Service Manual

Eaton Fuller Advantage® Heavy-Duty Manual Transmissions TRSM0970 EN-US

January 2016

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General Information

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Warnings & Cautions

Warning: Follow specified procedures in indicated order to avoid personal injury.

Note: Additional relevant information not covered in service procedure.

Warning: Before starting a vehicle:

- Ensure adequate fuel level.
- Sit in driver's seat.
- Place shift lever in Neutral.
- Set parking brake.

Warning: Before working on a vehicle or leaving cab with engine running:

- Ensure ignition is Off while hands are within the clutch housing area.
- Place shift lever in Neutral.
- Set parking brake.
- Block wheels.

Warning: When parking vehicle or leaving cab:

- Place shift lever in Neutral.
- Set parking brake.

Caution: Follow specified procedures in indicated order to avoid equipment malfunction or damage.

Caution: Do not release parking brake or attempt to select a gear until air pressure is at correct level.

Caution: To avoid damaging the transmission during towing:

- Place shift lever in Neutral.
- Lift drive wheels off of the ground or disconnect the driveline.

Caution: Do not operate vehicle if alternator light is illuminated or if gauge indicates low voltage.

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

Always use genuine Eaton replacement parts.

How to Use This Manual

This publication is divided into three sections: *General Information, Service Repair Procedures* and *Appendix*.

General Information

This section contains basic chapters such as *Transmission Overview*, *How to Use This Manual* and *Serial Tag and Model Nomenclature*.

Service Repair Procedures

A *Components Identification* diagram is included at the beginning of each procedure for disassembly, assembly, removal and installation. Below the *Components Identification* diagram is a numerical listing for each part with the part name.

Appendix

This section contains information such as *Operation*, *Lubrication Specifications*, *Inspection* (in base box manuals), *Power Flow* (in base box manuals), *Air System Operation* and *Troubleshooting* (in base box manuals), *General Troubleshooting* (in base box manuals), *Tool Specifications*, *Torque Specifications* and *Torque Overview*.

The service procedures in this manual are for transmission mechanical components only. To find the information you need, simply locate the procedure in the *Table of Contents*, turn to the page specified and follow the procedure. If you are unsure of the name of a component, reference the *Transmission Overview* pages.

Transmission Overview

This Eaton Fuller Advantage transmission model contains 10 forward speeds and 2 reverse speeds. The gear shift lever mechanically engages and disengages 5 forward gears and 1 reverse gear in the transmission front section.

The range lever on the shift knob allows the operator to control an air-shifted auxiliary section to provide a LO and HI Range. The 5 forward gears selected in LO Range are used again in HI Range to provide the remaining 5 progressive forward gear ratios

Once the highest shift lever position (5th gear) is obtained in LO Range, the operator preselects the range shift lever for HI Range. The range shift occurs in Neutral when the shift lever is moved from 5th gear to 6th gear position.

When downshifting, the operator preselects the range lever for LO Range and the range shift occurs automatically as the shift lever is moved to the next gear position. Refer to the illustrations in the *Power Flow* section.

Shift Patterns

A shift pattern decal should be in the vehicle to explain how to properly shift the transmission. If it has been lost, a replacement may be obtained from any Eaton® parts distributor.

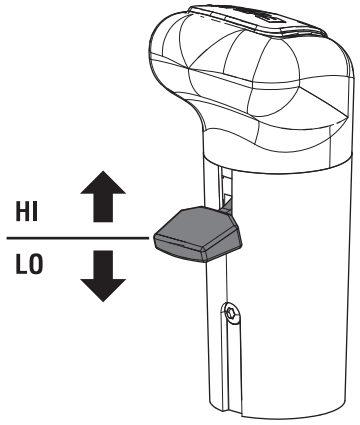
Operating Instructions

Initial Start Up

Important: Before starting a vehicle, always be seated in the driver's seat, move the shift ever to Neutral and set the parking brake.

Caution: Before moving a vehicle, understand the shift pattern configuration.

1. Make sure the shift lever is in Neutral and the parking brakes are set.
2. Key on and start engine.
3. Allow vehicle air pressure to build to the correct level. Refer to operator and OEM service manuals supplied with the truck.
4. Apply service brakes.
5. Release vehicle parking brakes.
6. Ensure range selector is in LO Range position.



7. Press clutch pedal to the floor.
8. Move shift lever to desired initial gear.
9. Slowly release clutch pedal and apply accelerator.

Upshifting

Caution: Never move the range selector with the shift lever in Neutral while the vehicle is moving.

1. Move the shift lever, double-clutching, to the next desired gear position in low range. Range shift from LO to HI Range (5th to 6th).
2. When in last gear position (in 10- and 13-speed transmissions only) for LO Range and ready for the next upshift, pull up the range selector and move the shift lever, double-clutching, to the next higher speed position. As the shift lever passes through Neutral, the transmission automatically shifts from LO Range to HI Range.
3. Continue upshifting, double-clutching, to the next desired gear position in HI Range

Downshifting

1. Move the shift lever, double-clutching, to the next desired gear position in HI Range. Range shift from HI to LO range (6th to 5th).
2. While in 6th gear and ready for the next downshift, preselect LO Range and push the range selector down.
3. Move the shift lever, double-clutching, to the next desired gear position in LO Range. As the shift lever passes through Neutral, the transmission automatically shifts from HI to LO Range.
4. Continue downshifting, double-clutching, to the next desired gear position in LO Range.

Double-Clutching Procedure

1. Press the pedal to disengage the clutch.
2. Move the shift lever to Neutral.
3. Release the pedal to engage the clutch.
   a. Upshift decelerate engine until engine RPM and road speed match.
   b. Downshift accelerate engine until engine RPM and road speed match.

Note: By engaging the clutch with the shift lever in Neutral, the operator controls the main shaft gear RPMs. This procedure allows the operator to speed up or slow down the main shaft gearing to properly match the desired gear speed and output shaft speed.

4. Quickly press the pedal to disengage the clutch and move the shift lever to the next gear position.
5. Release the pedal to engage the clutch.

Additional Operating Information

Preselect

Important: Always preselect all range shifts when upshifting or downshifting. To preselect, move the range selector to the needed position before starting the lever shift.

Preselected range shifts are completed automatically as the lever is moved through Neutral and into the next gear. Preselecting all range shifts prevents damage to the transmission and provides for smoother shifts.

Clutch Brake

Note: This is for clutch brakes used with pull-type clutches.

The Clutch Brake is applied by fully pressing the Clutch Pedal to the floor board. When applied, the brake slows (and can stop) the transmission front box gearing. It is a disc brake incorporated into the clutch and transmission drive gear assemblies. Never use the Clutch Brake when upshifting or downshifting. Use only for initial gear engagement when the vehicle is standing still.

Driver Instruction Manual

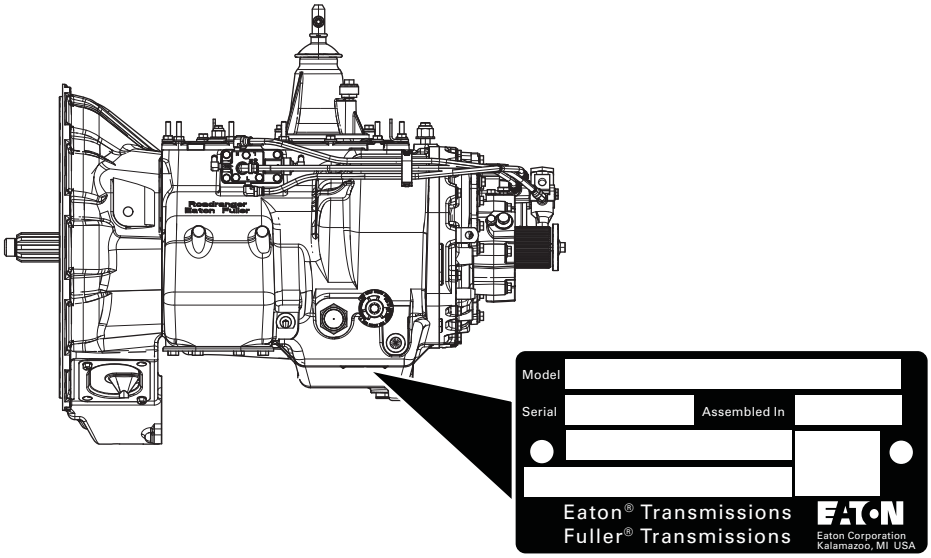
Complete operation instructions can be found in the *Driver Instruction Manual* TRDR0970.

Serial Tag Information and Model Nomenclature

Transmission model designation and other transmission identification information are stamped on the serial tag. To identify the transmission model and serial number, locate the tag on the transmission and then locate the numbers as shown. The figure below shows the tag location for these transmissions.

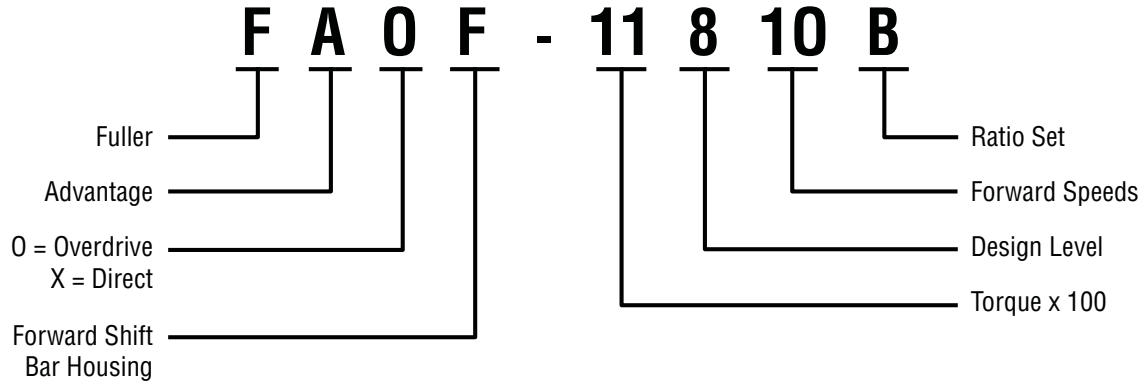
When calling for service assistance or parts, have the model and serial numbers handy.

Important: Do not remove or destroy the transmission identification tag.



Model Number

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



Prefix	Definition
FA	Fuller Advantage Twin Counter Shaft
FAF	With Forward Shift Bar Housing
FAO	With Overdrive

Prefix	Definition
FAOF	With Overdrive and Forward Shift Bar Housing

Serial Number

The serial number is the sequential identification number of the transmission. Before calling for service assistance, write the number down as it may be needed.

Bill of Material or Customer Number

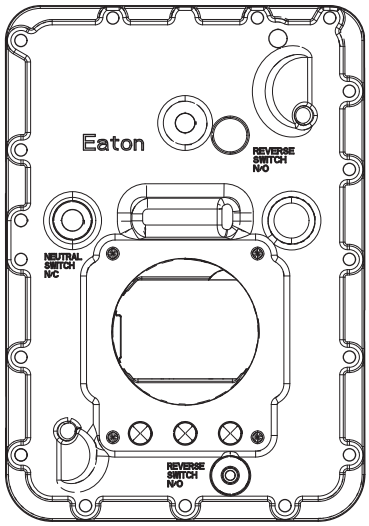
This number may be located below the model and serial numbers. It is a reference number used by Eaton.

Model Options

Torque Rating
The torque rating of the transmission specified in the model number is the input torque capacity in lb-ft. Various torque ratings are available. For more information, call 1-800-826-HELP (4357).

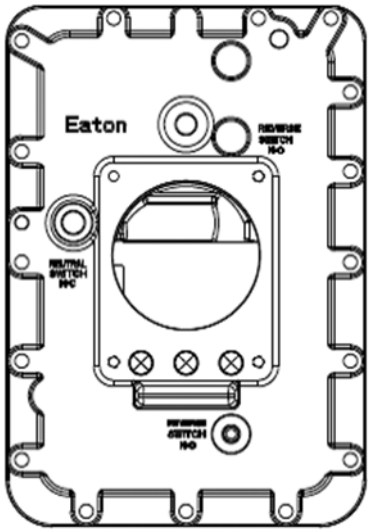
Shift Bar Housings
Two types of shift bar housings are available for this transmission.

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



Standard Shift Bar Housing

Forward Opening
The forward opening Shift Bar Housing has a gear shift lever opening located 3" closer to the front of the transmission than the standard opening. This forward design allows greater flexibility in mounting the transmission and is indicated by an “F” in the model number.



Forward Shift Bar Housing

Lubrication Pump
Internal Lube pump with spray bar lubrication system.

PTO-Driven
A PTO-driven pump is externally mounted on the 6- or 8-bolt PTO openings and driven off the PTO gear.

Power Take-Off (PTO) Usage
PTOs can be mounted in two ways.

6- or 8-Bolt
The 6- or 8-bolt openings are standard with the transmission. The PTO is mounted to the opening and driven from the PTO gear on the front Counter Shaft.

Thru-Shaft
The Thru-Shaft PTO mounts on the rear of the transmission. It requires a special auxiliary housing and main case Counter Shaft with internal splines.

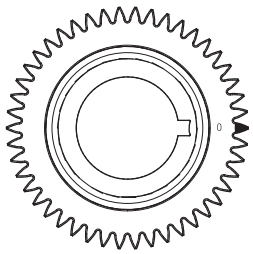
Timing Procedures

It is essential that both Counter Shaft assemblies of the front and auxiliary sections are timed. This ensures proper tooth contact is made between Main Shaft gears seeking to center on the Main Shaft during torque transfer and mating Counter Shaft gears that distribute the load evenly. If not properly timed, serious damage to the transmission is likely to result from unequal tooth contact, causing the Main Shaft gears to climb out of equilibrium.

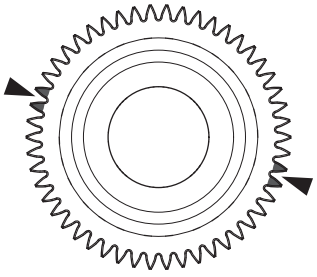
Timing is a simple procedure of marking the appropriate teeth of a gear set prior to installation and placing them in proper mesh while in the transmission. In the front section, it is necessary to time only the drive gear set. Depending on the model, only the low range, deep reduction or splitter gear set is timed in the auxiliary section.

Front Section

1. Clearly mark the tooth located directly over the drive gear keyway as shown prior to placing each Counter Shaft assembly into the case, This tooth is stamped with an “O” to aid identification.



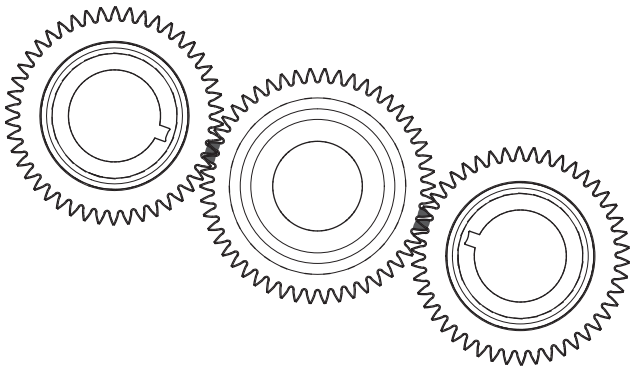
2. Mark any two adjacent teeth on the main drive gear.
3. Mark the two adjacent teeth located directly opposite the first set marked on the main drive gear. There should be an equal number of unmarked gear teeth on each side between the marked sets.



4. After placing the Main Shaft assembly into the case, the Counter Shaft bearings are installed to complete installation of the Counter Shaft assemblies. This meshes marked Counter Shaft drive gear teeth with marked main drive gear teeth.

When installing the bearings on the left Counter Shaft, mesh the Counter Shaft drive gear marked tooth with either set of main drive gear two marked teeth.

Repeat the procedure when installing the bearings on the right Counter Shaft; make use of the remaining set of main drive gear two marked teeth to time the assembly.



Auxiliary Section Timing

1. Mark any tooth on the low-range gear. Then mark the tooth located 180° from the first marked tooth.
2. Mark the valley between the two gear teeth of each auxiliary Counter Shaft assembly low-range gear stamped with “O” prior to placing each auxiliary Counter Shaft assembly into the housing.
3. Repeat the procedure on each auxiliary Counter Shaft reduction gear.
4. To time the auxiliary Counter Shafts, find the “O” at the rear bearing and place a straight edge from the “O” up to the front and mark the gear tooth. See Service Bulletin TMIB0150 for further timing instructions.

Note: Timing mark may be under bearing and washer.

Two Marked Teeth 180 Degrees Apart

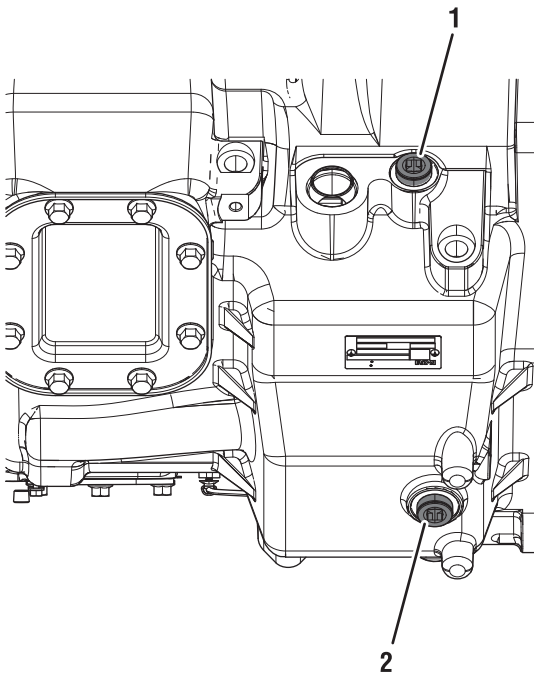
Auxiliary Counter Shaft Marked

Preventive Maintenance

See Drivers Instructions TRDR0970 for daily maintenance checks.

Inspection Before Transmission Removal

1. **Air System and Connections:** Check for leaks, worn air lines, loose connections and cap screws. See the “Servicing Air System” section.
2. **Clutch Housing Mounting:** Check all cap screws of clutch housing flange for looseness.
3. **Clutch Release Bearing (not shown):** Remove hand hole cover and check radial and axial clearance in release bearing. Check relative position of thrust surface of release bearing with thrust sleeve on push-type clutches.
4. **Clutch Pedal Shaft and Bores:** Pry upward on shafts to check wear. If excessive movement is found, remove clutch release mechanism and check bushings on bores and wear on shafts. See OEM literature.
5. **Lubricant:** Change at specified service intervals.Use only the types and grades as recommended. See Manual TCMT0021, *Roadranger® Lubricant Products*.
6. **Filler and Drain Plugs:** Remove filler plugs and check level of lubricant at specified intervals. Tighten fill and drain plugs securely.
7. **Cap Screws and Gaskets:** Check all cap screws, especially those on PTO covers and rear bearing covers, for looseness that would cause oil leakage. Check PTO opening and rear bearing covers for oil leakage due to faulty gaskets.
8. **Gear Shift Lever:** Check for looseness and free play in housing. If lever is loose in housing, proceed to the next inspection item.
9. **Gear Shift Lever Housing Assembly:** Remove air lines at Slave Valve and remove the gear shift lever housing assembly from the transmission. Check the tension spring and washer for set and wear. Check the gear shift lever spade pin and slot for wear.



