooting

Figure 19.1

VIN #: _____

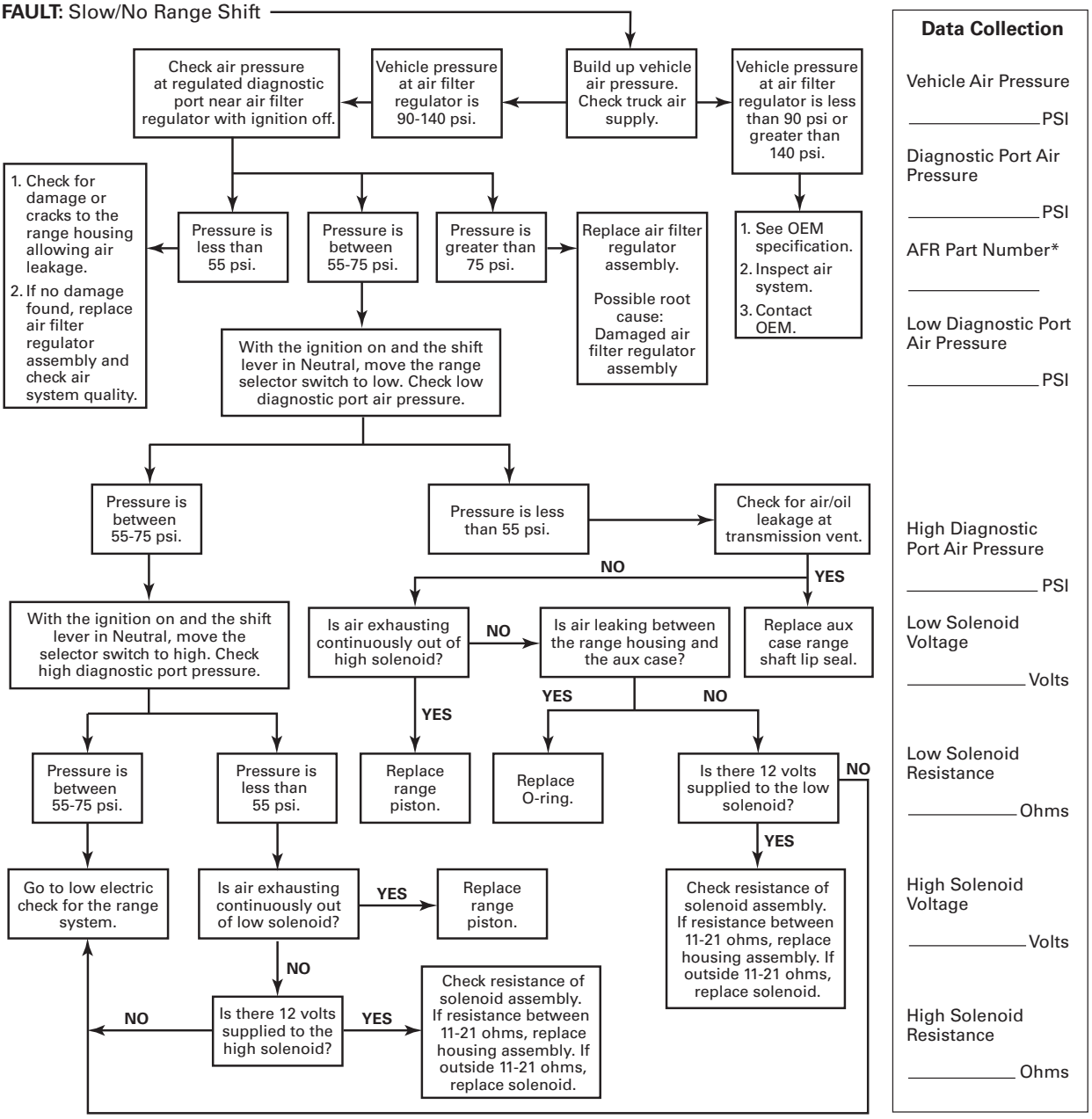
FLEET NAME: _____

MILEAGE: _____

ONTRAC CASE #: _____

Electric Over Air (EOA) Diagnostic Flowchart

Mechanical Checks



***NOTE:** AFR part number is stamped on the bottom of the cap head.

Figure 19.2

VIN #: _____

FLEET NAME: _____

MILEAGE: _____

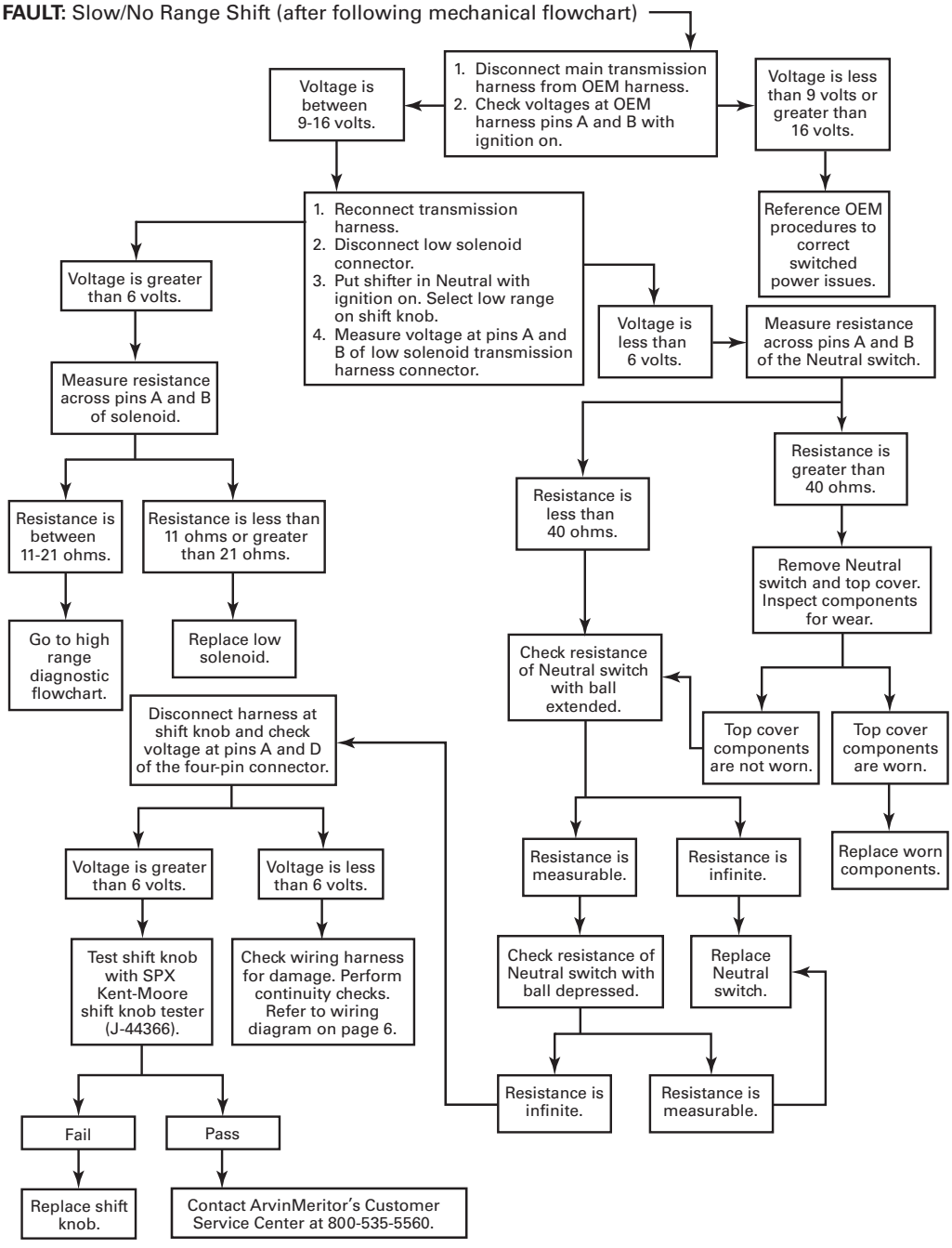
ONTRAC CASE #: _____

Electric Over Air (EOA) Diagnostic Flowchart

Electrical Checks, Low Range

NOTE: Follow the mechanical flowchart BEFORE the low range electrical flowchart.

FAULT: Slow/No Range Shift (after following mechanical flowchart)



Data Collection

OEM Harness Pins A & B

_____ Volts

Low Solenoid Harness Voltage at Pins A & B

_____ Volts

Neutral Switch Resistance at Pins A & B

_____ Ohms

Solenoid Resistance at Pins A & B

_____ Ohms

Neutral Switch Resistance with ball extended

_____ Ohms

Shift Knob 4 Pin Connector Voltage at Pins A & D

_____ Volts

Neutral Switch Resistance with ball depressed

_____ Ohms

Shift Knob Tester

Pass _____

Fail _____

Figure 19.3

VIN #: _____

FLEET NAME: _____

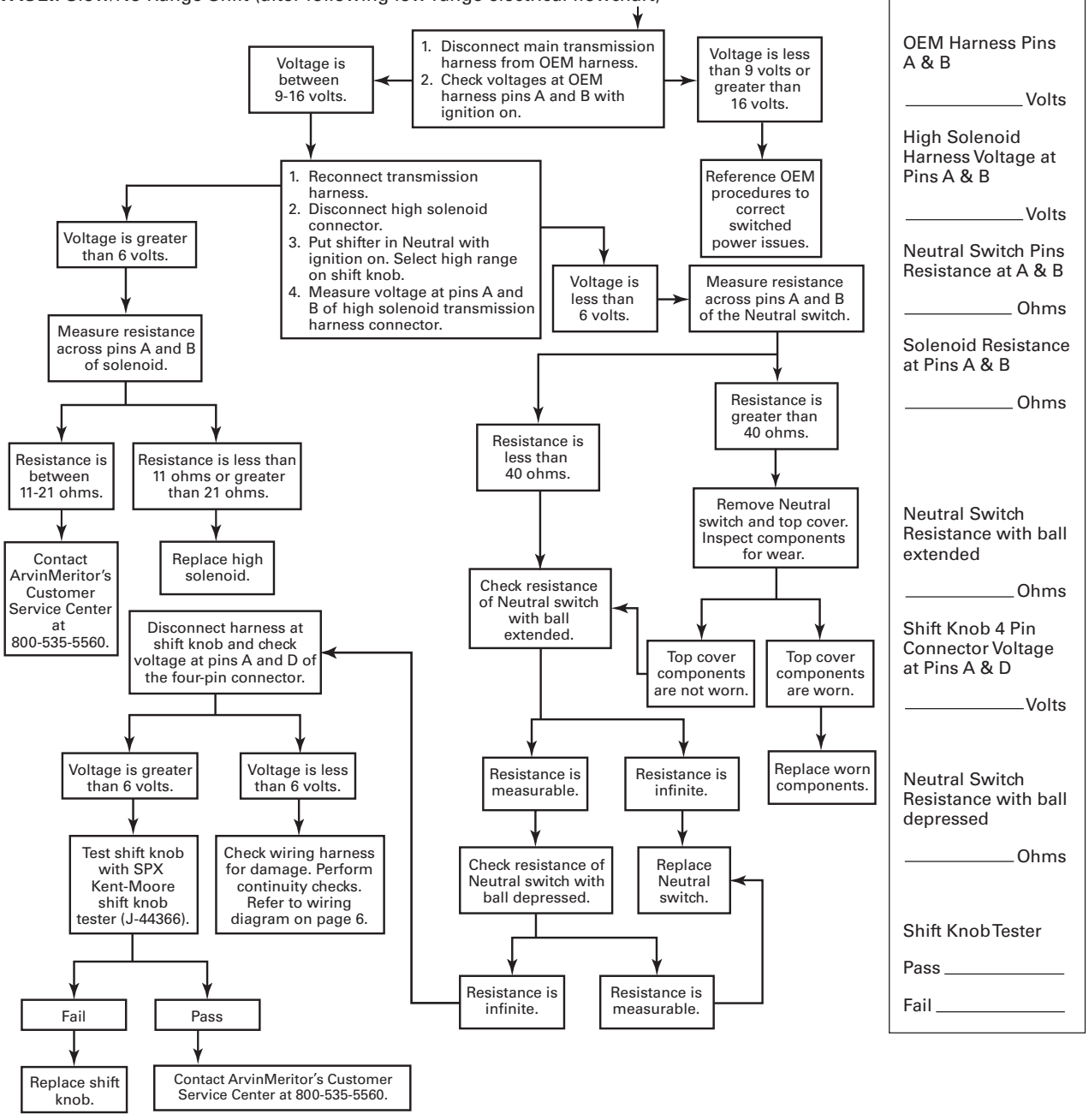
MILEAGE: _____

ONTRAC CASE #: _____

Electric Over Air (EOA) Diagnostic Flowchart

Electrical Checks, High Range

NOTE: Follow the low range electrical flowchart BEFORE this flowchart.
FAULT: Slow/No Range Shift (after following low range electrical flowchart)



Data Collection

OEM Harness Pins A & B

_____ Volts

High Solenoid Harness Voltage at Pins A & B

_____ Volts

Neutral Switch Pins Resistance at A & B

_____ Ohms

Solenoid Resistance at Pins A & B

_____ Ohms

Neutral Switch Resistance with ball extended

_____ Ohms

Shift Knob 4 Pin Connector Voltage at Pins A & D

_____ Volts

Neutral Switch Resistance with ball depressed

_____ Ohms

Shift Knob Tester

Pass _____

Fail _____

WARNING

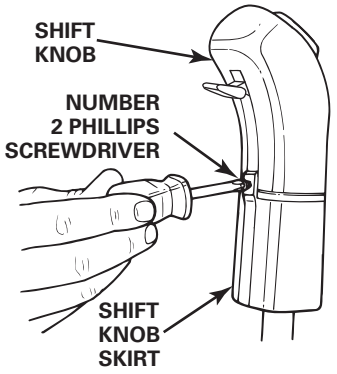
To prevent serious eye injury, always wear safe eye protection when you perform vehicle maintenance or service.

When you work on an electrical system, the possibility of electrical shock exists, and sparks can ignite flammable substances. You must always disconnect the battery ground cable before you work on an electrical system to prevent serious personal injury and damage to components.

Shift Knob Removal

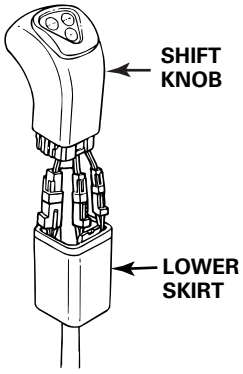
1. Use a Phillips-head screwdriver to remove the screw that secures the skirt to the shift knob housing. **Figure 20.1**.

Figure 20.1



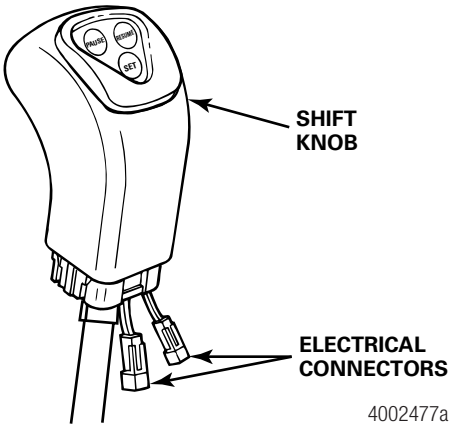
2. Separate the skirt from the shift knob assembly. **Figure 20.2**.

Figure 20.2



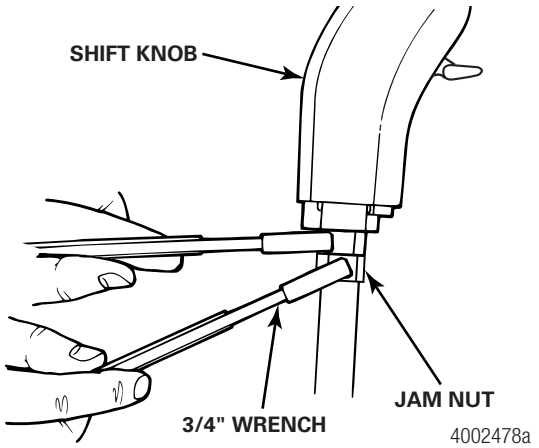
3. Disconnect the electrical connectors at the base of the shift knob by lifting the tab and pulling the connectors apart. **Figure 20.3**.

Figure 20.3



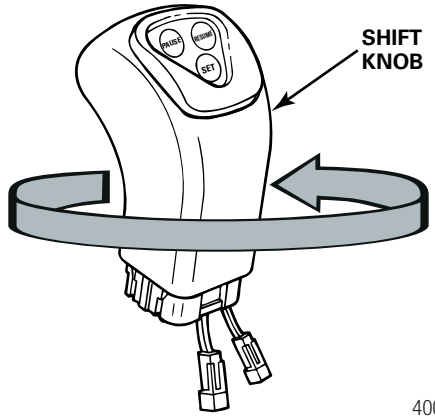
4. Use a 3/4-inch wrench to loosen the jam nut at the base of the shift knob. **Figure 20.4**.