1. Oil Fill Plug
47–68 N•m (35–50 lb-ft)
1.0625-12 Straight Thread

2. Oil Drain Plug
47–68 N•m (35–50 lb-ft)
1.0625-12 Straight Thread

Compression Type Fittings

Special Instructions

None

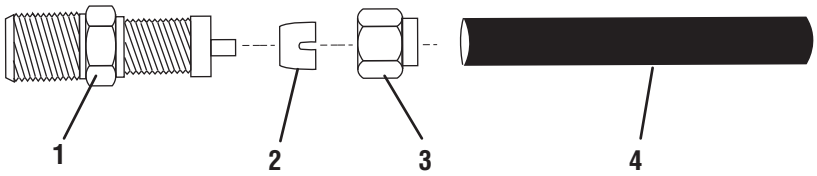
Warning: A sudden release of air pressure can cause personal injury or damage to equipment. To prevent injury or equipment damage, exhaust the Vehicle Air Tanks.

Special Tools

Caution: Small Air Lines are available in 1/8" or 5/32" sizes. Make sure 1/8" Air Lines are used with 1/8" fittings and 5/32" Air Lines are used with 5/32" fittings. Mixing sizes can cause air leaks or damage to fittings.

Note: Before removing the Air Lines and Hoses, label or record their location.

Component Identification



1. Connector
2. Collet
3. Nut
4. Air Line

Compression Type Fitting Removal and Installation

1. Exhaust the Vehicle Air Tanks before continuing.
2. Loosen the nut on the fitting and slide it back out of the way.
3. Pull the Air Line and attached Collet from the fitting.
4. Inspect the fitting, Air Line, Collet and Nut for damage or wear. Replace as necessary.

1. Check the threads of the fitting for thread sealant. If no sealant is present, apply Eaton Thread Sealant #71205 or equivalent.
2. Install the fitting.

   Note: Do not overtighten the nut. Overtightening can compress the Collet too much and cause an air line restriction.
3. Install the Air Line, Collet and Nut. If installing a new fitting, place the Collet in the fitting and loosely install the Nut. (Do not tighten the Nut yet.) Insert the Air Line through the Nut and into the Collet. Tighten the Nut as usual.
4. Enable the Vehicle Air System. Allow the Air Tanks to pressurize and check for leaks. Repair as necessary.

Push-to-Connect Type Fittings

Special Instructions

None

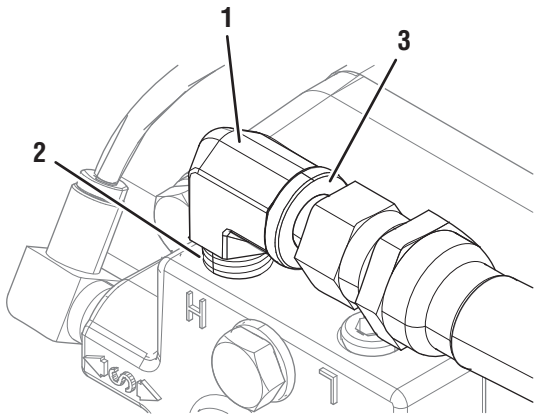
Warning: A sudden release of air pressure can cause personal injury or damage to equipment. To prevent injury or equipment damage, exhaust the Vehicle Air Tanks.

Note: Before removing the Air Lines and Hoses, label or record their location.

Special Tools

For Push-to-Connect Fittings, the Eaton Service Tool Kit K-2394 is recommended. The Kit contains the Release Tool and the Tubing Cutter.

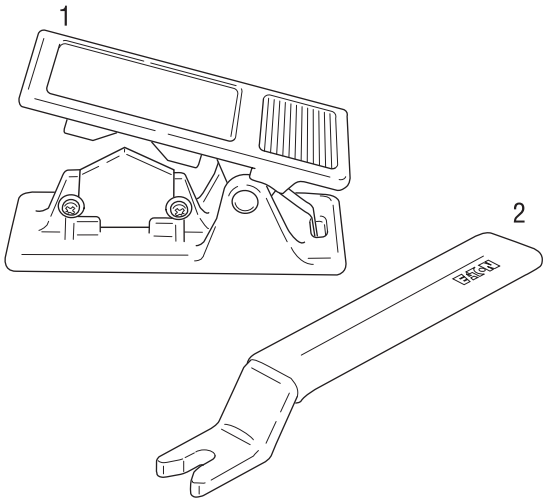
Component Identification



1. Body
2. Threads
3. Line Release

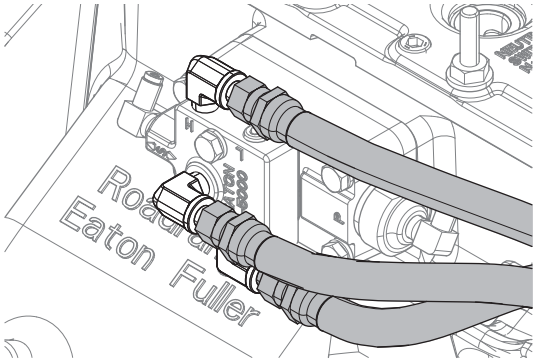
Push-to-Connect Type Fitting Removal and Installation

1. Exhaust the Vehicle Air Tanks before continuing.
2. Use the Air Line Release Tool from Kit K-2394 to press the Release Sleeve down while pulling the Air Line from the fitting.



1. Cutter
2. Release Tool

3. Inspect the fitting for damage or wear. Remove and replace as necessary.



1. Check the threads of the fitting for thread sealant. If no sealant is present, apply Eaton Thread Sealant #71205 or equivalent.
2. Install the fitting.
3. Inspect the Air Line for burrs or deformed areas. Trim the Air Line if necessary using a sharp razor blade or the Air Line Cutting Tool from Kit K-2394. The cut must be smooth and square. If the tubing end is deformed or burred, the internal o-ring in the fitting will be damaged when the Air Line is inserted.

4. Push the Air Line into the fitting. It should insert approximately 3/4". If it does not insert far enough or is difficult to insert, the fitting may be damaged and should be replaced. After inserting, give the Air Line a slight tug to make sure the line stays in place. If the Air Line does not stay in place, replace the fitting.
5. Enable the vehicle Air System. Allow the Air Tanks to pressurize and check for leaks.

Assembly and Disassembly Precautions

Assembly Precautions

General Information
Ensure that case interiors and housings are clean. It is important that dirt and other foreign material are kept out of the transmission during assembly. Dirt is abrasive and can damage polished surfaces of bearings and washers. Use certain precautions, as listed below, during assembly.

Bearings
Use a flange-end bearing driver for bearing installation. These special drivers apply equal force to both bearing races, preventing damage to balls/rollers and races while maintaining correct bearing alignment with bore and shaft. Avoid using a tubular or sleeve-type driver, whenever possible, as force is applied to only one of the bearing races.

Cap Screws
To prevent oil leakage and loosening, use Eaton Fuller Sealant, Part Number 71205, on all cap screws.

Gaskets
Use new gaskets throughout the transmission as it is being rebuilt. Make sure all gaskets are installed. An omission of any gasket can result in oil leakage or misalignment of bearing covers.

Initial Lubrication
Coat all limit washers and shaft splines with lubricant during assembly to prevent scoring and galling of such parts.

O-Rings
Lubricate all o-rings with silicon lubricant.

Universal Joint Companion Flange or Yoke
Pull the companion flange or yoke tightly into place with the two Output Shaft bolts, using 84–92 lb-ft of torque. Ensure the speedometer drive gear or a replacement spacer of the same width has been installed. Failure to pull the companion flange or yoke tightly into place can result in damage to the Main Shaft rear bearing.

Important: See the appropriate Illustrated Parts List (specified by model series) to ensure that proper parts are used during assembly of the transmission.

Disassembly Precautions

General Information
It is assumed in the detailed assembly instructions that the lubricant has been drained from the transmission, the necessary linkage and vehicle air lines disconnected and the transmission has been removed from vehicle chassis

Removal of the Gear Shift Lever housing assembly (or remote control assembly) is included in the detailed instructions (“Gear Shift Lever Removal”). This assembly must be detached from the Shift Bar Housing before the transmission can be removed.

Important: Follow each procedure closely in the detailed instructions. Be sure to make use of the text, illustrations and photographs provided.

Assemblies
When disassembling the various assemblies, such as the Main Shaft, Counter Shafts and Shift Bar Housing, lay all parts on a clean bench in the same sequence as removed. This procedure will simplify assembly and reduce the possibility of losing parts.

Bearings
Carefully wash and lubricate all usable bearings as removed and protectively wrap until ready for use. Remove bearings planned to be reused with pullers designed for this purpose.

Cleanliness
Provide a clean place to work. It is important that no dirt or foreign material enters the unit during repairs. Dirt is abrasive and can damage bearings. It is always good practice to clean the outside of the unit before starting the planned disassembly.

Input Shaft
The Input Shaft can be removed from the transmission without removing the Counter Shafts, Main Shaft or main drive gear. Special procedures are required and provided in this manual.

Snap Rings
Remove snap rings with pliers designed for this purpose. Snap rings removed in this manner can be reused, if they are not sprung or loose.

When Using Tools to Move Parts

Always use restraint when applying force to shafts, housings, etc. Movement of some parts is restricted. Never apply force to driven parts after they stop solidly. The use of soft hammers, soft bars and mauls for all disassembly work is recommended.

Auxiliary Section Removal and Disassembly

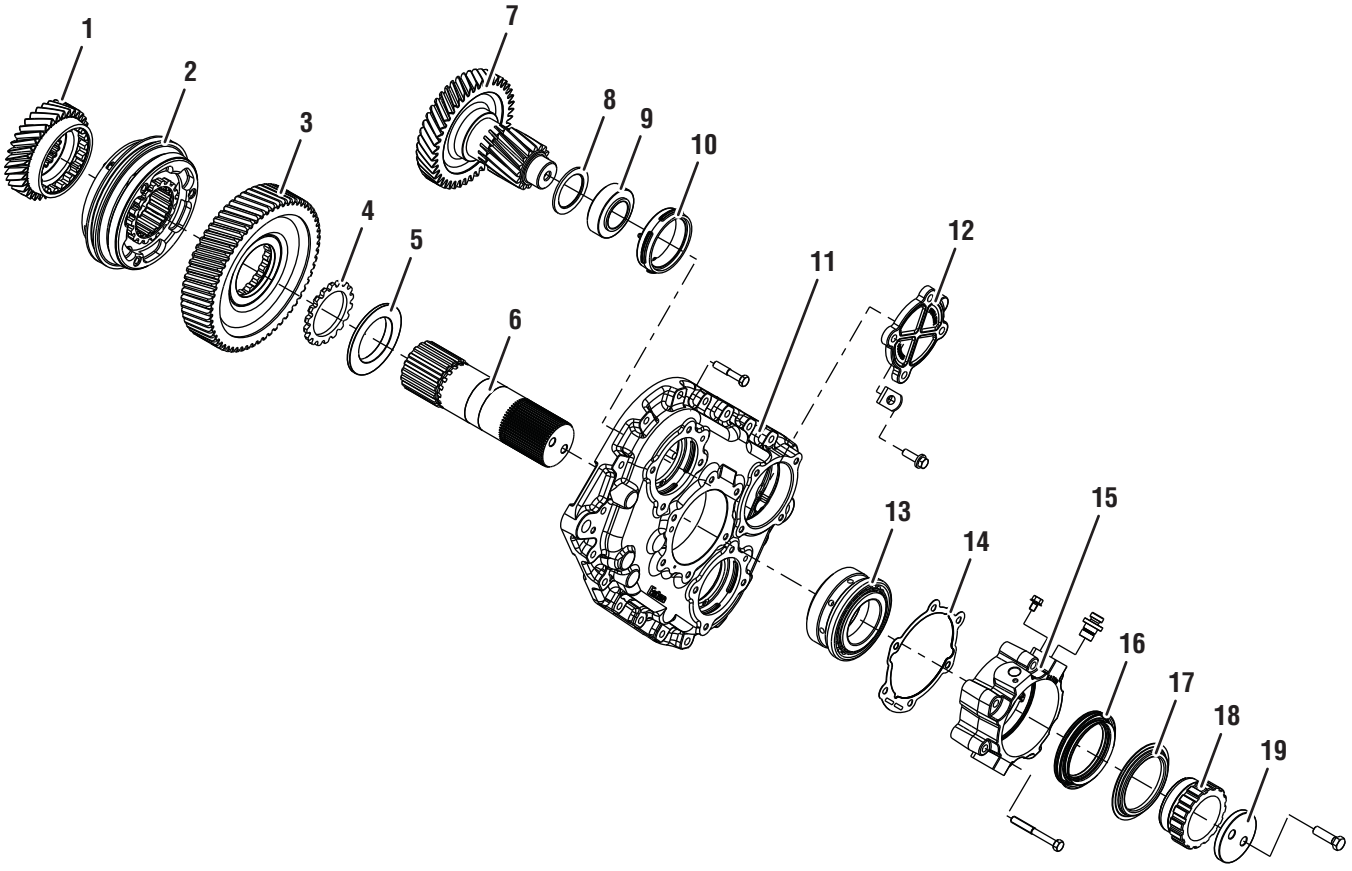
Special Instructions

None

Special Tools

- RR1006TR - Auxiliary Section Hanger
- RR1002TR - Counter Shaft Support Tools

Component Identification

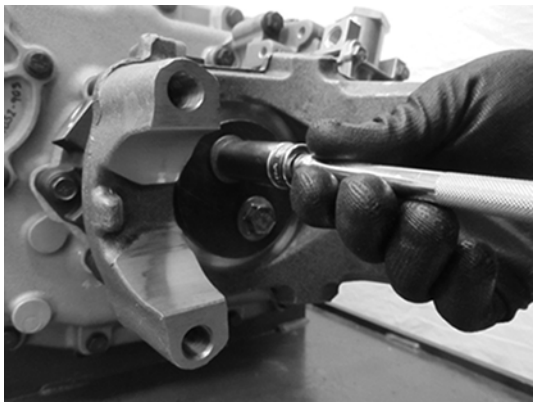


1. Auxiliary Drive Gear
2. Synchronizer Assembly
3. Reduction Gear
4. Washer
5. Spacer
6. Auxiliary Main Shaft
7. Auxiliary Counter Shaft
8. Spacer
9. Bearing
10. Race
11. Auxiliary Case
12. Auxiliary Counter Shaft Cover
13. Auxiliary Main Shaft Bearing Set
14. Gasket
15. Bearing Cover
16. Seal
17. Dust Shield
18. Speed Rotor Assembly
19. Output Yoke Retainer Flange

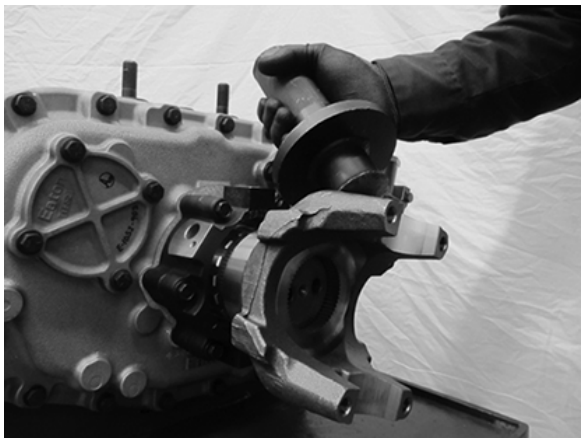
Auxiliary Section Removal and Disassembly

Output Yoke Removal

1. Remove the two bolts that fasten the output yoke to the Output Shaft.

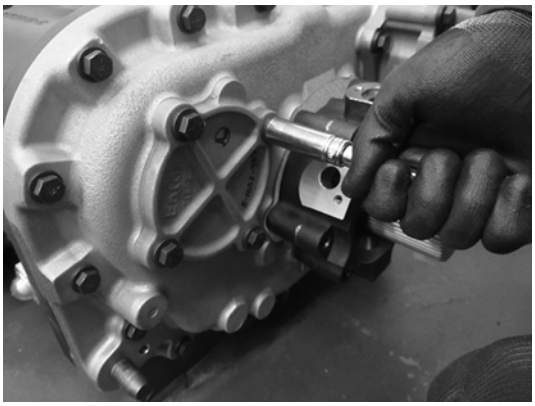


2. Remove the output yoke from the Output Shaft, a maul or hammer may be required to apply force to the yoke for removal.

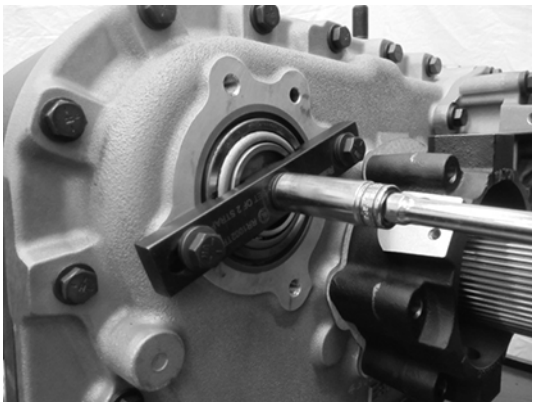


Auxiliary Section Removal

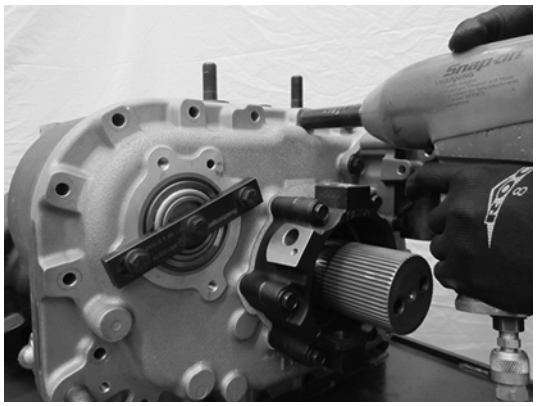
1. Remove both Auxiliary Counter Shaft Bearing Covers.



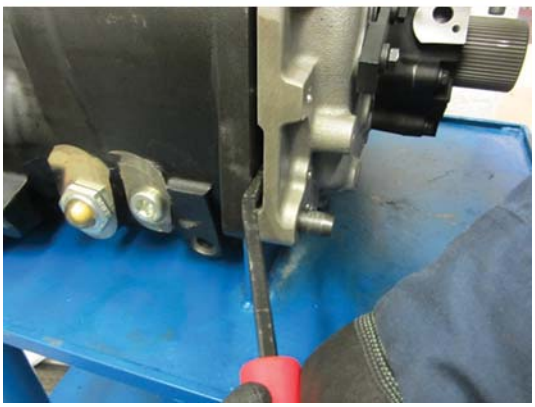
2. Install Auxiliary Counter Shaft Support Straps using bolts 3 out of the 4 bolts for the auxiliary Counter Shaft bearing covers.