Figure 20.4



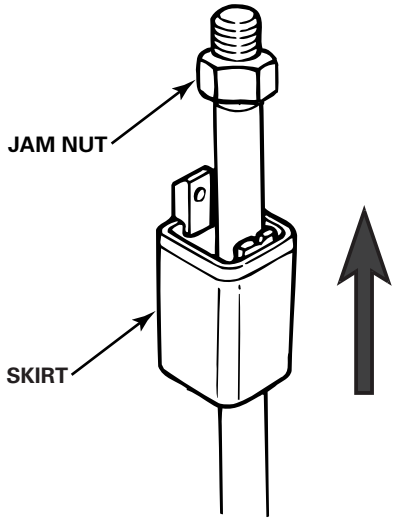
5. Turn the shift knob COUNTERCLOCKWISE to remove it from the lever. **Figure 20.5**.

Figure 20.5



6. Remove the jam nut and shift knob skirt. **Figure 20.6**.

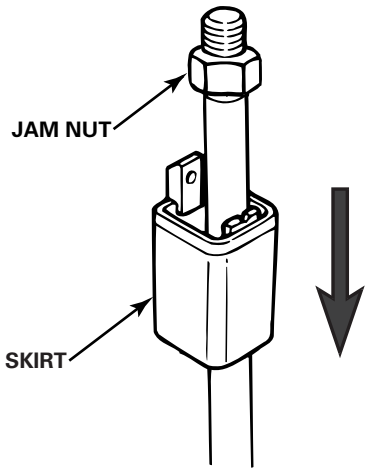
Figure 20.6



Shift Knob Installation

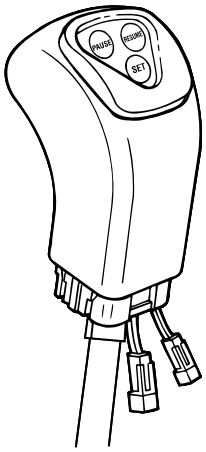
1. Slip the shift knob skirt over the shift tower. Install the jam nut. **Figure 20.7**.

Figure 20.7



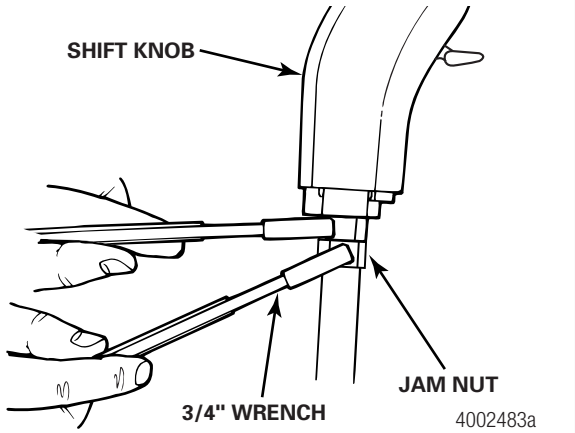
2. Turn the shift knob CLOCKWISE to install it on the lever. **Figure 20.8**.

Figure 20.8



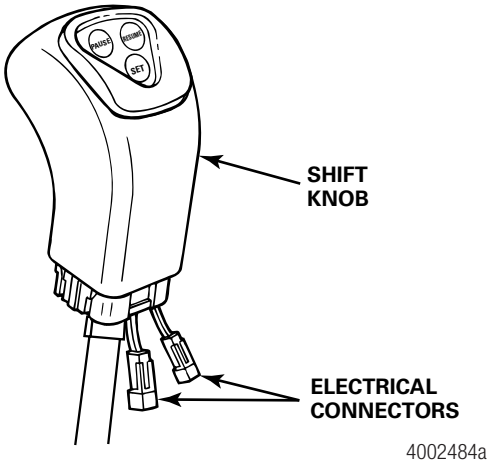
3. Position the knob as desired. Use a 3/4-inch wrench to tighten the jam nut at the base of the shift knob to 30-40 lb-ft (41-54 N•m). **Figure 20.9**.

Figure 20.9



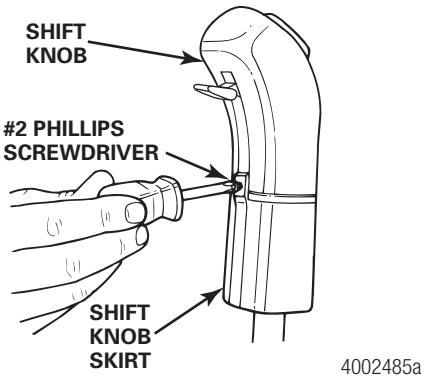
4. Connect the electrical connectors at the base of the shift knob by pushing them together to connect the tabs. **Figure 20.10**.

Figure 20.10



5. Use a Phillips-head screwdriver to install the screw that secures the skirt to the shift knob housing. **Figure 20.11**.

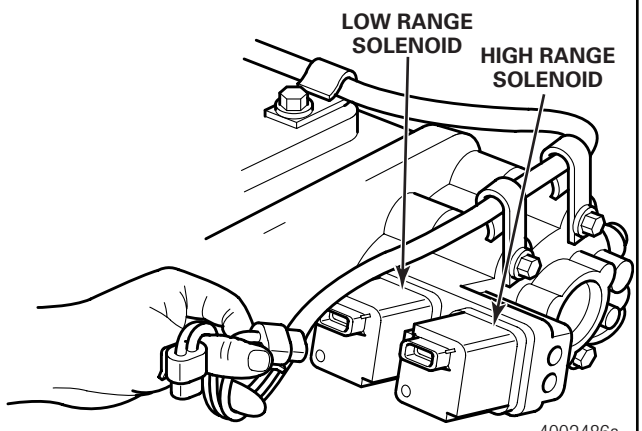
Figure 20.11



Range Cylinder Solenoid Removal

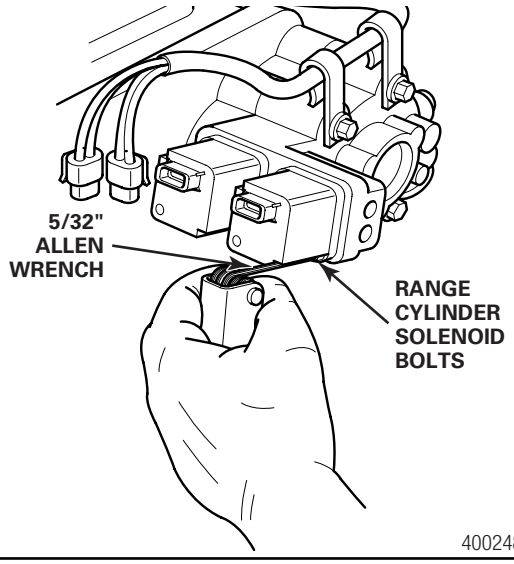
1. Disconnect the two range solenoid connectors. **Figure 20.12**.

Figure 20.12



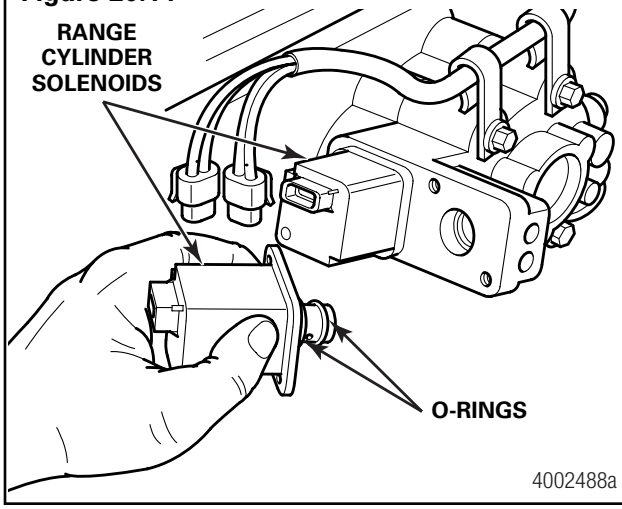
2. Use a 5/32-inch Allen wrench to remove the two Allen-head bolts that secure either the high or low range cylinder solenoid, depending on which solenoid you will replace. **Figure 20.13**.

Figure 20.13



3. Remove either the high or low range cylinder solenoid from the range housing. The low side of the range housing is illustrated. **Figure 20.14**.

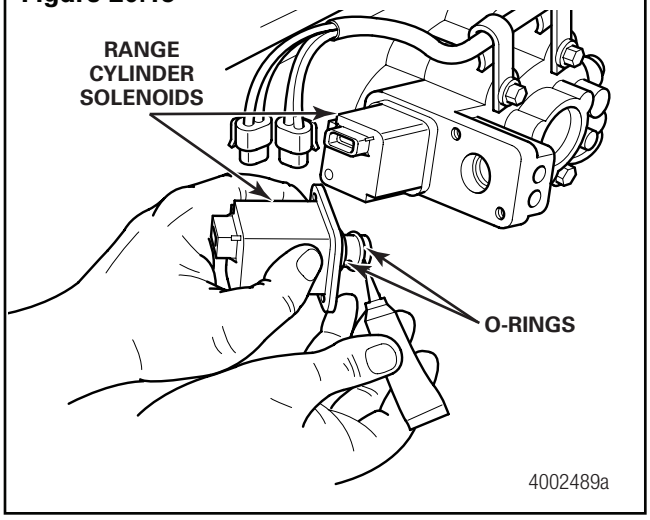
Figure 20.14



Range Cylinder Solenoid Installation

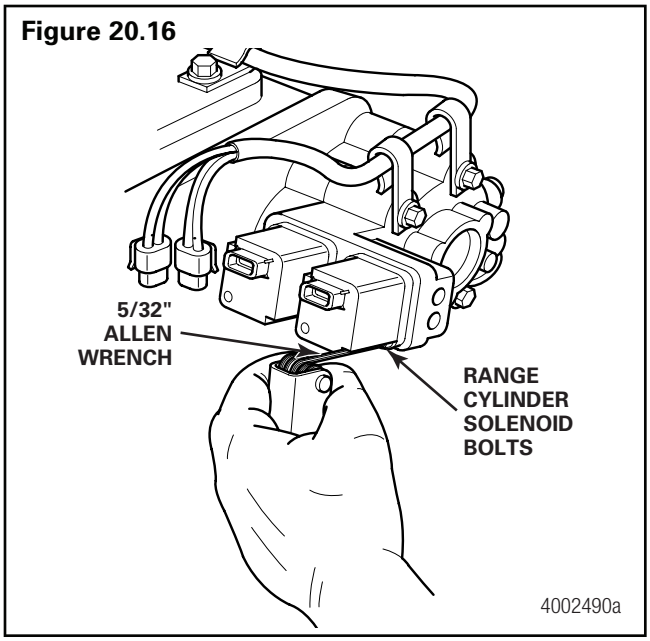
1. Lubricate the new range cylinder solenoid O-rings with Dow Corning® 3451 Silicone Grease or equivalent. Install the O-rings onto the replacement range cylinder solenoid. **Figure 20.15**.

Figure 20.15



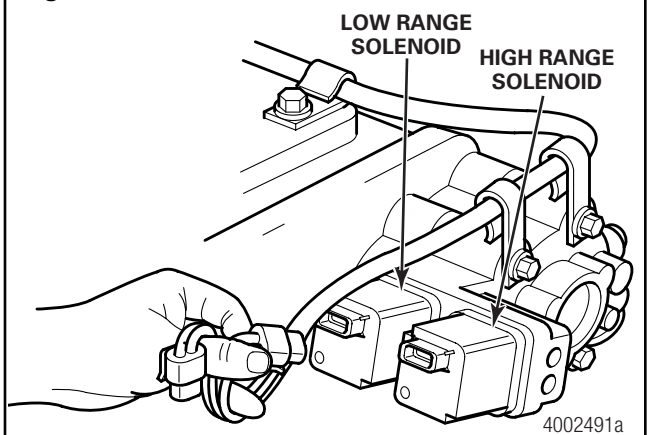
2. Use a 5/32-inch Allen wrench to install the range cylinder solenoid into the range housing. Install the two Allen-head bolts that secure the range cylinder solenoid. Tighten the bolts to 45-55 lb-in (5-6 N•m). T
3. Connect the range cylinder solenoid connector. **Figure 20.16**.

Figure 20.16



4. Reconnect the two solenoid connectors. **Figure 20.17**.

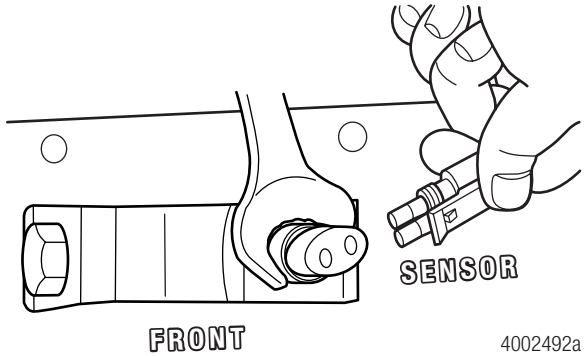
Figure 20.17



Neutral Switch Removal

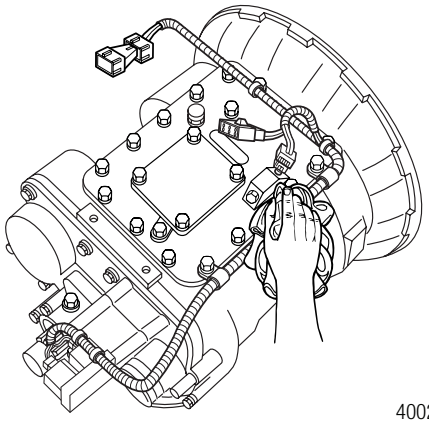
1. Disconnect the harness connector from the EOA neutral switch. **Figure 20.18**.

Figure 20.18



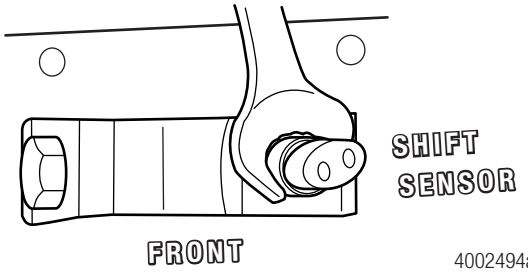
2. Clean the top cover housing before removal. **Figure 20.19**.

Figure 20.19



3. Use a 7/8-inch wrench to remove the neutral switch from the top cover housing. **Figure 20.20**.

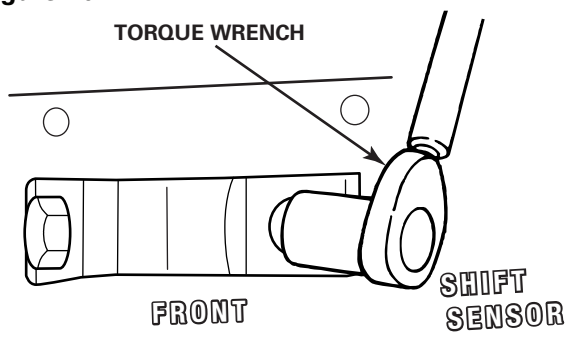
Figure 20.20



Neutral Switch Installation

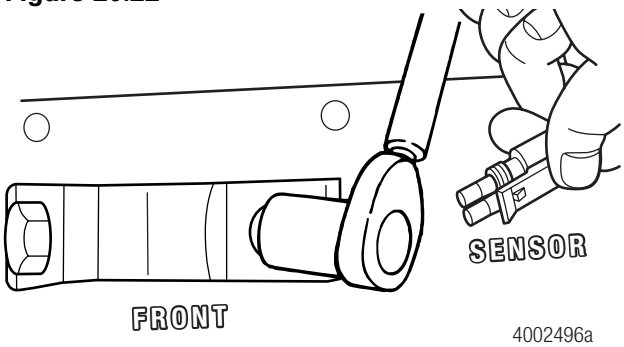
1. Install the neutral switch into the top cover. Use a torque wrench to tighten the switch to 150-210 lb-in (17-24 N•m). **Figure 20.21**.

Figure 20.21



2. Connect the wiring harness connector to the neutral switch. **Figure 20.22**.

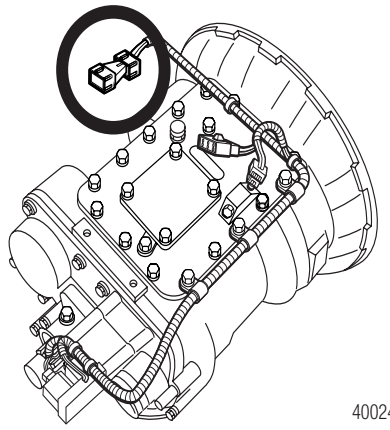
Figure 20.22



Wiring Harness Removal

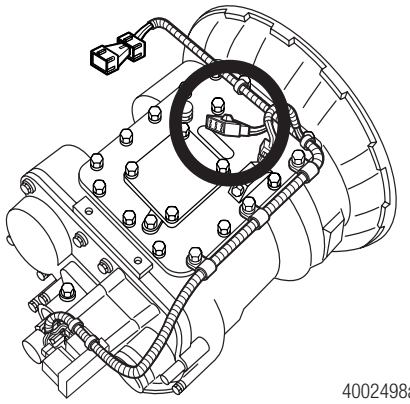
1. Disconnect the two-pin power connector. **Figure 20.23**.

Figure 20.23



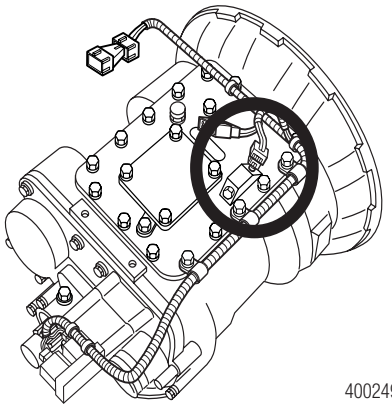
2. Disconnect the six-pin shift knob connector. **Figure 20.24**.