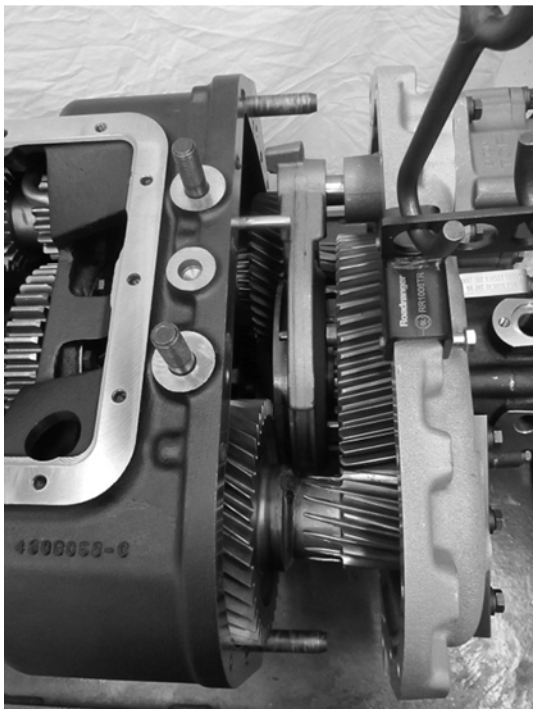
3. Remove the 19 bolts that fasten the auxiliary section to the transmission main case.



4. Using prying points, separate the auxiliary section from the transmission main case enough to fit the auxiliary section lifting bracket into place.

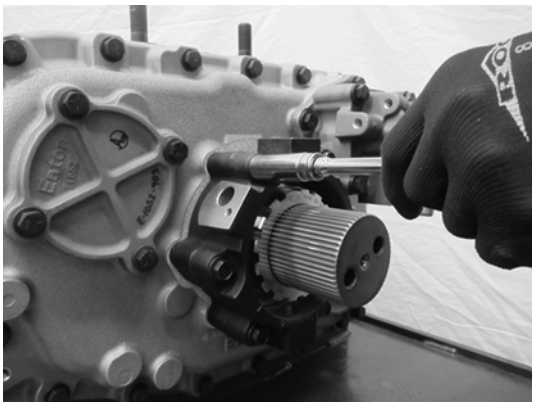


5. Using an overhead crane or hoist, remove the auxiliary section with the auxiliary section lifting bracket.

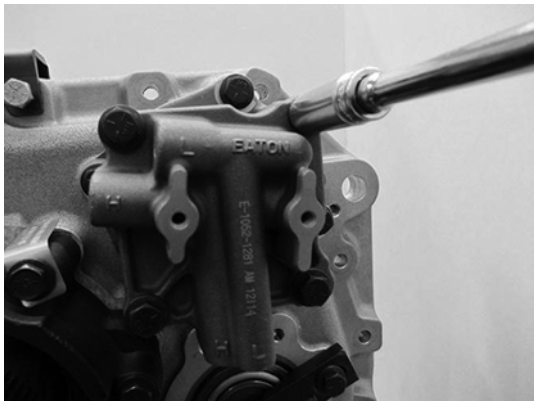


Auxiliary Section Disassembly

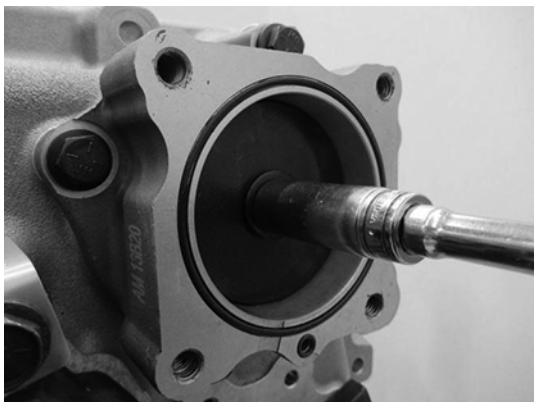
1. Remove the six cap screws that fasten the Output Shaft bearing cover to the auxiliary section, remove the Output Shaft bearing cover.



2. Remove the cap screws that fasten the range cover to the range cylinder. Remove the range cover.

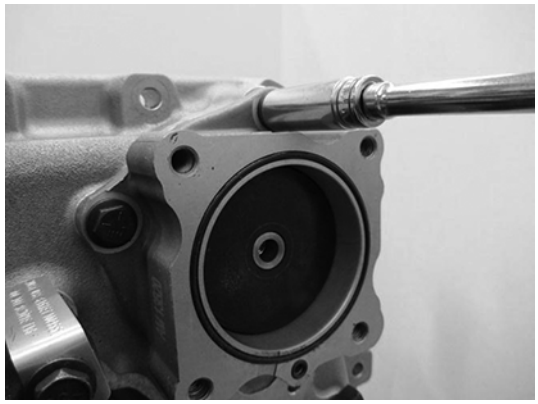


3. Remove the single cap screw that fasten the range piston to the range shift yoke bar.

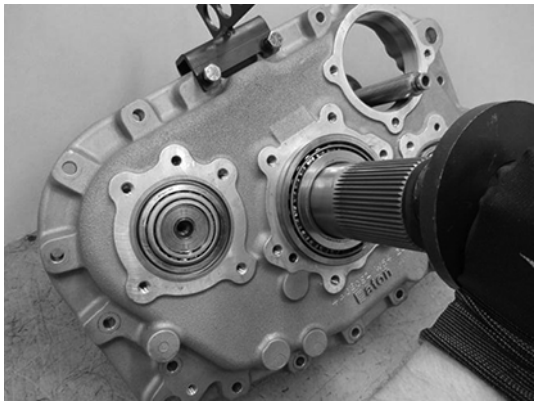


4. Remove the four cap screws fastening the range cylinder to the auxiliary section. Remove the range cylinder assembly.

Caution: Auxiliary Counter Shafts will fall out part way through this process.



5. Place the auxiliary section on a bench with the gearing facing down; remove the auxiliary Counter Shaft support straps, using a hand maul drive the Output Shaft out of the case.



6. As the Auxiliary Main Shaft is driven out, remove the Synchronizer assembly and the range yoke.
7. Remove the bearing cup and outer spacer from the auxiliary case bore.

8. Using the front face of the low range gear as a base, press the Output Shaft through the gear and bearing. Remove the bearing and washer from the hub of the auxiliary reduction gear.

   Note: If reusing the bearing set, the tapered roller bearings are specific to each side of the race.

9. Remove the splined spacer and stepped washer from the auxiliary reduction gear.

Range Synchronizer Disassembly

1. Remove the range synchronizer from the Output Shaft.

2. Place the low range synchronizer on a bench with the larger ring facing down, (place a shop towel over the assembly to avoid losing any springs) pull the high range synchronizer from the blocker ring

3. Remove the sliding clutch from the pins of the synchronizer ring.

Range Synchronizer Assembly

1. Install the Sliding Clutch on the blocker pins with the recessed side up.

2. Install the three springs into the bores of the high range Synchronizer Ring.

3. Place the high range Synchronizer Ring over the blocker pins of the low range Synchronizer, seating the springs against the pins.

4. Apply downward pressure to the high range Synchronizer ring while twisting counterclockwise to compress the springs and fully seat the ring on the blocker pins of the low range Synchronizer.

5. Install the synchronizer assembly on the splines of the auxiliary main shaft with the synchronizer seated against the range reduction gear.

Auxiliary Section Removal and Disassembly – In Chassis

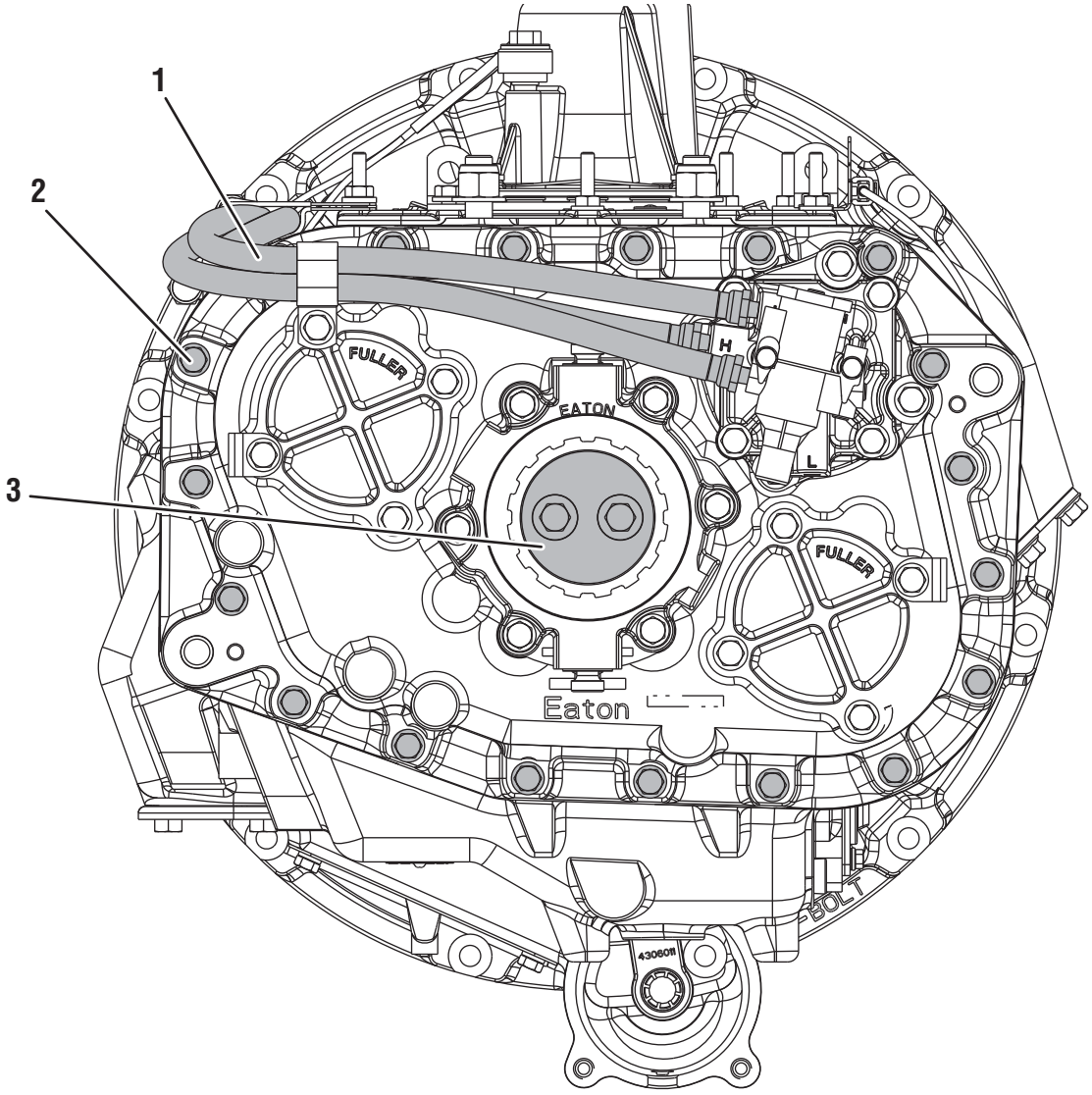
Special Instructions

The following procedure covers the removal and disassembly of the Auxiliary section with the transmission remaining in the chassis. If the transmission is removed from the truck refer to the "Auxiliary Section Removal (Bench Procedure)" in this section.

Special Tools

None

Component Identification



1. Air Lines
2. Auxiliary Case Bolts (x19)
3. Auxiliary Main Shaft Retaining Flange and Yoke

In Chassis

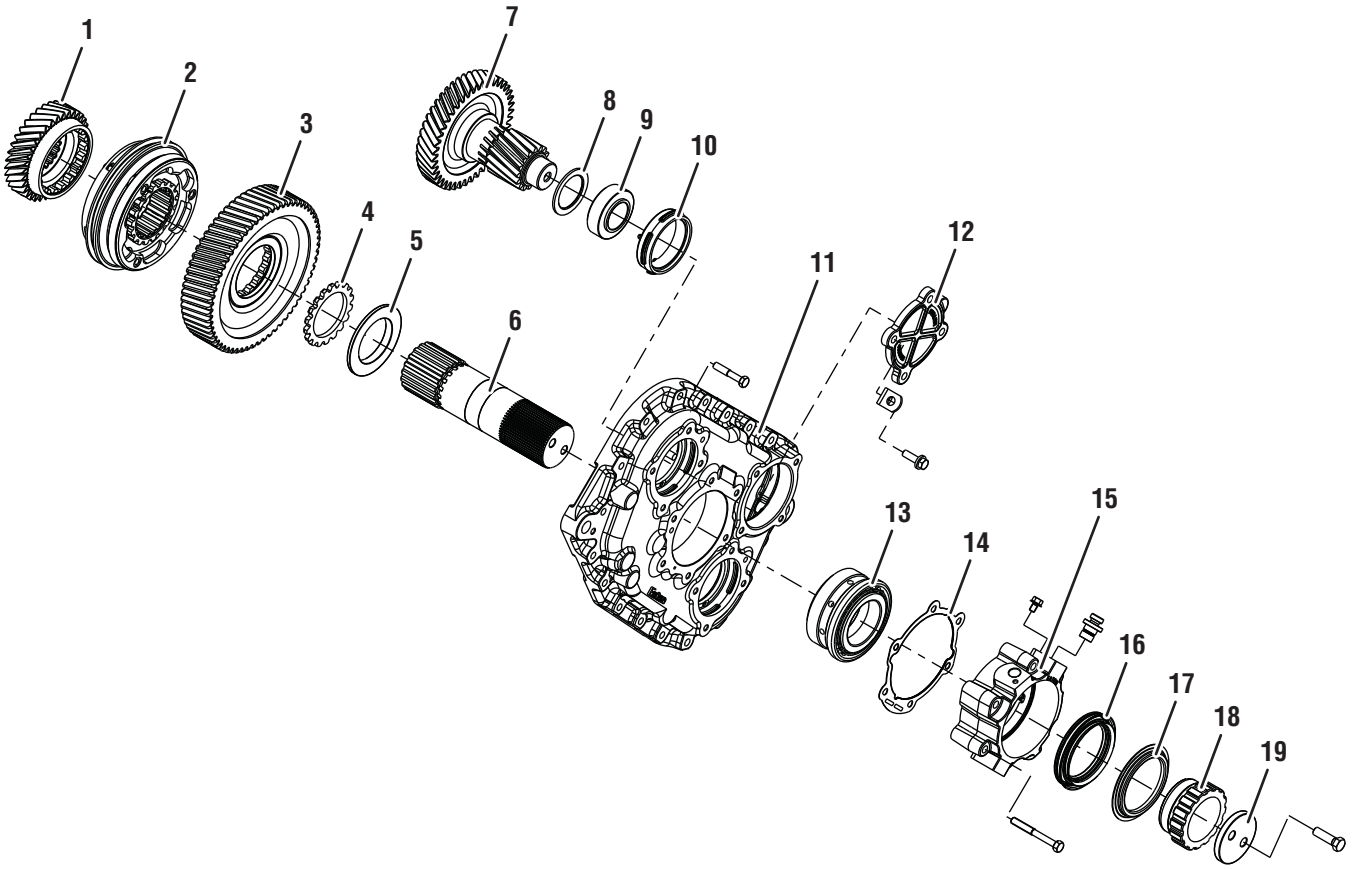
1. Drain the oil.
2. Disconnect the air lines from the range cylinder and OEM supplied. (Refer to Air Line disconnection for the procedure.)
3. Disconnect the driveline a move out of the way.
4. If any OEM equipment needs to be removed refer to the OEM for guidelines.
5. Remove the 19 bolts securing the auxiliary section to the transmission.
6. Put the removal jack in place and secure to the auxiliary section.
7. Slowly remove the auxiliary section from the main case and the dowel pins.
8. Once the Auxiliary Section is on the bench, go to Auxiliary Section Removal and Disassembly on page 17.

Auxiliary Section Assembly and Installation

Special Instructions
None

Special Tools
PVC pipe (4-3/8" tall x 4" diameter)

Component Identification



1. Auxiliary Drive Gear
2. Synchronizer Assembly
3. Reduction Gear
4. Washer
5. Spacer
6. Auxiliary Main Shaft
7. Auxiliary Counter Shaft
8. Spacer
9. Bearing
10. Race
11. Auxiliary Case
12. Auxiliary Counter Shaft Cover
13. Auxiliary Main Shaft Bearing Set
14. Gasket
15. Bearing Cover
16. Seal
17. Dust Shield
18. Speed Rotor Assembly
19. Output Yoke Retainer Flange

Auxiliary Section Assembly and Installation

Auxiliary Section Assembly

1. Place Output Shaft on bench with yoke end facing up.

2. Install the stepped washer onto the backside of the Auxiliary Reduction Gear.

3. Install the splined spacer into the clutching teeth of the Auxiliary Reduction Gear.

4. Install the Auxiliary Reduction Gear onto the Output Shaft with the clutching teeth facing down.

5. Mark any two teeth 180 degrees apart on the Range Reduction Gear using a highly visible dye.

6. Place the Inner Bearing (longer rollers) tapered side up over the Auxiliary Main Shaft.

7. Drive the bearing down to the Auxiliary Reduction Gear using the Output Shaft bearing driver.

8. Slide the Bearing Spacer down on top of the Inner Bearing.

Auxiliary Counter Shaft Installation and Timing

1. If previously removed, install the bearings onto the rear of each Counter Shaft.

2. On each low range gear of the Auxiliary Counter Shaft assemblies, use a highly visible color of dye to mark the tooth stamped with an “O” for timing purposes.

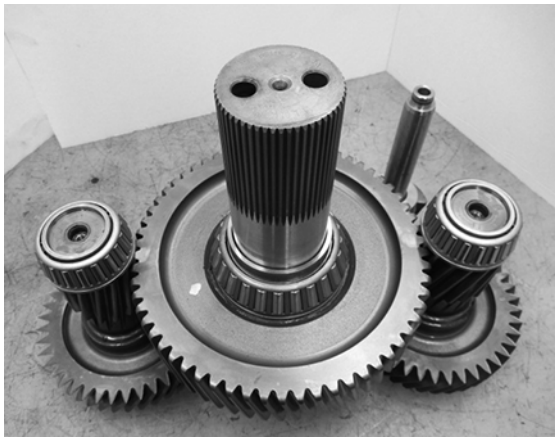
   Note: The "O" may be behind the washer and bearing on the rear of the Counter Shaft gear.

3. Place the auxiliary Main Shaft positioning cone around the splines of the shaft, set the Main Shaft upright with the synchronizer facing down.

   Note: Cone size must be 4-3/8" tall with a 4" inner diameter. PVC pipe is recommended.

4. Move the upper and lower Counter Shafts into place on the range reduction gear lining up the timing marks previously made.

5. Position the range shift yoke on the range synchronizer sliding clutch with the shaft aligned above the lower Counter Shaft.