Figure 20.24



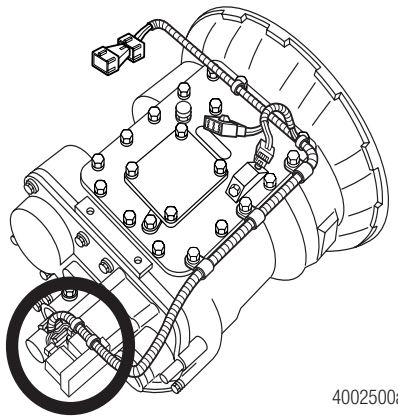
3. Disconnect the two-pin neutral switch connector. **Figure 20.25**.

Figure 20.25



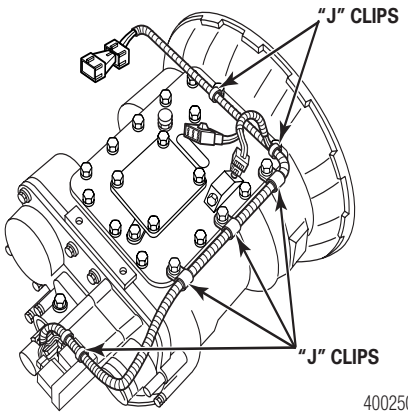
4. Disconnect both the high and low solenoid two-pin connectors. **Figure 20.26**.

Figure 20.26



5. Remove the wiring harness from the "J" clips. Remove the harness from the transmission. **Figure 20.27**.

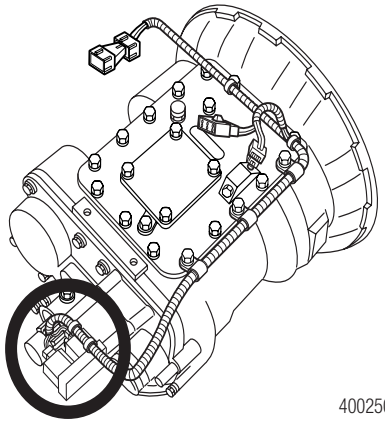
Figure 20.27



Wiring Harness Installation

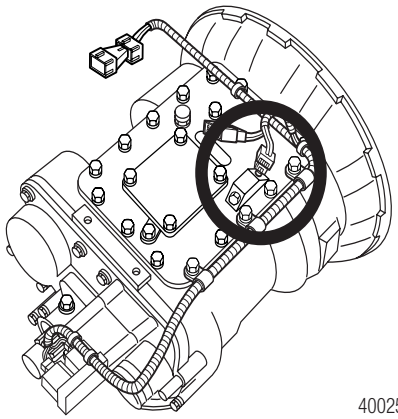
1. Connect the two-pin range solenoid wiring harness connectors to the high and low range solenoids. The BLACK and YELLOW wires must lead to the high solenoid, rearward. The BLUE and BLACK wires must lead to the low solenoid, forward. **Figure 20.28**.

Figure 20.28



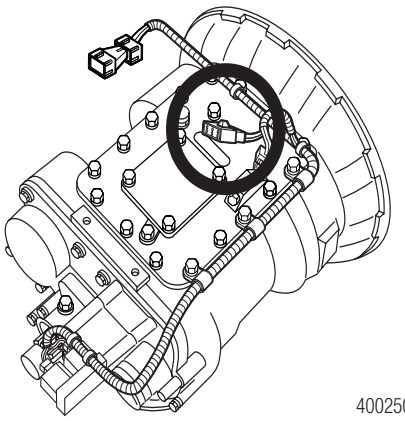
2. Connect the two-pin wiring harness connector to the neutral switch. **Figure 20.29**.

Figure 20.29



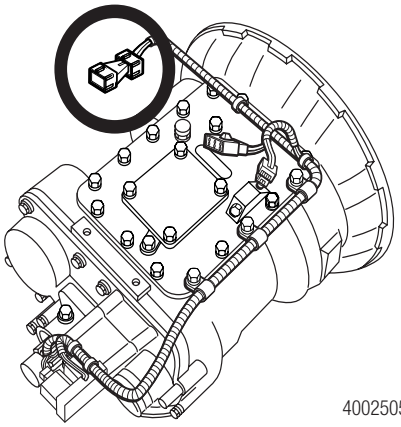
3. Connect the six-pin wiring harness connector to the OEM shift knob wiring harness. **Figure 20.30**.

Figure 20.30



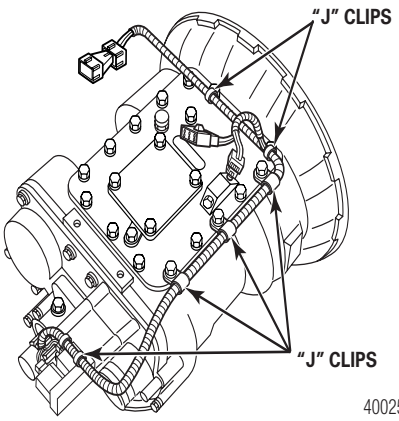
4. Connect the two-pin power connector to the OEM power connector. **Figure 20.31**.

Figure 20.31



5. Secure the wiring harness to the "J" clips. **Figure 20.32**.

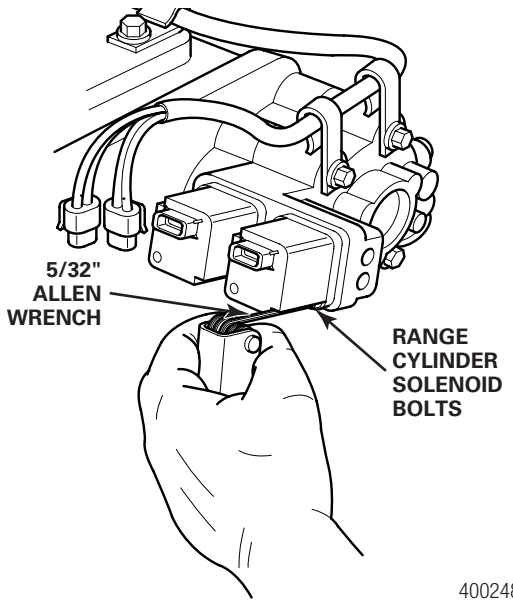
Figure 20.32



Range Cylinder Removal

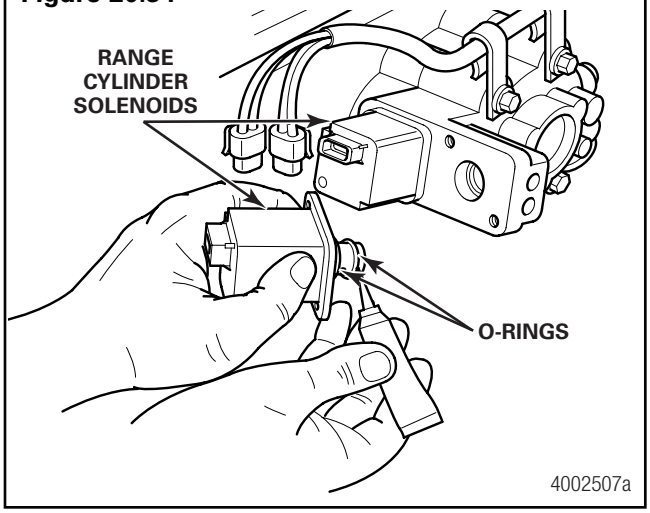
1. Use a 5/32-inch Allen wrench to remove the four Allen-head bolts that secure the two range cylinder solenoids. **Figure 20.33**.

Figure 20.33



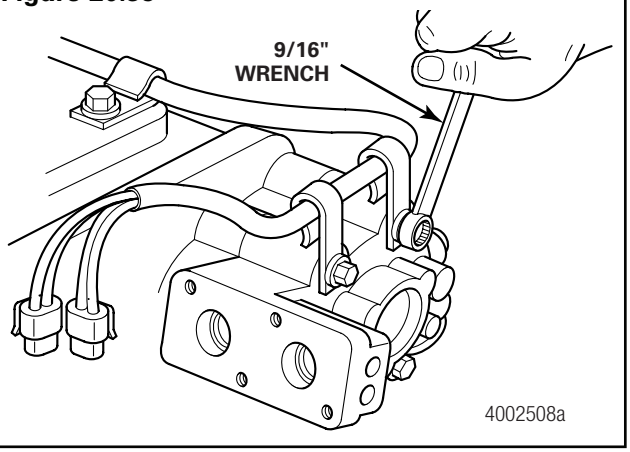
2. Remove the range cylinder solenoids. **Figure 20.34**.

Figure 20.34



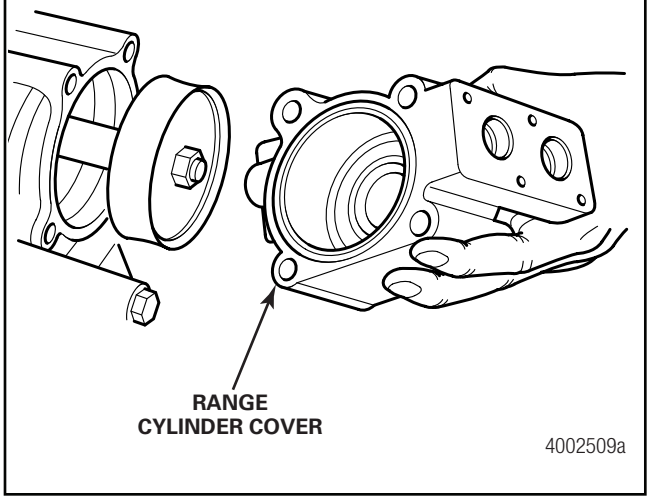
3. Use a 9/16-inch wrench to remove the four 3/8-16 range cylinder cover bolts. **Figure 20.35**.

Figure 20.35



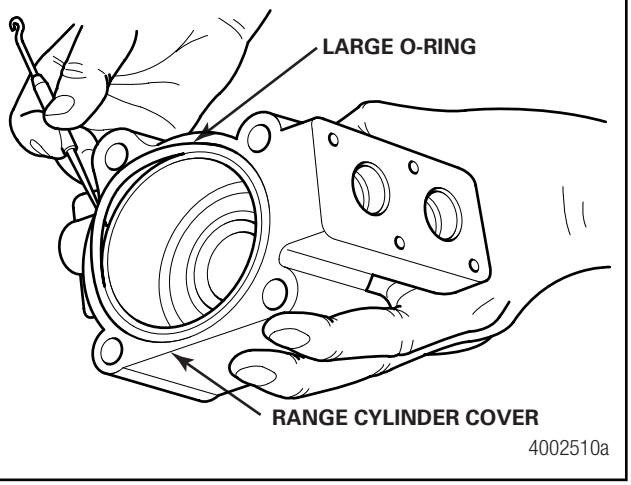
4. Remove the range cylinder cover. **Figure 20.36**.

Figure 20.36



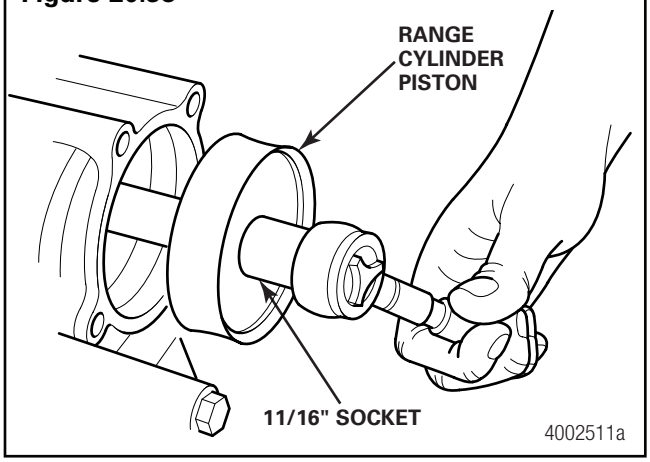
5. Remove the large O-ring from the range cylinder cover. **Figure 20.37**.

Figure 20.37



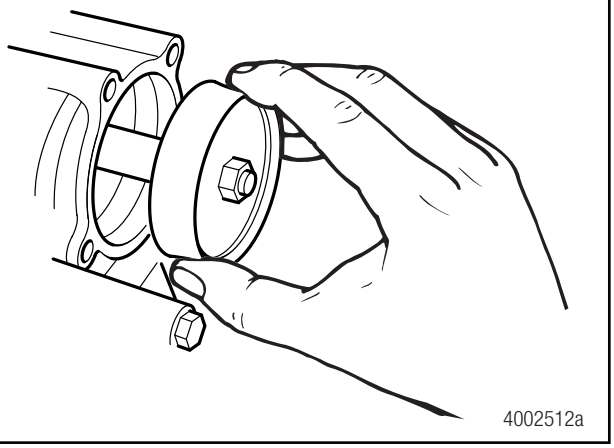
6. Use an 11/16-inch socket to remove the 11/16-inch range cylinder piston nut. **Figure 20.38**.

Figure 20.38



7. Remove the piston from the housing. **Figure 20.39**.

Figure 20.39



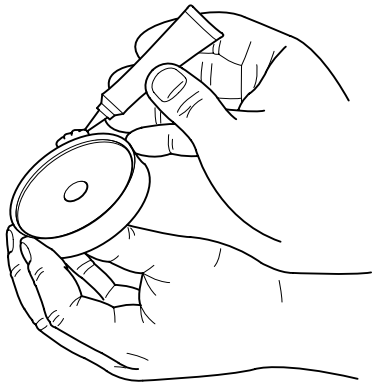
Range Cylinder Installation

WARNING

Take care when you use Loctite® adhesive to avoid serious personal injury. Read the manufacturer's instructions before using this product. Follow the instructions carefully to prevent irritation to the eyes and skin.

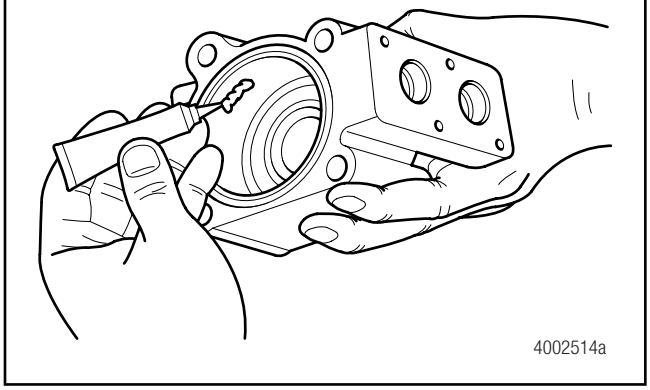
1. Lubricate the range cylinder piston O-ring with Dow Corning® 3451 silicone grease or equivalent. Install the O-ring onto the range piston. **Figure 20.40**.

Figure 20.40



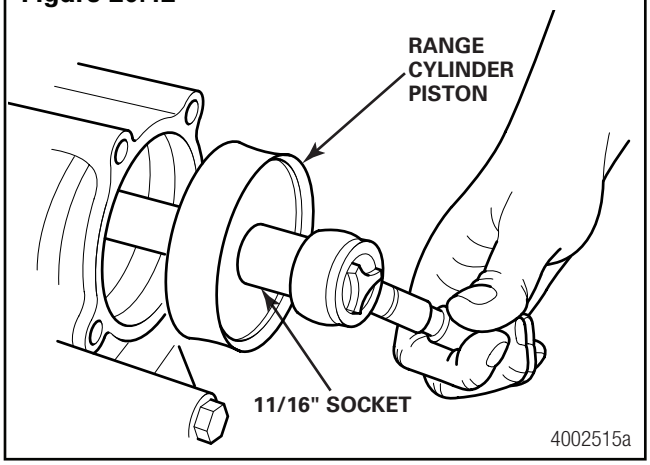
2. Lubricate the bore of the range cylinder housing with Dow Corning® 3451 silicone grease or equivalent. Install piston into the bore of the range housing. **Figure 20.41**.

Figure 20.41



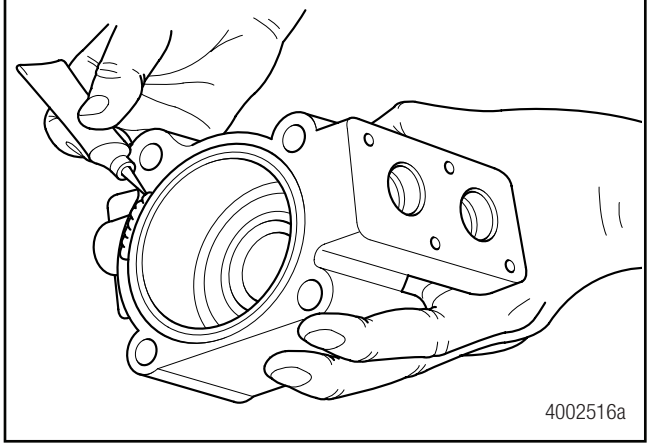
3. Install the range shift shaft nut with an 11/16-inch socket. Use an 11/16-inch socket to tighten the nut to 35-50 lb-ft (47-68 N•m). **Figure 20.42**. T

Figure 20.42



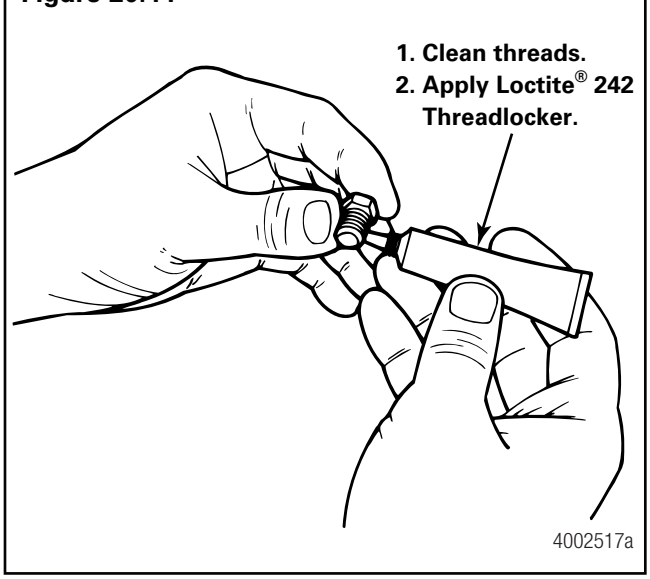
4. Lubricate the large and small O-rings with Dow Corning® 3451 silicone grease or equivalent. Install the range cylinder cover O-ring and the small O-ring. **Figure 20.43**.