6. Install the double bearing race into the auxiliary case with the race flange out.

7. Before installing the main case, remove excess RTV sealant from the mating surfaces of the auxiliary case and main case.

8. Place the auxiliary case over the Main Shaft/Counter Shaft assembly.

9. Install the upper and lower Counter Shaft rear bearing races into the auxiliary case.

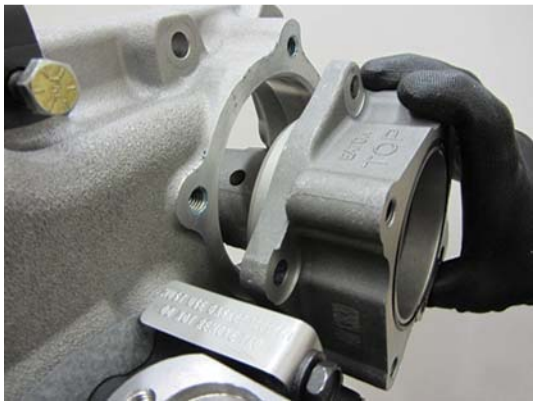
10. Install the auxiliary Counter Shaft support straps to hold the Counter Shafts in place.

Note: Hold the Counter Shafts from spinning while tightening auxiliary Counter Shaft support straps, failure to do this could allow Counter Shafts to come out of time with the range reduction gear.

11. Place the outer auxiliary shaft bearing over the shaft with the tapered side down (short rollers), drive into place using the Output Shaft bearing driver.

12. Install the Output Shaft bearing cover and gasket.

13. Apply lube to the o-ring on the Range Shift Fork Shaft and Range Cylinder o-ring, install the Range Cylinder.



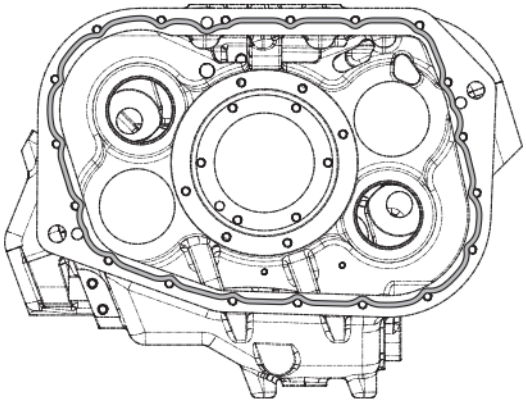
14. Install the range cylinder bolts; torque to 45–55 lb-ft.

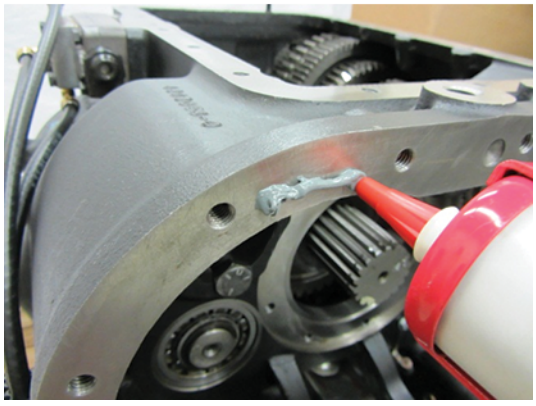
15. Apply lube to the Range Piston o-ring, install piston into the Range Cylinder. Install the Range Piston cap screw and torque to 20–25 lb-ft.

16. If the main case gearing does not need to be serviced, attach the auxiliary section lifting bracket to the top of the auxiliary case.

17. Apply Loctite 5810A RTV or anaerobic 5188 sealant to the auxiliary case to main case joint, using an 1/8" bead apply the sealant inward of all cap screws holes.

    Note: Follow the pattern in the image below. Parts must be assembled within 30 minutes of applying sealant. The area must be clean of contaminants, ensure surfaces are adequately prepped.





18. Install the auxiliary case assembly onto the transmission Main Case dowel pins. Using the Output Shaft, wiggle the auxiliary case forward until it is as far forward as possible. Remove the auxiliary section lifting bracket.

19. Push auxiliary section flush with the transmission main case and install cap screws. Torque cap screws to 40–45 lb-ft.

    Note: If auxiliary case does not come flush with the transmission main case with minimal force this could indicate an issue with auxiliary gearing timing.

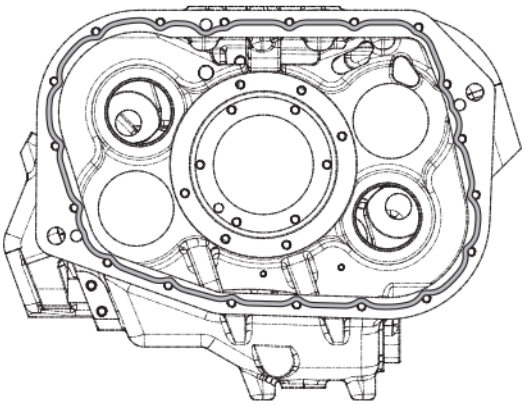
    Note: If auxiliary section bearings or gearing were replaced then the auxiliary Counter Shaft shimming procedures will need to be followed.

Auxiliary Section Installation In Chassis

1. Ensure that the auxiliary Counter Shaft support straps are still installed and all three cap screws are snug.

2. Apply Loctite 5810A RTV or anaerobic 5188 sealant to the auxiliary case to main case joint, using an 1/8" bead apply the sealant inward of all cap screws holes.

   Note: Follow the pattern in the image below. Parts must be assembled within 30 minutes of applying sealant. The area must be clean of contaminants, ensure surfaces are adequately prepped.



3. Using a transmission jack and support bracket, lift the auxiliary case assembly and line up the two holes in the auxiliary case with the transmission main case alignment pins. Push the case forward toward the transmission main case.

   Note: Verify the auxiliary counter shafts are still timed to the auxiliary reduction gear before installing. This will allow for easier installation and timing to the auxiliary drive gear.

4. Once the auxiliary case is pushed as far into the transmission main case as possible, remove the auxiliary section lifting bracket. Loosen the auxiliary Counter Shaft support strap cap screws and fully seat the auxiliary case to the transmission main case.

   Note: Fully seating the auxiliary section to the transmission main case should take light force; do not draw it in with bolts. If the auxiliary section will not come flush with the transmission main case, a timing issue with the auxiliary section gearing may be the cause.

5. Install the 16 cap screws that fasten the auxiliary section to the transmission main case. Torque bolts to 35–45 lb-ft.

Auxiliary Counter Shaft Shimming

1. Remove the auxiliary Counter Shaft support straps and install a 0.100" shim between the cover and auxiliary Counter Shaft. Use two of the Counter Shaft bearing cover bolts and torque bolts to 7 lb-in. Spin the Output Shaft multiple times to assist in seating the bearing races. Ensure cap screws are still torqued at 7 lb-in.

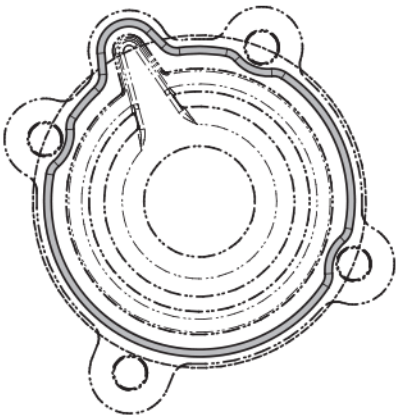
2. Using feeler gages, measure the gap between the auxiliary counter shaft covers and the auxiliary case. Use multiple positions closest to the cap screws.

3. Subtract the thickness of feeler gauges needed to fit in between the auxiliary case and auxiliary counter shaft covers from 0.100". Use that number to pick a shim that will allow for end-play of within 0.001"–0.005".

Note: Example: 0.042" of feeler gauges fit in between auxiliary case and the auxiliary Counter Shaft bearing cover. Subtract 0.042" from 0.100" which equals 0.058". A shim of 0.052"–0.055" would be required for the 0.003"–0.005" end-play. (If the required thickness shim does not exist, use the closest undersized shim.)

4. Install required shim into bearing bore, apply Loctite 5810A RTV or anaerobic 5188 sealant to the counter shaft bearing cover position on the auxiliary case and install cover. Torque cap screws to 30–35 lb-ft.

Note: Follow the pattern in the image below. Parts must be assembled within 30 minutes of applying sealant. The area must be clean of contaminants, ensure surfaces are adequately prepped.

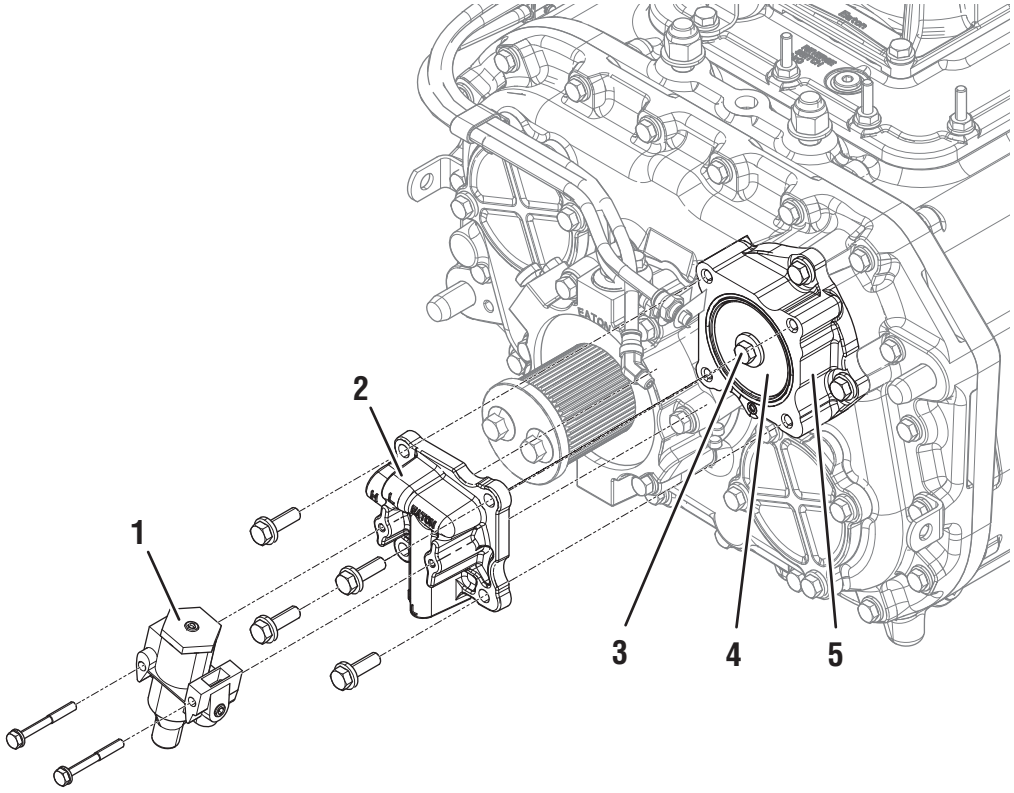


Range Cylinder Rebuild – In Chassis

Special Instructions
None

Special Tools
None

Component Identification

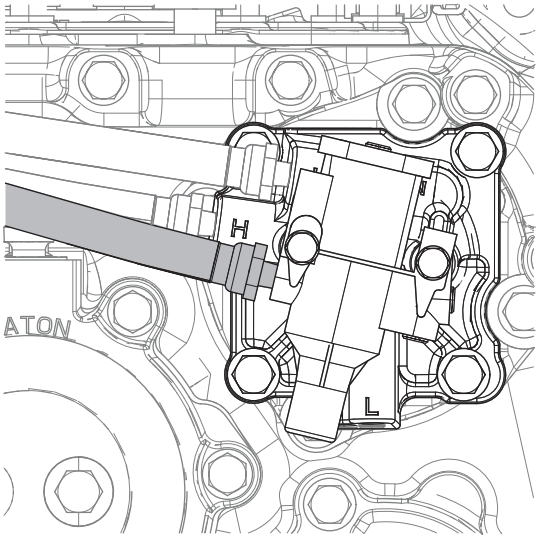


1. Air Filter/Regulator
2. Range Cylinder Cover
3. Range Cylinder Piston Bolt
4. Range Cylinder Piston
5. Range Cylinder

Range Cylinder Disassembly and Assembly

Range Cylinder Disassembly

1. Drain the air on truck before disconnecting the air supply line to the air filter regulator.

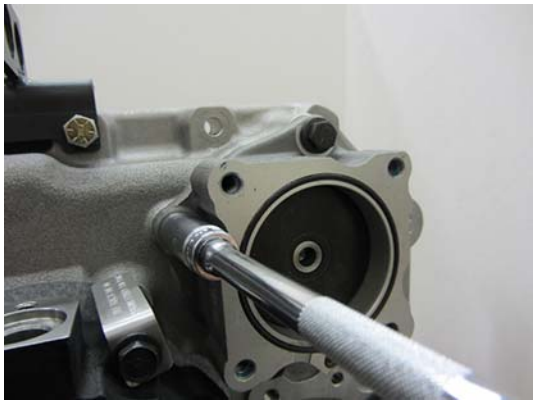


2. Disconnect the air lines and make lines that go to the range cylinder low and high side fitting.
3. Remove the air filter/regulator.

4. Remove the 4 bolts that hold the range cover to the range cylinder and remove the cover.

5. Remove the retaining bolt for the range cylinder piston.

6. Remove the 4 bolts that retain the range cylinder to the Auxiliary case.



7. Remove the range cylinder and piston from the Auxiliary case.

8. Remove the piston from the range cylinder.

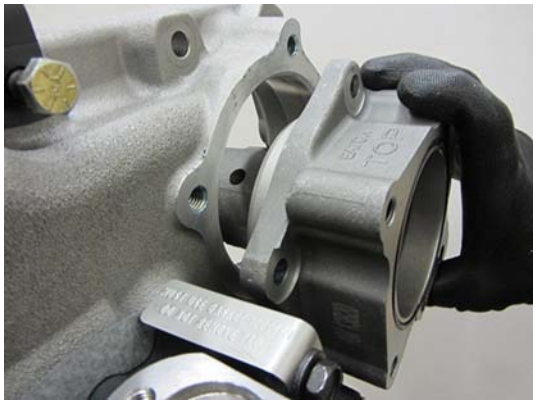
9. Inspect for cut O-rings, rust or debris in the cylinder, scoring, and blocked air passages.

Range Cylinder Assembly

1. Install a new O-ring on the range cylinder to seal against the Auxiliary case.

2. Install a new O-ring in the range cylinder bore and the cylinder face. Lube the O-rings.

3. Install the range cylinder in the bore. Make sure the cylinder has "top" pointing up and bolt into place. Torque the 4 bolts 30–35 lb-ft.



4. Install a new O-ring on the range piston and range yoke bar. Lube with silicone.

5. Install the range piston into the cylinder and onto the yoke bar.

6. Torque the bolt 35–45 lb-ft.

7. Install the two O-rings that seal the range cylinder to the range cover.

   Note: Verify that the small air passage is located at the bottom to align properly with the cover.

8. Install the range cylinder cover and 4 bolts. Torque bolts 30–35 lb-ft.

9. Install the air filter regulator and torque bolts 8–12 lb-ft.

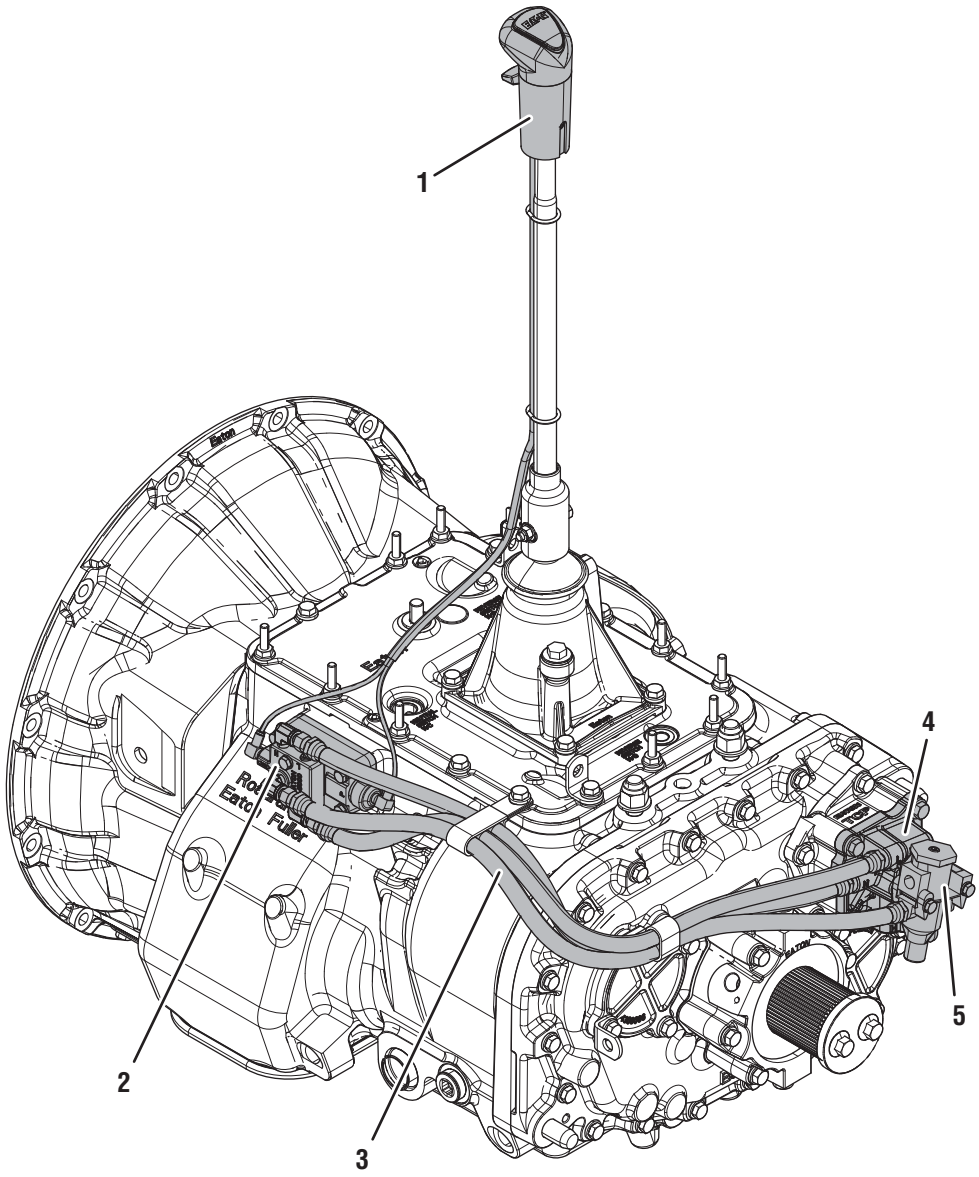
10. Install the air lines to the range cover as marked and connect the air supply lines to the air filter regulator.
11. Verify all the work is done correctly. Air-up the truck and verify operation of the transmission range system.

Shifting Controls Removal and Installation

Special Instructions
Does not include instructions for the air filter-regulator.