Figure 20.43



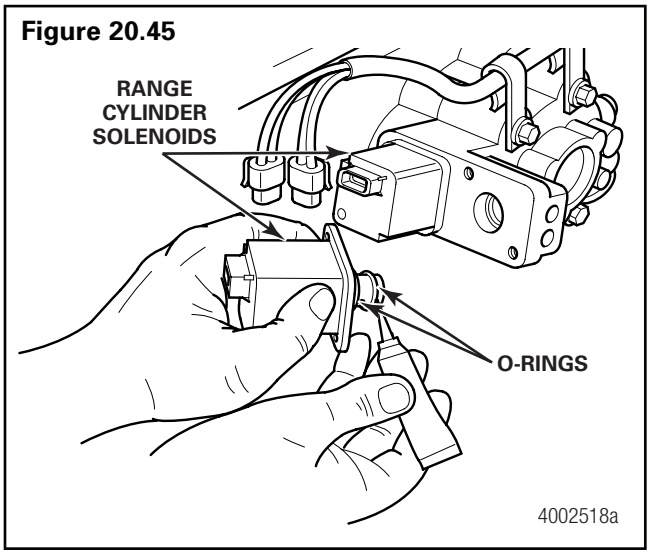
5. Install the range cylinder cover. Clean the capscrew threads. Apply Loctite® 242 Threadlocker, Meritor part number 2297-B-6112, to threads of the capscrews. Use a torque wrench to tighten the four 3/8-16 capscrews to 35-45 lb-ft (47-61 N•m). **Figure 20.44**. T

Figure 20.44



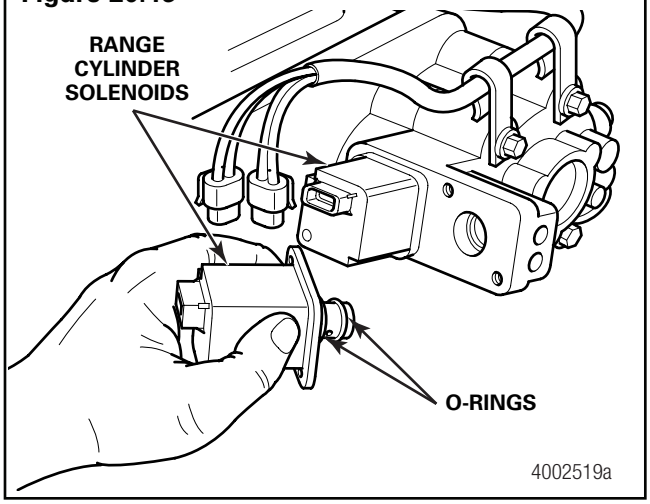
6. Lubricate the range cylinder solenoid O-rings with Dow Corning® 3451 silicone grease or equivalent. Install the O-rings onto the range cylinder solenoids. **Figure 20.45**.

Figure 20.45



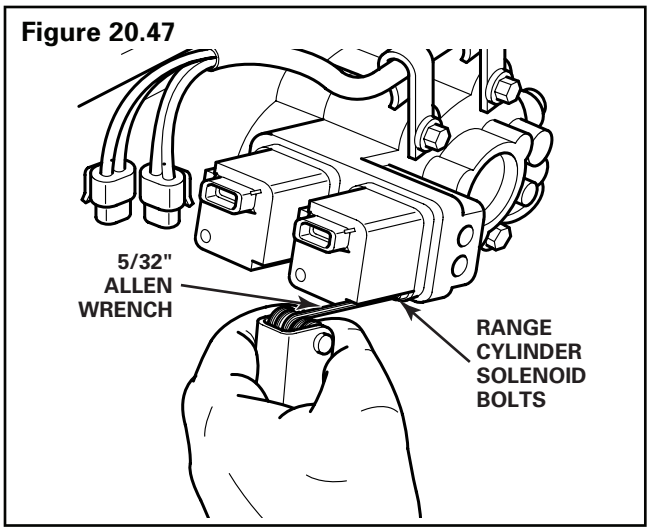
7. Lubricate the range cylinder solenoid O-rings with Dow Corning® 3451 silicone grease or equivalent. Install the O-rings onto the range cylinder solenoids. **Figure 20.46**.
8. Install the range cylinder solenoids onto the range housing.

Figure 20.46



9. Use a 5/32-inch Allen wrench to install the four range cylinder solenoid bolts. Tighten the bolts to a torque of 50 lb-in (6 N•m). **Figure 20.47**. T

Figure 20.47



Air Filter Regulator Assembly Removal

1. Drain the vehicle air system.
2. Use a one-inch wrench to remove the air filter regulator from the range piston housing. **Figure 20.48**.

Air Filter Regulator Assembly Installation

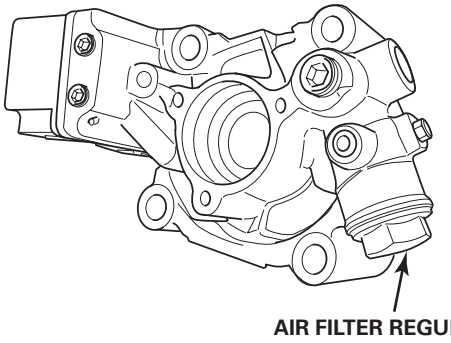
1. Lightly lubricate the two O-rings on the new air filter regulator assembly supplied in the kit with Meritor part number 2297-S-8365 lubricant or equivalent.
2. Use a one-inch wrench to install the new air filter regulator assembly into the range piston housing.

CAUTION

Tighten the air filter regulator assembly to 19-25 lb-ft (26-34 N•m) when you install it into the range piston housing. Do not overtighten the assembly. Damage to components can result. T

3. Tighten the air filter regulator assembly to 19-25 lb-ft (26-34 N•m). Do not overtighten the assembly. T
4. Check for air leaks. Test drive the vehicle.

Figure 20.48



Range Cylinder Piston Removal

1. Drain the vehicle's air system.
2. Disconnect the wiring from the high and low range solenoids. **Figure 20.49**. Mark the wiring for reinstallation later in the procedures.
3. Disconnect the air supply line from the range piston housing.
4. Use a 9/16-inch wrench to remove the mounting screws from the range cylinder housing. **Figure 20.50**.

Figure 20.49

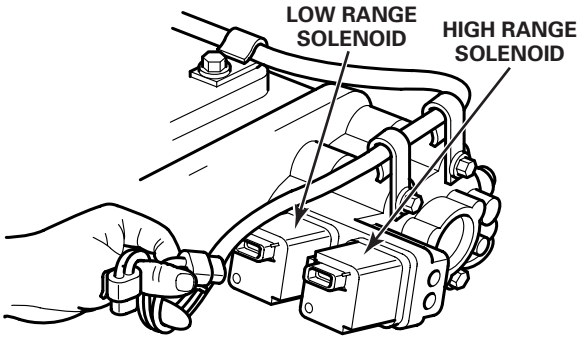
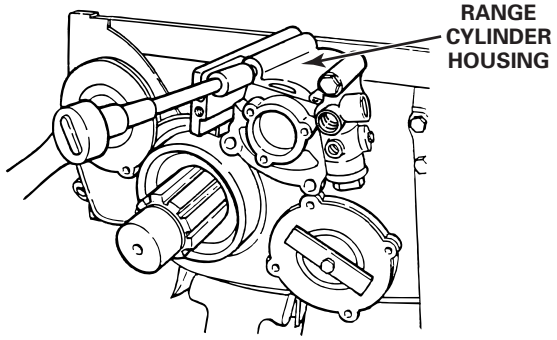
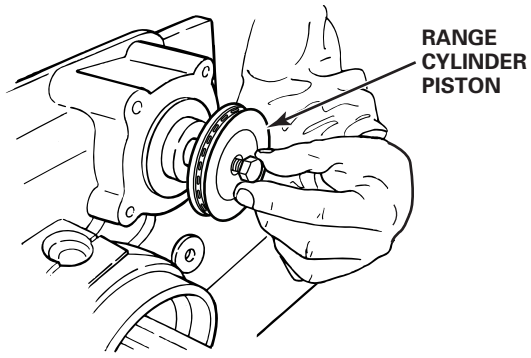


Figure 20.50



5. Remove the range cylinder housing from the auxiliary case.
6. Inspect the housing, especially the bore, for wear and damage. Replace damaged or worn parts.
7. Discard the range cylinder housing O-ring.
8. Use an 11/16-inch wrench to remove the nut that secures the range cylinder piston to the high-low shaft. Remove the piston from the shaft. **Figure 20.51**.

Figure 20.51



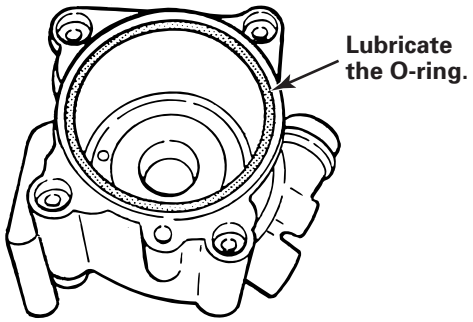
Range Cylinder Piston Installation

1. Replace the piston with the new one supplied in Kit 5401. Use a slight back-and-forth rotary motion to install the new piston onto the high-low shaft.
2. Use an 11/16-inch wrench to install the nut that fastens the piston to the high-low shaft. Tighten the nut 30-50 lb-ft (48-67 N•m). T

NOTE: Knead the grease packet before you apply the grease.

3. Thoroughly clean old grease from the range piston housing and parts. Apply grease (Meritor part number 2297-S-8365) to the range cylinder piston and housing.
4. Use Meritor part number 2297-S-8365 silicone lubricant or an equivalent product to lubricate the range cylinder housing O-ring. **Figure 20.52**. Install a new O-ring into the range cylinder housing bore.

Figure 20.52



5. Use the following procedure to install the range cylinder housing over the piston. **Figure 20.53**.
   A. Use a 9/16-inch wrench to install the capscrews that secure the housing to the auxiliary cover. **Figure 20.54**.
   B. Install the capscrews and tighten them 35-45 lb-ft (48-67 N•m). T
   C. Reconnect the wiring to the high and low solenoids. Refer to the marks you made on the high and low range solenoid wiring in Step 3 to correctly reconnect the wiring.
   D. Reconnect the air supply line to the piston housing. **Figure 20.55**.
   E. Test drive the vehicle.

Figure 20.53

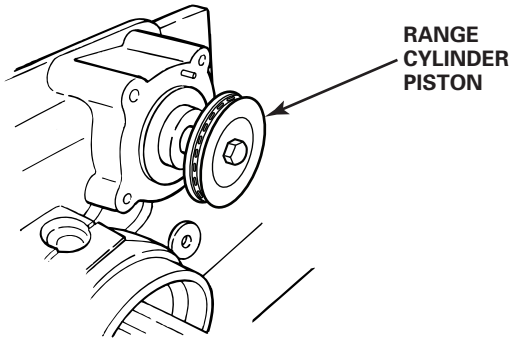


Figure 20.54

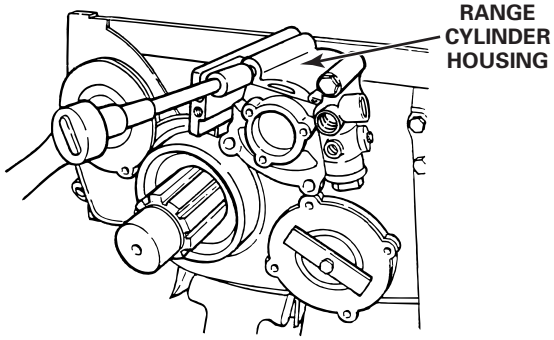
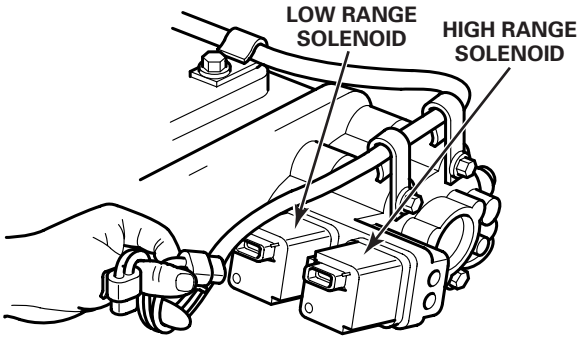
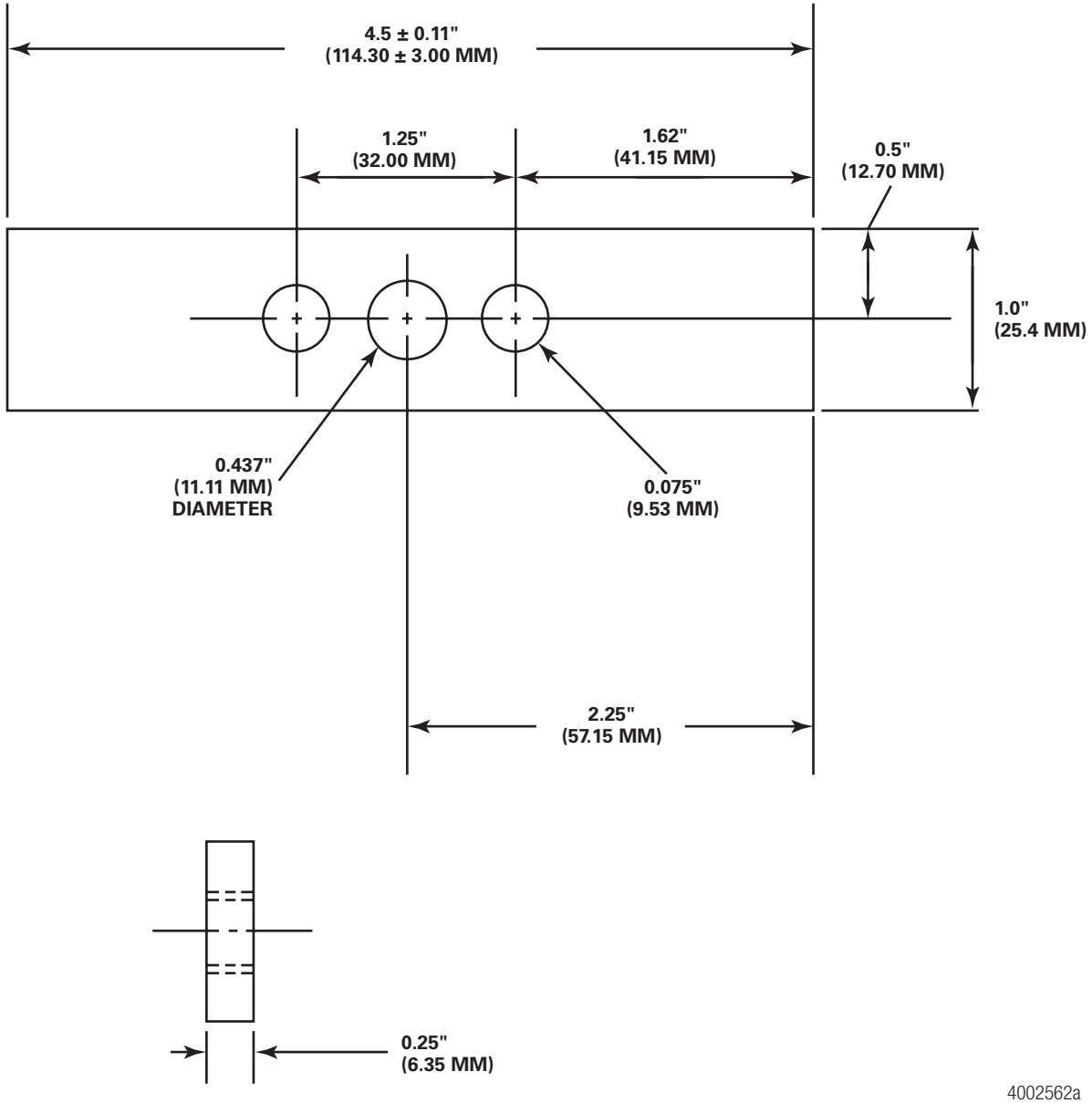


Figure 20.55



Countershaft Holding Cover Plate

NOTE: Use mild steel bar stock.



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