Special Tools
None

Component Identification



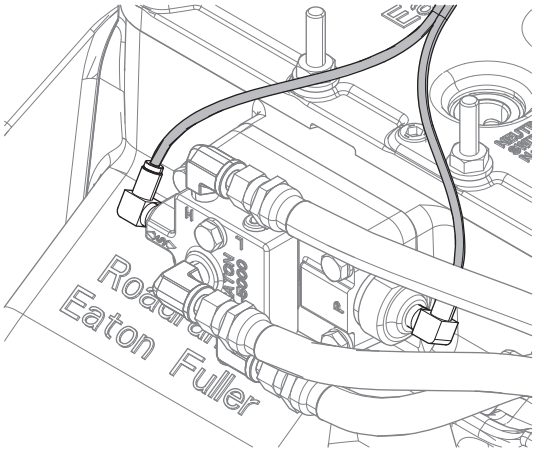
1. Roadranger Valve
2. Slave Valve
3. Air Lines
4. Range Cover / Range Cylinder
5. Air Filter-regulator

Shifting Controls Removal and Installation

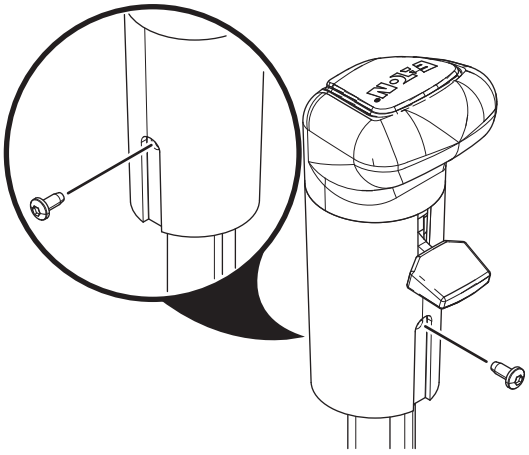
Control Valve Removal

1. Disconnect the two 5/32" O.D. air lines at the “S” Port and “P” Port of Slave Valve on transmission case.

   Note: The Shift Lever Housing assembly can now be removed from Shift Bar Housing.



2. Remove the two mounting screws for the Roadranger Valve cover.



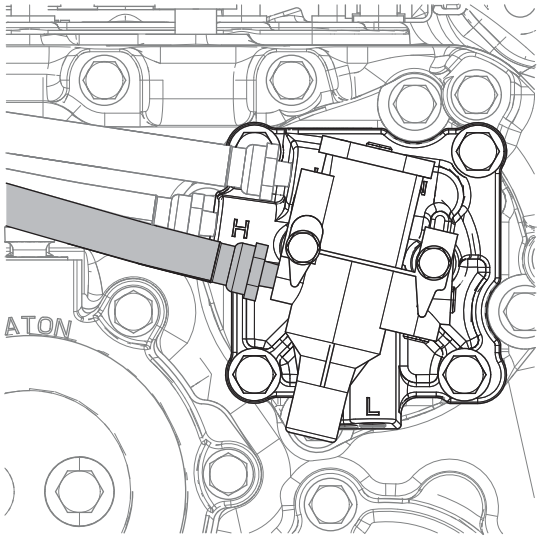
3. Slide the cover down the Shift Lever to expose valve ports. Disconnect the two 5/32" O.D. air lines at the A-5010 valve.

4. Loosen the jam nut. Then turn the Roadranger Valve and nut from the Gear Shift Lever.

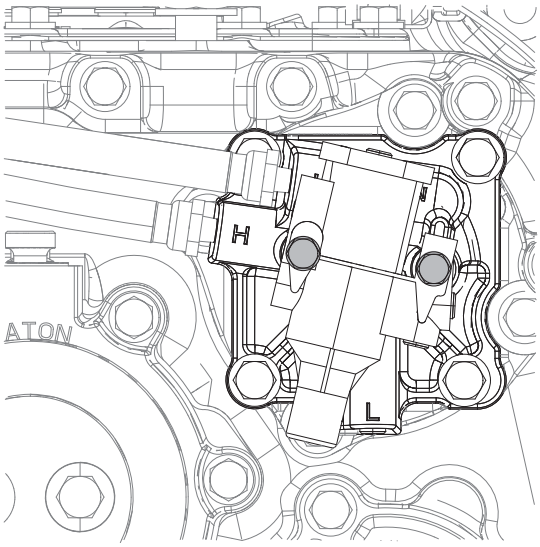
5. Remove the Valve Cover, Air Lines, Sheathing and o-rings from the lever.

Air Filter Regulator Assembly

1. Disconnect the 1/4" I.D. air line between the Slave Valve and Air Filter Regulator assembly.



2. Remove the two cap screws fastening the Air Filter-regulator to the range cover.

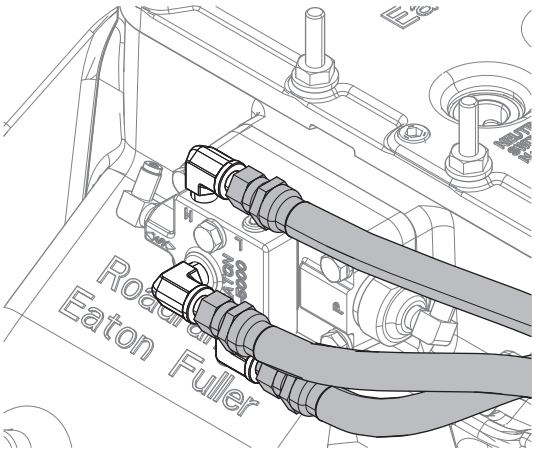


3. Remove the Air Filter-regulator assembly.

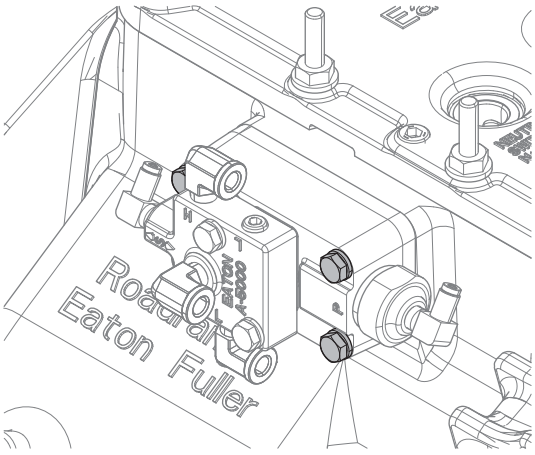
Slave Valve Removal

1. Disconnect all three 1/4" I.D. air lines connected to the Slave Valve.

   Note: Mark the lines and fittings for the correct locations.



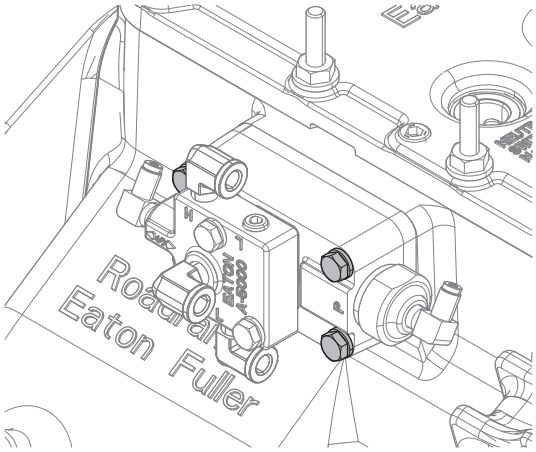
2. To remove the Slave Valve, unfasten the four bolts attaching the Slave Valve to the transmission case.



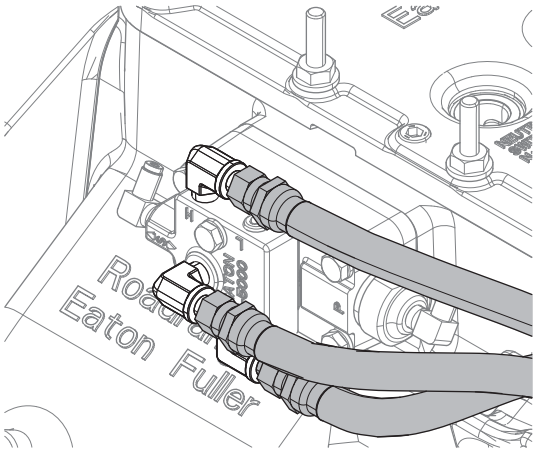
3. Remove the spring and plunger pin from the bore in the transmission case as well as the Slave Valve gasket.

Slave Valve Installation

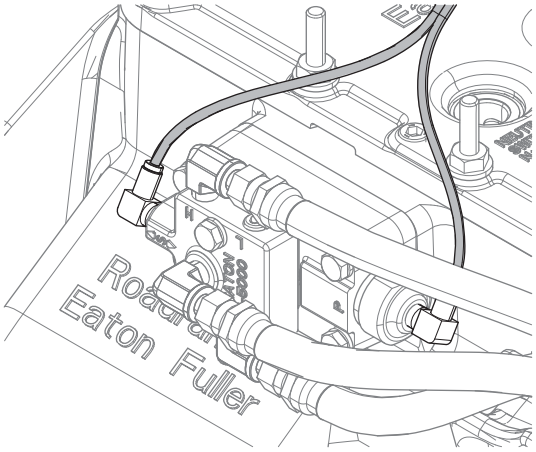
1. Install the spring and plunger into the side of the main case.
2. Place a new gasket on the Slave Valve.
3. Place the Slave Valve on the transmission case and install the four bolts. Torque the bolts 8–12 lb-ft.



4. Connect the three air lines for the range cylinder as marked.



5. Reconnect the “S” and “P” lines going to the shift valve.



Roadranger® Valve Removal and Installation

Special Instructions

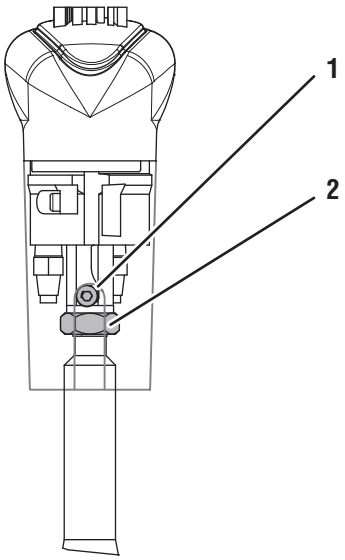
To position the Roadranger Valve, the Range Lever must be to the front of the Splitter Button to the left when facing forward.

Warning: A sudden release of air pressure can injure you or damage equipment. To prevent injury or equipment damage, the Vehicle Air Tanks must be exhausted.

Special Tools

None

Component Identification

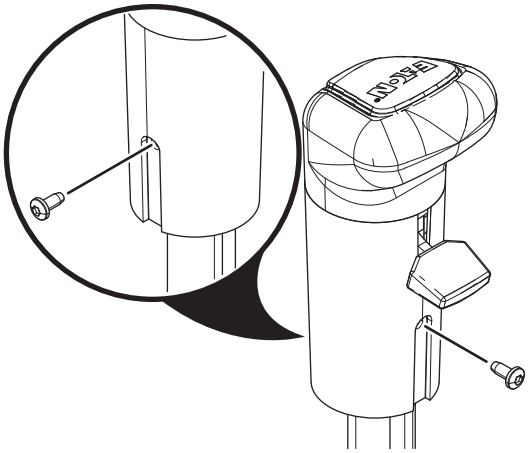


1. Skirt Attachment Screws (x2)
2. Master Valve Jam Nut

Roadranger® Valve Removal and Installation

Removal

1. From the Roadranger Valve Cover, remove the two Mounting Screws.



2. Slide the Roadranger Valve Cover down.
3. Disconnect the Air Lines from the air fittings.

4. Loosen the Jam Nut from the Roadranger base. Rotate the Roadranger Valve until it is removed.

5. Inspect the parts: Nut, Valve Cover, Air Lines, Sheathing and o-rings from the Lever Shaft.
6. In the Roadranger Valve, inspect the air fittings and remove if damaged.

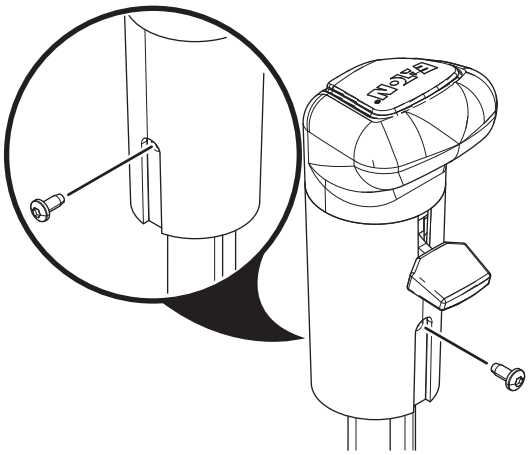
Installation

1. Make sure the Nut, Valve Cover, Air Lines, Sheathing and o-rings are in position on the Lever Shaft.
2. If previously removed, replace the Air Fittings and torque to 84–120 lb-in.
3. Place the Roadranger Valve on the Lever Shaft and rotate so the Range Selector faces the vehicle front.
4. From the Roadranger Valve bottom, tighten the Jam Nut to 35–45 lb-ft. of torque.

5. Connect the Air Lines to the Air Fittings.

6. Slide the Cover into position on the Roadranger Valve.
7. Install the Roadranger Valve Cover Mounting Screws.

   Note: Make sure the Air Lines are seated fully.

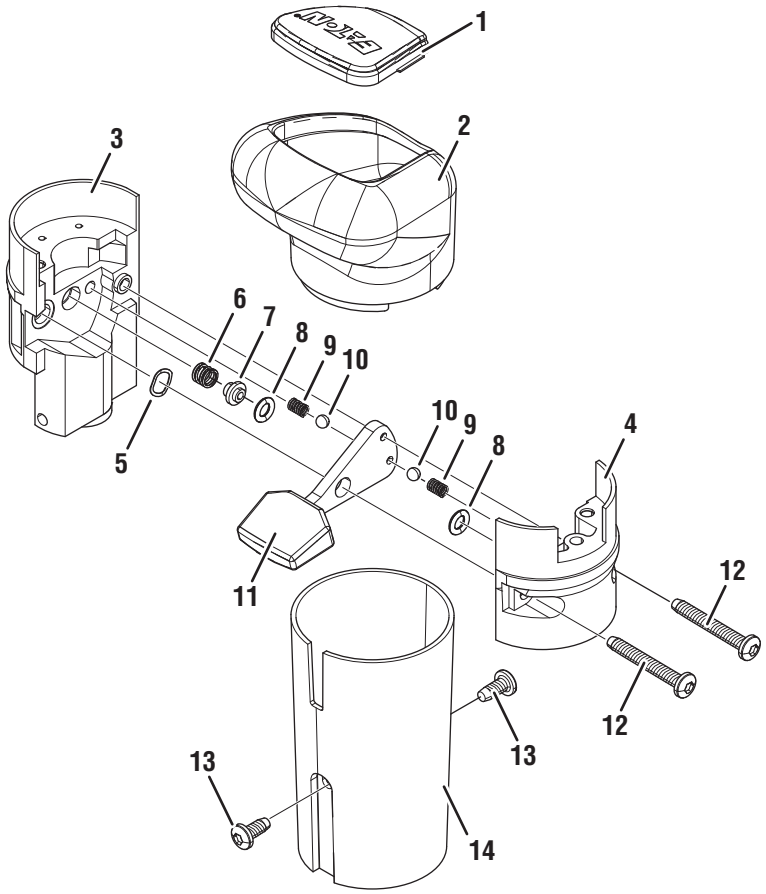


Roadranger® Valve Disassembly and Assembly

Special Instructions
None

Special Tools
None

Component Identification



1. Medallion
2. Top Cover
3. Housing, Right
4. Housing, Left
5. Retainer
6. Pin Spring
7. Pin
8. O-Rings (x2)
9. Springs (x2)
10. Balls (x2)
11. Lever
12. Housing Screws (x2)
13. Cover Screws (x2)
14. Cover

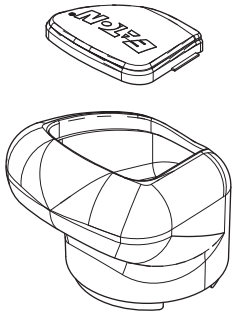
Roadranger® Valve Disassembly and Assembly

Disassembly

1. Remove two screws holding bottom cover to valve and slide cover down Shift Lever to expose air line fittings. Disconnect air lines.

2. Loosen jam nut and turn Roadranger valve from Shift Lever.

3. Pry medallion from recess in top cover.



4. Turn out the two screws to remove the top cover from valve housing.
5. Turn out the two screws in side of valve housing to separate the housing.
6. Remove the Range preselection lever from left housing and the position balls and guide from lever.
7. If necessary, remove spring and o-ring from bores in left housing.
8. If necessary, remove springs, o-ring and sleeve from bores in right housing.

Assembly

1. Refer to the drawing for proper reassembly. Use a very small amount of silicone lubricant on the o-rings to avoid clogging ports. A small amount of grease on the position springs and balls will help to hold them in place during reassembly.
2. Reinstall Roadranger valve on Gear Shift Lever and tighten jam nut.

3. Attach air lines and reinstall bottom cover.

Gear Shift Lever Disassembly and Assembly

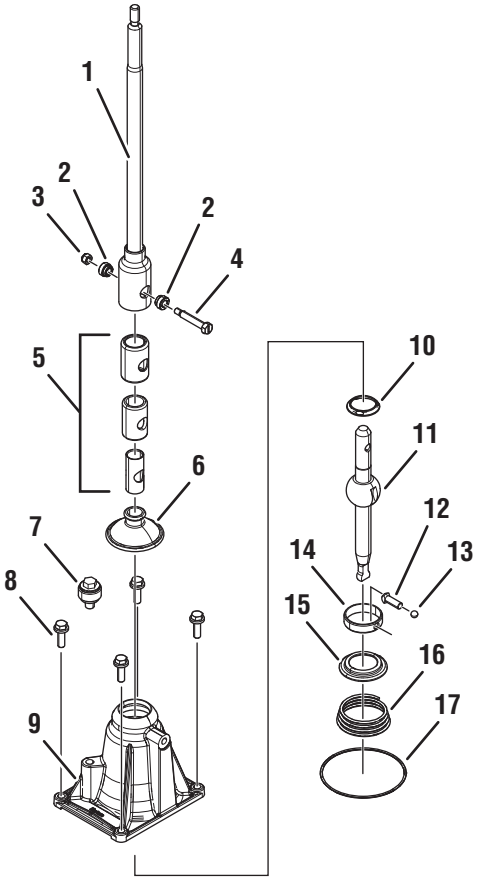
Special Instructions

If total disassembly is needed, the Roadranger Valve, must be removed first. Release the spring, one coil at a time.

Special Tools

Vise with brass jaws or wood blocks

Component Identification

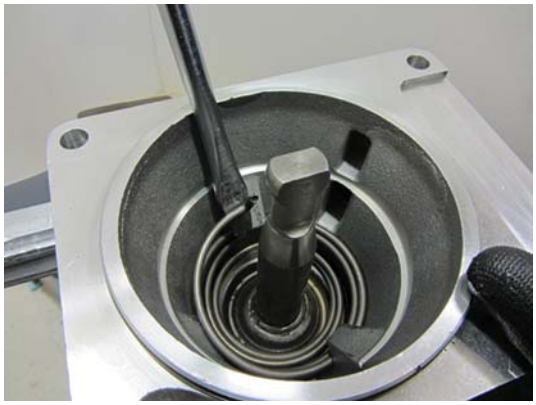


1. Upper Lever
2. Bushings (x2)
3. Nut
4. Bolt
5. Isolator
6. Rubber Boot
7. Vent
8. Cap Screws (x4)
9. Housing
10. O-ring
11. Lower Level
12. Spade Pin
13. Ball
14. Collar
15. Stepped Washer
16. Tension Spring
17. O-ring

Gear Shift Lever Disassembly and Assembly

Disassembly

1. Remove the boot from the Gear Shift Lever and secure the assembly in a vise with the bottom of the housing up. Use a large screwdriver to twist between the spring and housing, forcing the spring from under the lugs in the housing. Remove one coil at a time.

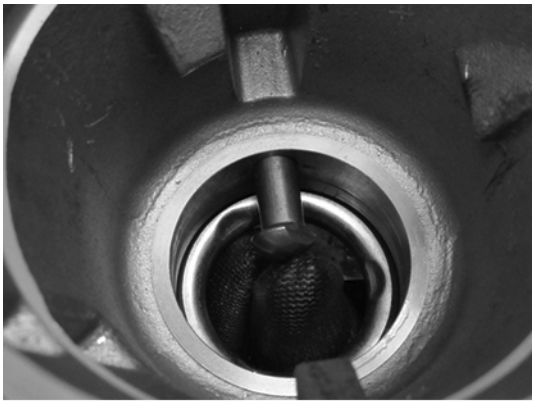


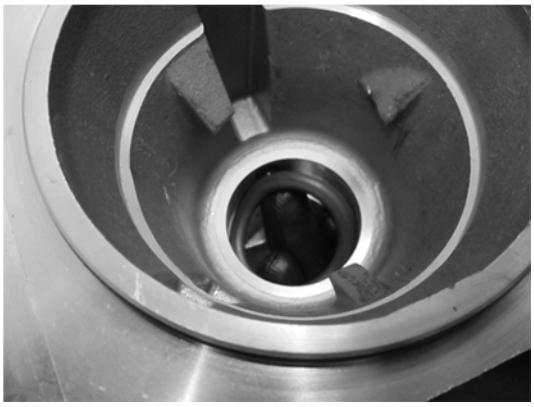
2. Remove the tension spring, washer and Gear Shift Lever from housing.

3. Remove the spade pin from the bore in the housing tower. If necessary, remove the o-ring from the groove inside the Shift Tower.

Assembly

1. With the Gear Shift Lever housing secured in a vise (as during disassembly), install the spade pin in the bore of the housing tower. If previously removed, install the o-ring in the tower groove.





2. Position the Gear Shift Lever in the housing with a spade pin in the lever ball slot and install the tension spring washer over the ball, dished-side up.

3. Install the tension spring under the lugs in the housing, seating one coil at a time. Use of a spring driving tool is recommended.

4. Remove the assembly from vise and install the rubber boot over the Gear Shift Lever and against the housing.

Input Shaft Removal and Installation

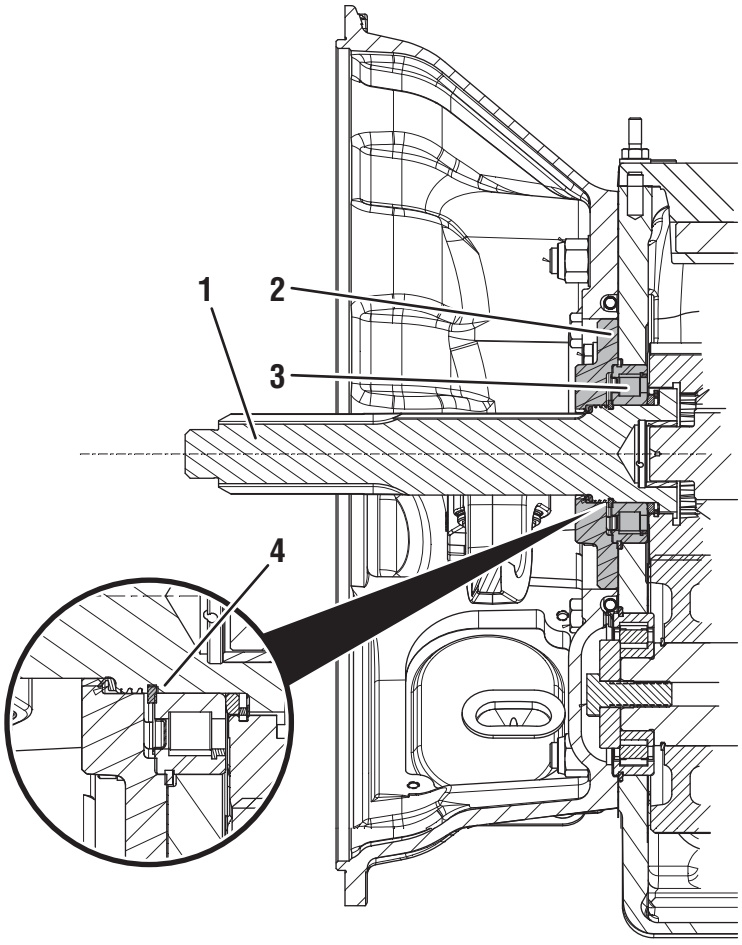
Special Instructions

None

Special Tools

- RR1023TR Input Shaft Bearing Puller
- RR1019TR Hand Maul
- RR1005TR Input Shaft Bearing Driver

Component Identification



1. Input Shaft
2. Bearing Cover
3. Input Bearing
4. Input Snap Ring

Input Shaft Removal and Installation

Replacing Input Shaft without Disassembling the Main Case or Removing Clutch Housing

1. Remove the six cap screws fastening the front bearing cover to the transmission main case.

2. If present, remove and discard the rubber seal on the Input Shaft. This rubber seal is only used to seal the transmission during shipment.
3. Remove the snap ring from the Input Shaft.

4. Using a soft maul drive the Input Shaft towards the rear of the transmission case as far as possible. Pull the Input Shaft forward.

5. Install the Input Shaft bearing remover and remove the bearing from the transmission main case.

   Note: A pry bar or screwdriver may also be used to remove the Input Shaft bearing.

6. Remove the Input Shaft Spacer.

7. Remove the snap ring retaining the Input Shaft to the main drive gear.

8. Remove the Input Shaft from the main drive gear.
9. Inspect the Input Shaft bushing, replace if damaged.

Installation

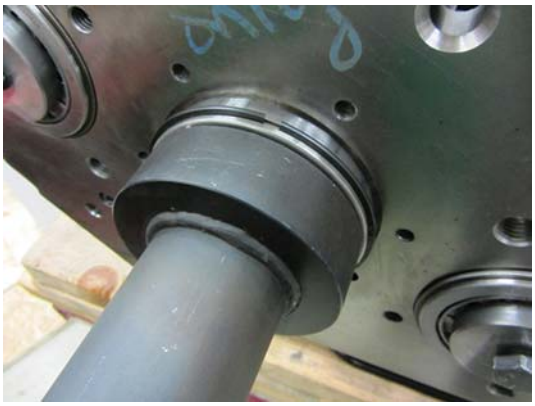
1. If necessary, complete installation of the Input Shaft bushing.
2. Install the Input Shaft into the main drive gear splines.
3. Install the snap ring that retains the Input Shaft to the main drive gear

4. Install the Input Shaft Spacer.

5. Install the Input Shaft bearing onto the Input Shaft.

Note: The external snap ring on the Input Shaft bearing should face out.

6. Using a flanged-end bearing driver install the Input Shaft bearing into the transmission main case until the snap ring groove is fully visible.



7. Install the Input Shaft snap ring.

8. Install the front Bearing Cover and gasket. Make sure the oil return and gasket line up with the oil return hole in the main case.

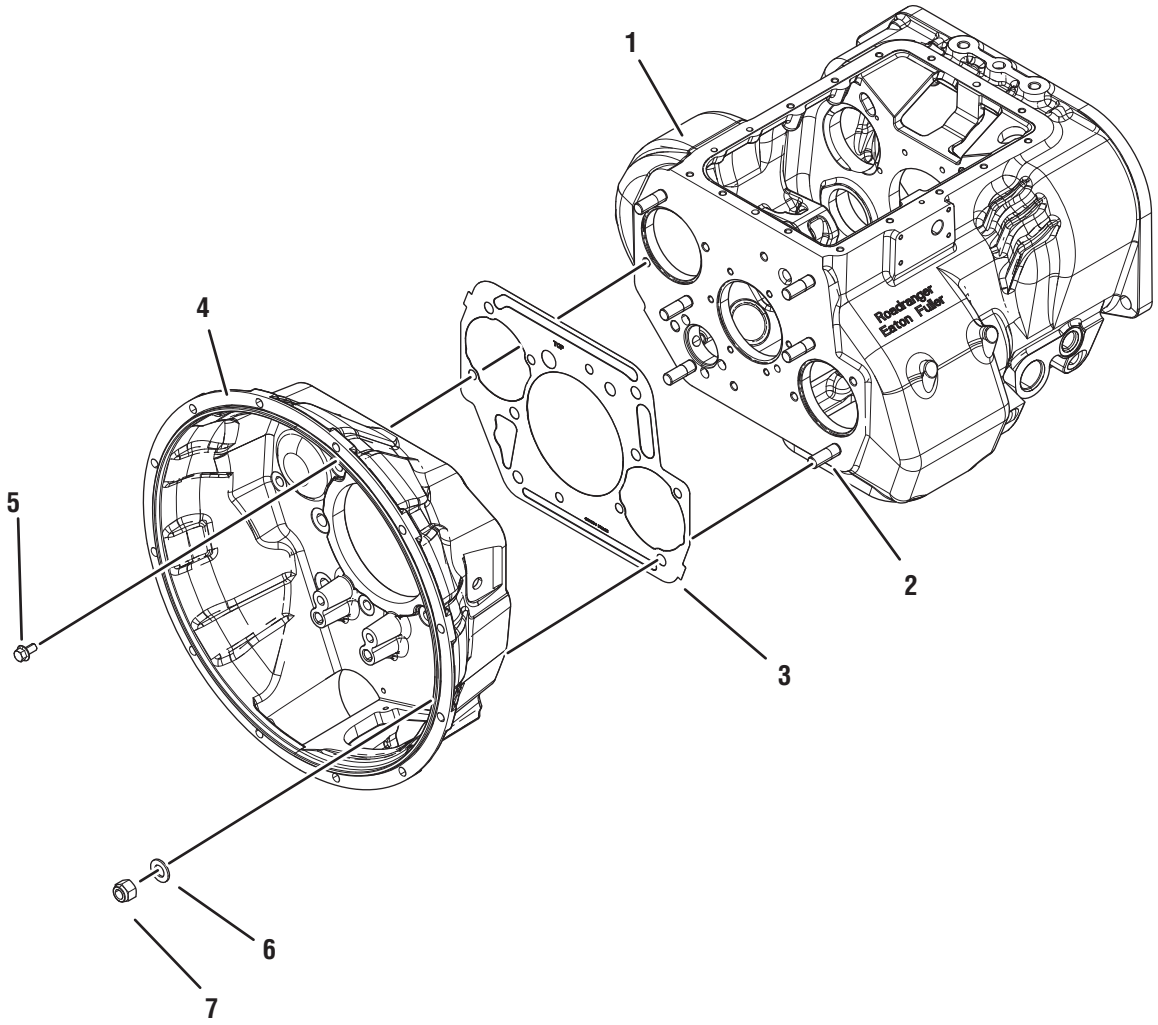
9. Install the front bearing cover and gasket; torque the six cap screws to 35–45 lb-ft.

Clutch Housing Removal and Installation

Special Instructions
None

Special Tools
None

Component Identification

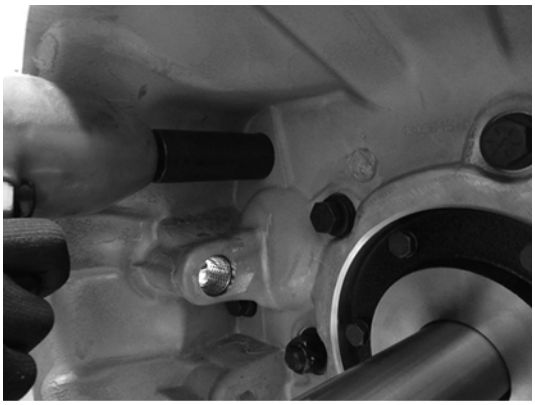


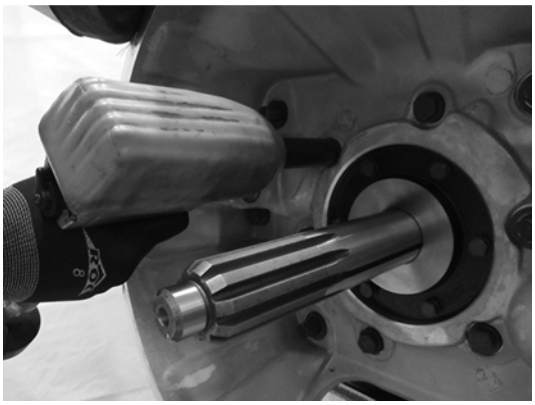
1. Main Case
2. Stud
3. Gasket
4. Clutch Housing
5. Cap Screws (x6)
6. Washers (x6)
7. Nuts (x6)

Clutch Housing Removal and Installation

Removal

1. Remove the clutch release mechanism and clutch brake assembly (if equipped).
2. Remove the 6 cap screws and 6 nuts and washers fastening the Clutch Housing to the transmission main case.

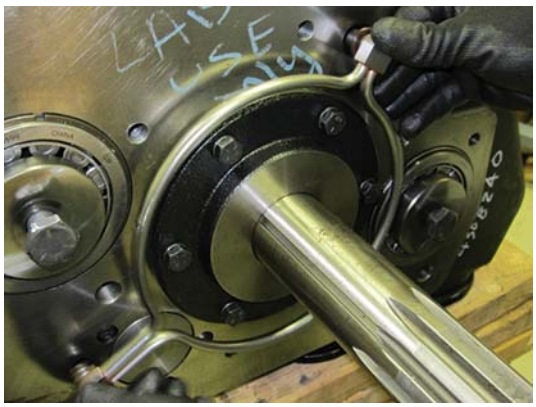




3. Remove the Clutch Housing from the transmission main case.

Installation

1. Make sure the clutch housing and Main Case surfaces are clean. Install a new clutch housing gasket on the Main Case side.
2. Install the Halo Tube Assembly into the case.



3. Install the clutch housing.

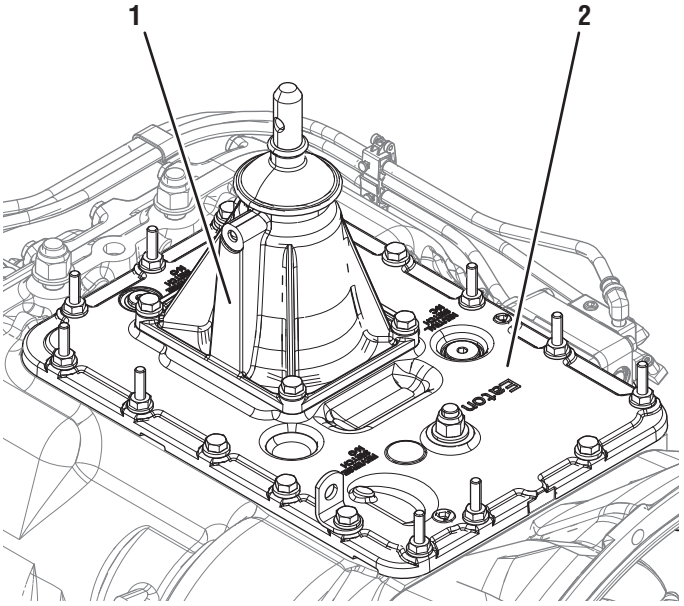
4. Put the 6 nuts and washers on the mounting studs and install the bolts into place.
5. In a cross-pattern sequence, torque the nuts to 30 lb-ft, then rotate clockwise 100°. Torque the bolts to 30 lb-ft, then rotate clockwise 115°.

Shift Bar Housing and Shift Tower Removal and Installation

Special Instructions
None

Special Tools
None

Component Identification



1. Shift Tower
2. Shift Bar Housing

Shift Bar Housing and Shift Tower Removal and Installation

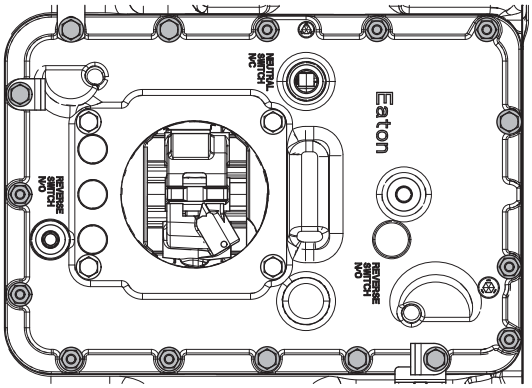
Shift Tower Removal

1. Remove the Shift lever bolt and remove the lever from the short shift tower.
2. Remove the four bolts that secure the tower to the Shift Bar Housing.

3. Tap on the tower with a rubber maul and then remove the tower from the transmission.

Shift Bar Housing Removal

1. Remove the 16 cap screws and studs fastening the Shift Bar Housing to the Transmission Case. Remove the Shift Bar Housing.

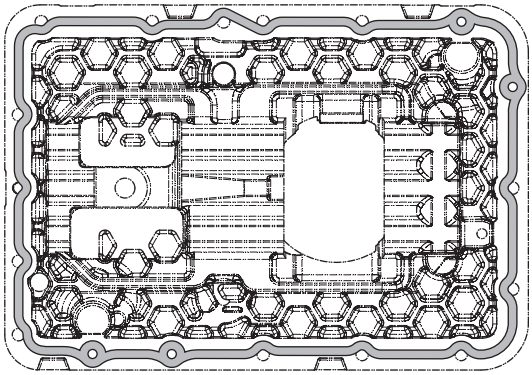


Shift Bar Housing Installation

1. Ensure all transmission main case Main Shaft sliding clutches are in their Neutral position.

2. Apply Loctite 5810A RTV or anaerobic 5188 sealant to the Shift Bar Housing gasket surface and install the Shift Bar Housing.

   Note: Follow the pattern in the image below. Parts must be assembled within 30 minutes of applying sealant. The area must be clean of contaminants, ensure surfaces are adequately prepped.



3. Install the Shift Bar Housing onto the transmission main case.

   Note: Ensure the Slave Valve is not installed until after the Shift Bar Housing and Actuator Pin are installed.

4. Install the 16 cap screws that fasten the Shift Bar Housing to the transmission main case. Torque cap screws to 35–45 lb-ft.

5. Install the Slave Valve plunger into the transmission main case.

6. Install the Slave Valve onto the transmission main case.

Shift Tower Installation

1. Apply lubricant to the Shift Tower o-ring.

2. Install the Shift Tower onto the Shift Bar Housing. Use a constant downward force to fully seat the o-ring into the Shift Bar Housing bore.

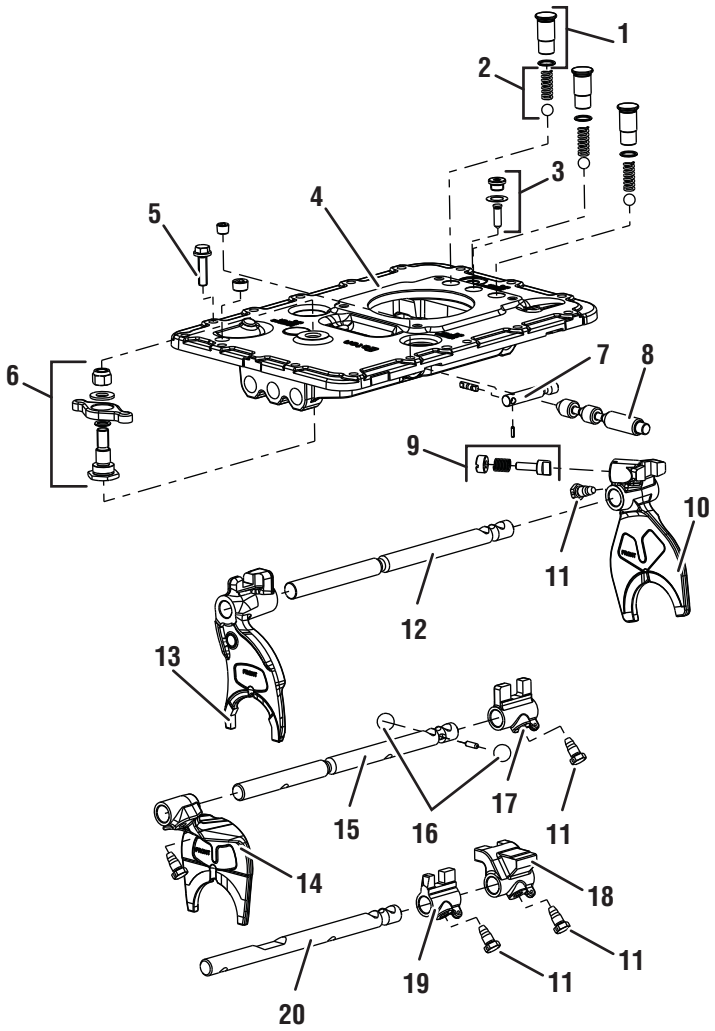
3. Install the four cap screws that fasten the Shift Tower to the Shift Bar Housing. Torque cap screws to 30–40 lb-ft.

Shift Bar Housing Disassembly and Assembly

Special Instructions
None

Special Tools
RR10XXXTR - Shift Lever Spring Installation Tool (Tension Spring Driver)

Component Identification



1. Detent Cap Assembly
2. Ball and Spring
3. Reverse Plunger
4. Shift Bar Housing
5. Cap Screws (x16)
6. Actuator Assembly
7. Neutral Switch Interlock
8. Air Valve Shaft
9. Reverse Detent
10. Reverse / LO Shift Yoke
11. Lock Screws
12. Reverse / LO Shift Rail
13. Direct / Overdrive Shift Yoke
14. 1st / 2nd Shift Yoke
15. 1st / 2nd Shift Rail
16. Steel Balls (x2)
17. 1st / 2nd Shift Block
18. Direct / Overdrive Shift Block
19. Shift Block
20. Shift Rail

Shift Bar Housing Disassembly and Assembly

Shift Bar Housing Disassembly

1. Remove the three Detent Spring Caps from the Shift Bar Housing.

2. Tilt the Shift Bar Housing on its side to remove the springs and balls from the housing bores.

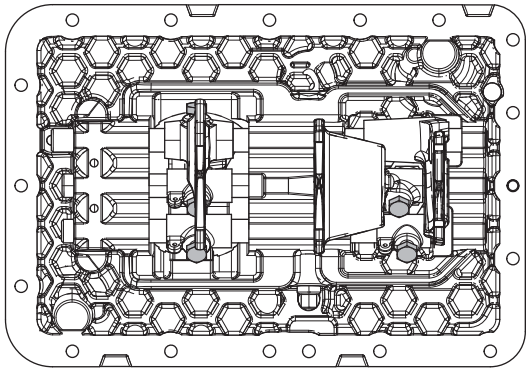
   Note: Detent Spring Caps are press fit into the Shift Bar Housing. Use caution when removing Detent Spring Caps so as to not damage the aluminum surface.

3. Place the Shift Bar Housing Assembly upside down on a flat workspace. (The front of the housing facing to the left.)

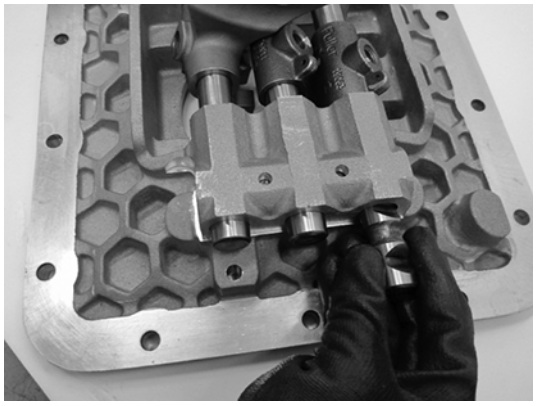
4. Cut and remove the lock wire from the Shift Bar retaining cap screws.

   Note: Start with the upper Shift Bar, move all bars to the right and out the rear boss bore.

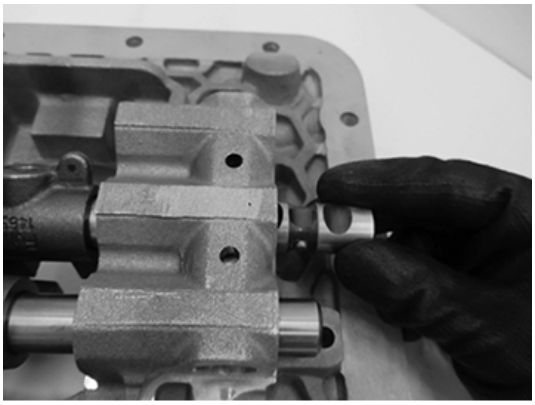
5. Remove Shift Bar retaining cap screws



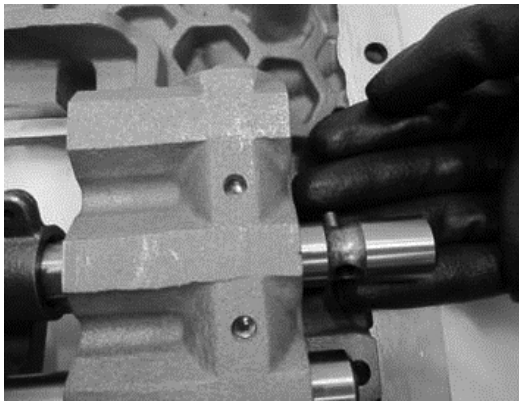
6. Move the 3rd–4th Gear Shift Bar to the housing rear, removing the yoke and block from the bar.



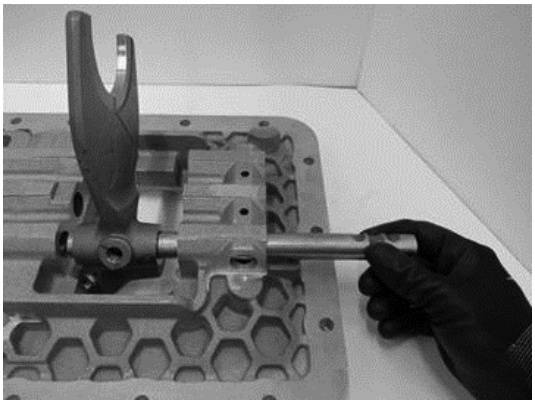
7. Move the 1st–2nd Gear Shift Bar to the housing rear, removing the yoke and block from the bar.



8. Remove the small interlock pin from the bore as the Neutral notch in the bar clears the rear boss bore.

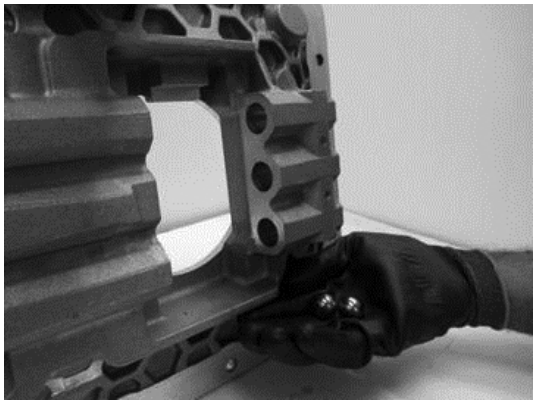


9. Move the short low-reverse speed Shift Bar to the housing rear, removing the yoke from the bar.



10. Remove the actuating plunger from the center boss bore.

11. Tilt the Shift Bar Housing on its side to remove the two 3/4" interlock balls from the housing bore.



12. If necessary, remove the plug, spring and reverse stop plunger from the low-reverse gear shift yoke bore.

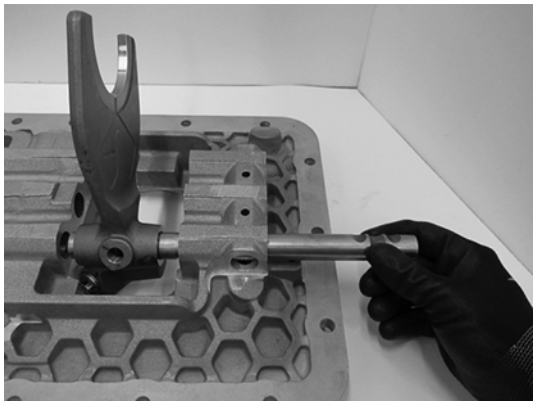
Shift Bar Housing Assembly

1. If previously removed, install the reverse-stop plunger in the low-reverse shift yoke, making sure the plunger is fully seated in the yoke slot bore.

2. Install the spring in the yoke bore and on the plunger shank.

3. Install the plug and tighten to compress the spring (left).

4. Back the plug out 1–1 1/2 turns and stake the plug through the small hole in the yoke.
5. Place the Shift Bar Housing upside down on a work bench.
6. Install the bar in the first bore of the Shift Bar Housing.



7. Install the yoke lock screw and wire securely.

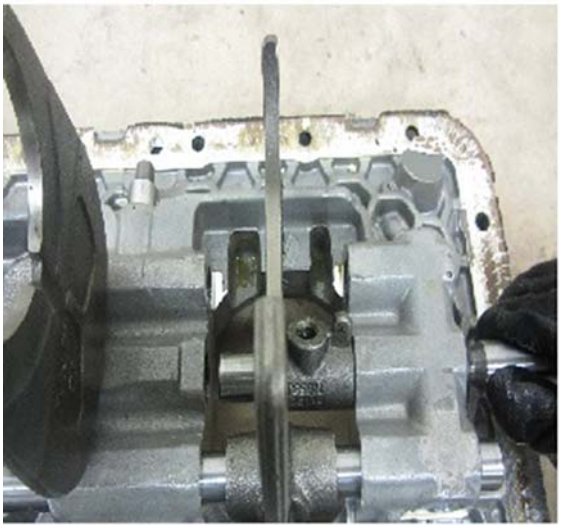
   Note: Brass covers must be used on vise teeth (if used) to avoid damaging the Shift Bar Housing gasket surface.

8. Install the actuating plunger in the center boss bore.

9. Install one 3/4" interlock ball in the rear boss top bore. This ball rides between the low-reverse and 1st–2nd gear shift bars.

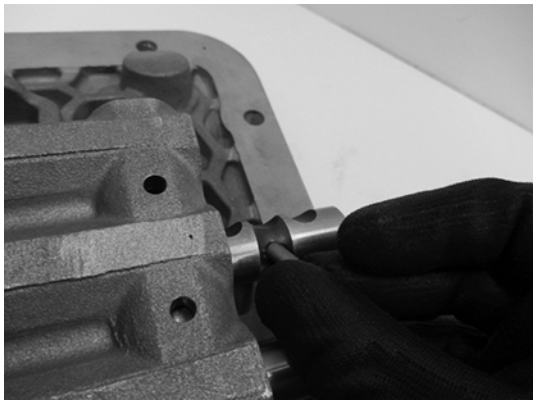
Note: Coating the 3/4" interlock balls with grease will help keep them in place in the bores.

10. While holding the notched end of the bar, install the 1st–2nd speed Shift Bar in the housing boss middle bore. Position the Shift Block on the bar between the center and rear bosses.



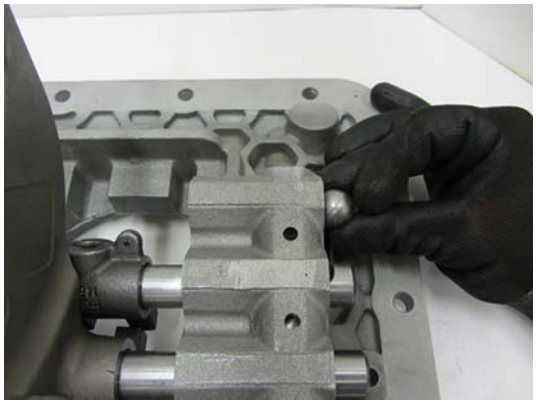
11. Position the yoke on the bar between the front and center bosses, long hub to the housing front.

12. Just before inserting the notched end of the rear boss bar, install the small interlock pin vertically in the Neutral notch bore.



13. Install the block and yoke lock screws, tighten and lock wire securely.

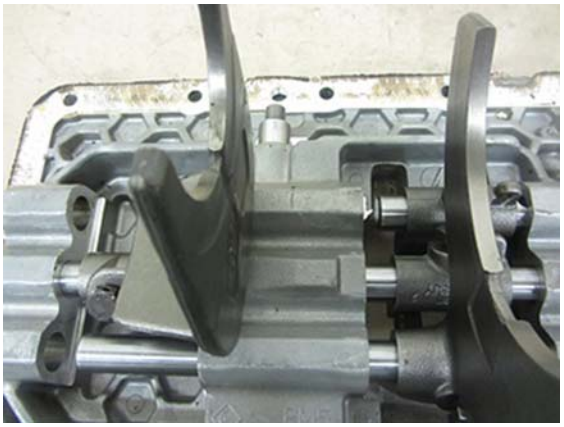
14. Install the second 3/4" interlock ball in the rear boss top bore. This ball rides between the 1st–2nd and the 3rd–4th Shift Bars.



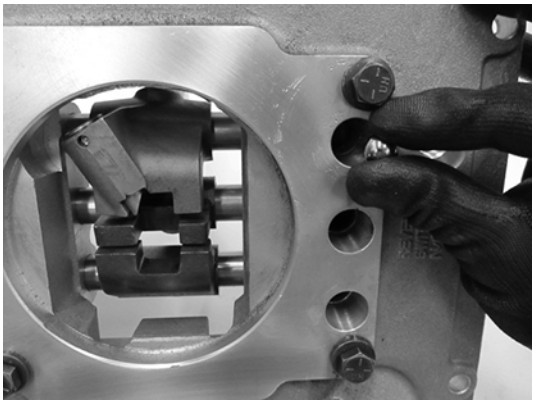
15. Install the 3rd–4th speed Shift Bar in the housing boss upper bore.

16. Position the shift block on the bar between the front and center bosses, long hub to the housing rear.

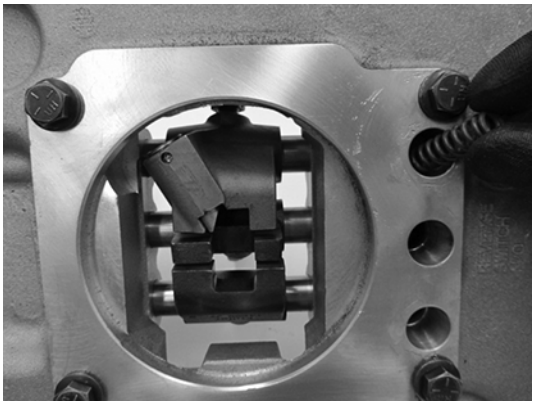
17. Install the block and yoke lock screws, tighten and lock wire securely.



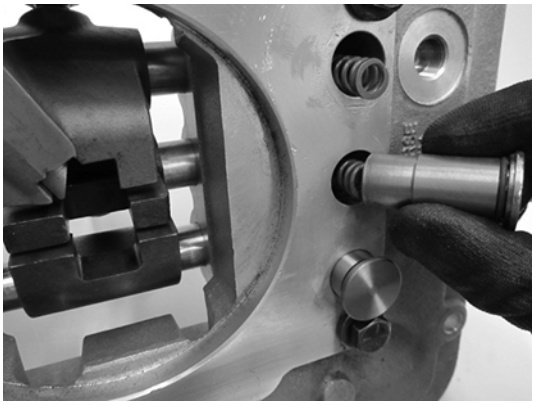
18. After all lock screws and safety wire have been installed, flip the Shift Bar Housing over.



19. Install the three tension balls and springs into the bores on the top of the Shift Bar Housing.



20. Install the Detent Spring Caps over the springs in each bore; seat the caps using a plastic hammer.

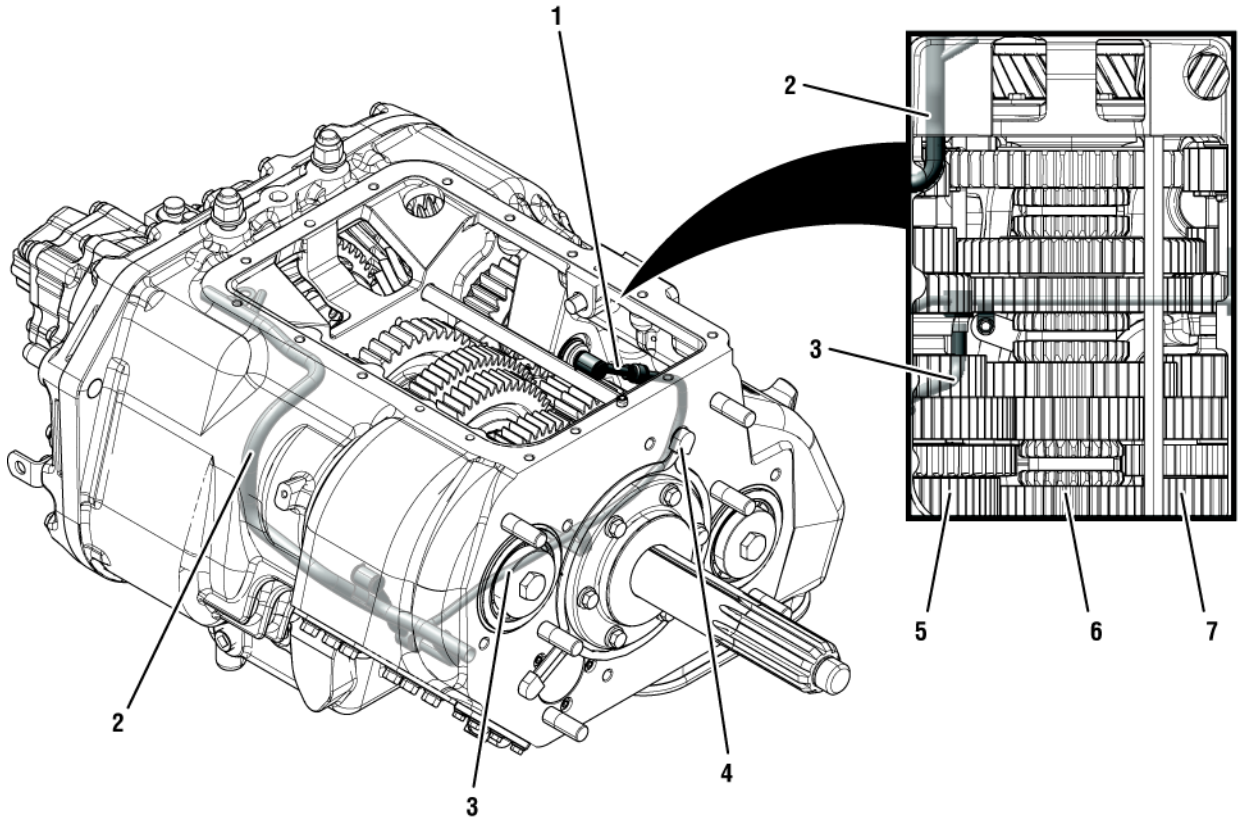


Main Case Disassembly and Lubrication Tube Removal

Special Instructions
None

Special Tools
None

Component Identification



1. Upper Idler Lubricant Tube
2. Auxiliary Lubricant Tube
3. Idler Feed Lubricant Tube
4. Halo Lubricant Tube
5. Upper Counter Shaft
6. Main Shaft
7. Lower Counter Shaft

Main Case Disassembly and Lubrication Tube Removal

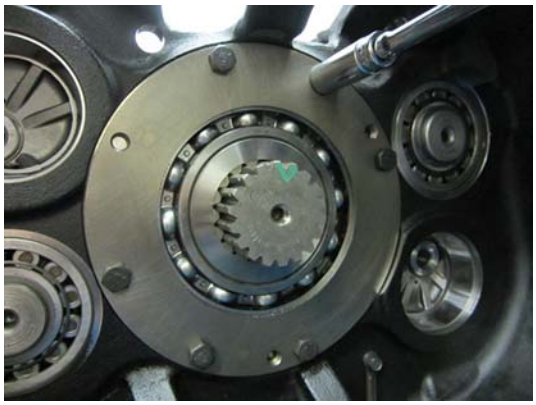
Main Case Disassembly

1. Remove the six cap screws fastening the Input Shaft bearing cover to the transmission main case.

2. Remove the Input Shaft Snap Ring from the Input Shaft.

3. Remove the snap ring holding the Auxiliary Drive Gear to the Main Shaft, remove the Auxiliary Drive Gear.

4. Remove the six cap screws fastening the bearing retainer ring to the main case intermediate wall.



5. Using a pry bar, force the Main Shaft toward the rear of the case to aid in unseating the Main Shaft bearing from the transmission main case.

6. Use a rolling head pry bar (Crow's foot) to work the Main Shaft bearing from the main case intermediate wall.

7. Using the K-Line tools slide hammer (RR1010TR) and adapter (RR1011TS-1), remove both upper and lower auxiliary Counter Shaft front bearing races.

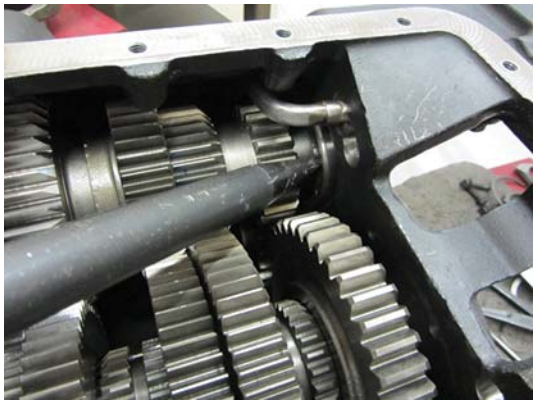
8. Remove metal clips from the Reverse Idler Feed Tube.

9. Remove the spiral lock from the front of the upper reverse idler using a small screwdriver to pry it from the groove.

10. Using the K-Line tools slide hammer (RR1010TR) and adapter (Part Number XX) thread the tool into the upper Reverse Idler Shaft, remove the upper Reverse Idler Shaft and Eccentric Cam.

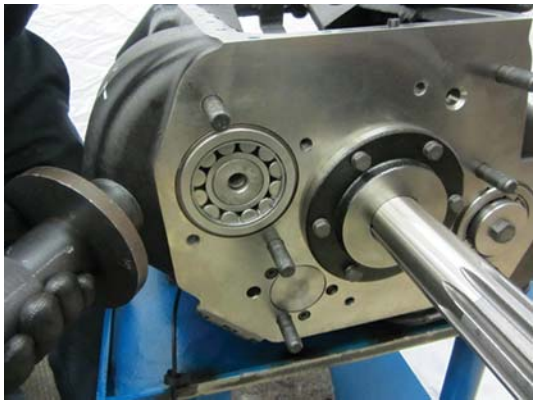
11. Remove the snap ring from the upper Counter Shaft rear bearing.

12. Using a soft bar, drive the rear Counter Shaft bearing out from the intermediate wall and off of the upper Counter Shaft.



13. Remove the front Counter Shaft bearing bolt and retainer.

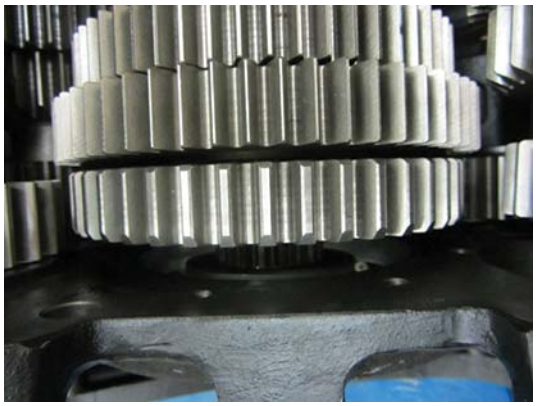
14. Using the K-Line soft maul with hand guard, strike the case to the left of the front Counter Shaft bearing to drive it out of the bore.



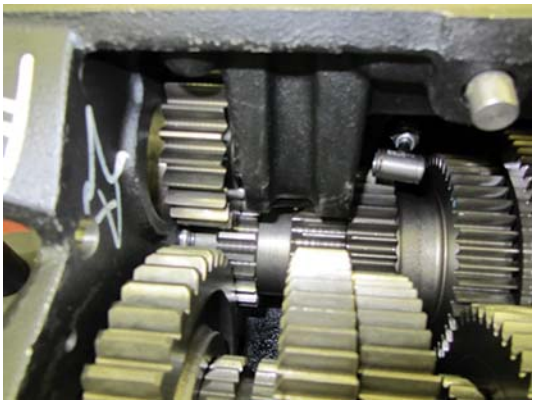
15. Position the upper Counter Shaft as far towards the case as possible (away from the Main Shaft).

16. Slide the reverse gear as far to the rear of the case as possible. Using snap ring pliers, remove the snap ring from the I.D. of the gear.

17. Move the reverse gear forward against 1st gear, engaging the splines of the Main Shaft sliding clutch.



18. Push the upper reverse idler gear towards the outside of the case (away from the Main Shaft).



19. Using the K-Line J-Hook, position the hook underneath the middle Main Shaft sliding clutch (2nd–3rd gear sliding clutch).

20. Keeping the reverse gear tucked against 1st gear, move the Main Shaft as far towards the back of the case as possible. Lift the front of the Main Shaft out and swivel the Main Shaft out of the main case.

Note: Use caution when lifting the Main Shaft from the main case as the reverse gear can move freely.

21. Remove the snap ring from the rear lower Counter Shaft bearing.

22. Drive the rear lower Counter Shaft bearing from the bore using a soft bar and hand maul.

23. Using a soft maul with hand guard main case, strike the case to the right of the front lower Counter Shaft bearing to remove it from the bore.

Main Drive Gear and Input Shaft Removal

1. Using the K-Line tools input bearing puller, remove the Input Shaft Bearing.

   Note: Input Shaft may also be driven through the bearing using a soft hand maul.

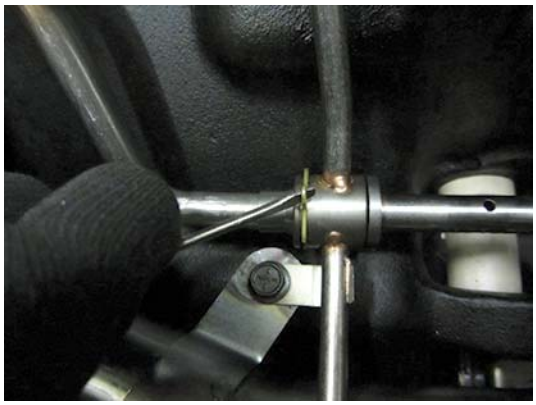
2. With the upper Counter Shaft still pushed as far toward the case as possible, remove the Input Shaft, main drive gear and spacer as an assembly.

3. Using the K-Line J-Hook (RR1004TR), remove the upper and lower Counter Shafts from the transmission main case.

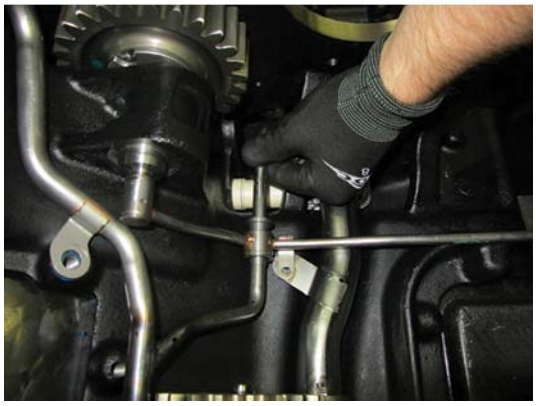
Lubrication Tube Removal

1. Remove the cap screw fastening the Suction Strainer and Reverse Idler Feed Tubes together.

2. Remove the metal retaining clip (yellow) holding the tube assemblies together.



3. Remove the cap screw fastening the auxiliary drive gear feed tube to the transmission main case intermediate wall, remove the auxiliary drive gear feed tube.



4. Remove metal clips from the Reverse Idler Feed Tube.

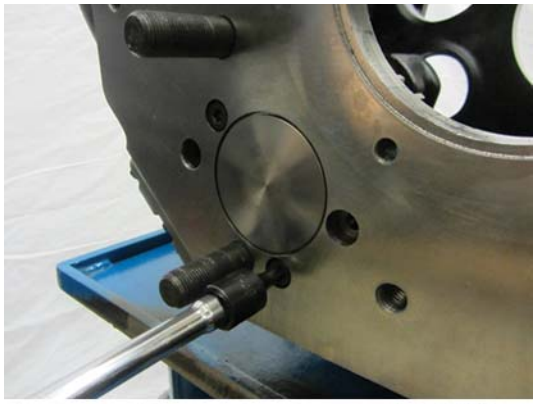
5. Unbend the tab wrapped around the main case webbing (or loosen bolt if equipped) for the Reverse Idlers Feed Tube and remove it from the transmission case.

6. Remove the two bolts fastening the Main Feed Tube assembly to the transmission case.

7. Remove the Main Feed Tube assembly from the transmission case by pulling the assembly from the oil pump and swivel the assembly out of the case while guiding it through the intermediate wall.

8. Remove the Suction Strainer from the transmission main case.

9. Remove the three bolts fastening the Oil Pump to the transmission main case and remove the oil pump.



10. Remove the Oil Pump Cover from the front of the transmission main case.

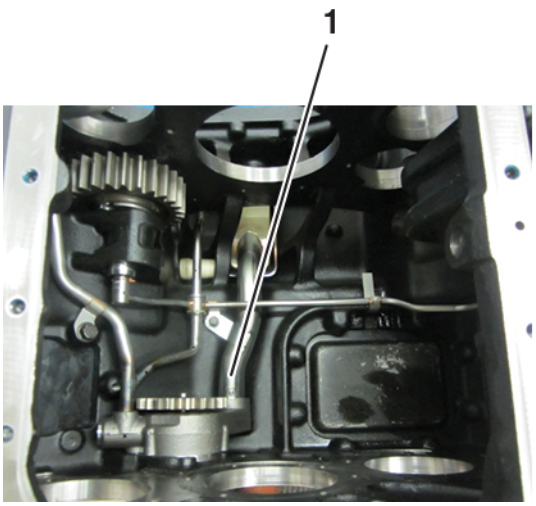
11. Remove the bolts fastening the Oil Pump Port Cover to the side of the transmission main case, remove cover and gasket.

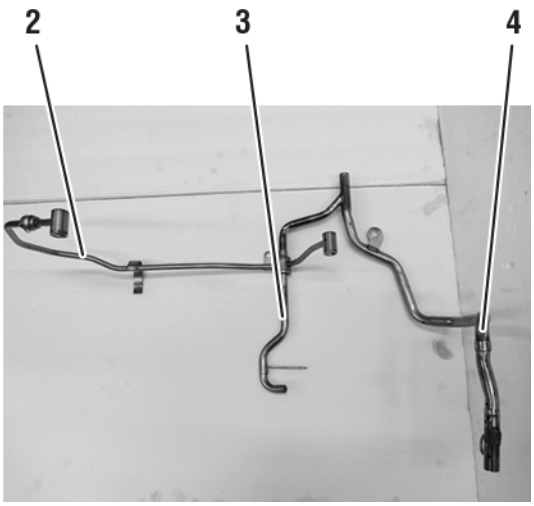
Oil Pump and Lube Tube Installation

Special Instructions
None

Special Tools
None

Component Identification





1. Suction Strainer
2. Reverse Idler Feed Tube
3. Auxiliary Feed Tube
4. Main Case Feed Tube

Oil Pump and Lube Tube Installation

Oil Pump Installation

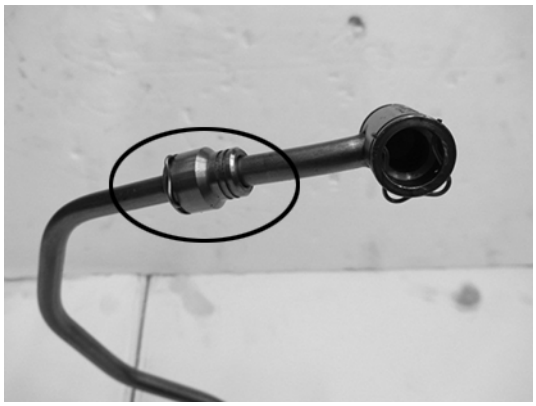
1. Clean any debris from the transmission main case before assembly.
2. Install the Oil Pump Port Cover and new gasket on the side of the transmission main case; torque cap screws to 8–12 lb-ft.
3. Apply oil or assembly lube to the o-ring on the Oil Pump Cover. Install into the front of the transmission main case.

4. Install the Oil Pump into the transmission main case; torque cap screws to 8–12 lb-ft.

Lubrication Tubes Installation

1. Install both Reverse Idler Retaining Clips onto on the Lube Tube connection points.

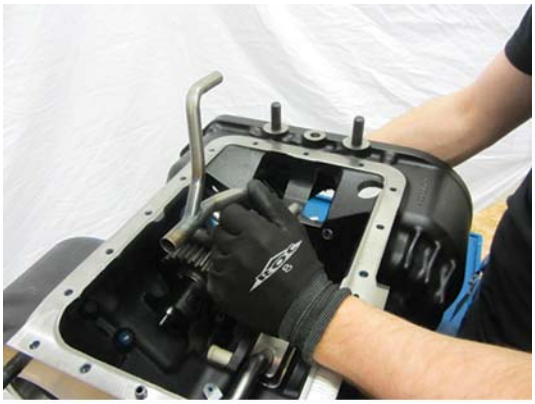
2. Install the short upper reverse idler tube onto the Reverse Idler Tube assembly.



3. Install the Suction Strainer into the transmission main case, push the tube into the oil pump until the tab is flush against the oil pump.

4. Install the Main Feed Tube into the transmission main case.

   Note: The tube needs to be rotated through the Shift Bar Housing opening while going through the intermediate wall, then rotated into place to line up with the oil pump.



5. Install the Reverse Idlers Feed Tube into the transmission main case.

6. With the Reverse Idler Feed Tube in place, bend the metal tab around the webbing at the 8-bolt PTO cover opening to secure the tube.

7. Connect the Reverse Idlers Feed Tube to the lower Reverse Idler.

8. Install the auxiliary Drive Gear Feed Tube into the transmission main case, connect the Reverse Idlers Feed Tube, Main Feed Tube and auxiliary Drive Gear Feed Tube together and install the retaining clip.

9. Install the cap screw that secures the Suction Strainer, Reverse Idlers Feed Tube and auxiliary Drive Gear Feed Tube together.

10. Install the two cap screws securing the Main Feed Tube to the transmission main case.

Main Case Gear Timing and Assembly

1. Using the “O” stamped onto the rear of the Main Case Counter Shafts, mark the corresponding tooth on the main drive gear set (front gear) with highly visible ink or dye.

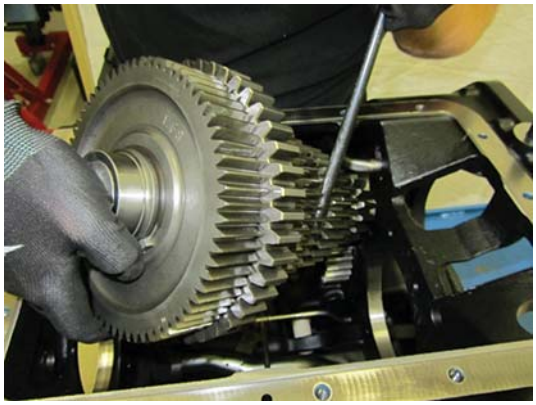
2. Mark two adjacent teeth on the main drive gear with highly visible ink or dye, then mark two more teeth 180 degrees apart.

   Note: There should be an equal number of teeth in between both marks, counting both directions around the gear.

Main Case Counter Shaft Installation

1. Using a J-Hook, install the lower Counter Shaft into the transmission main case.

   Note: Place the back of the lower Counter Shaft into the rear Counter Shaft bearing bore and carefully swing the Counter Shaft into place.



2. Using a J-Hook, install the upper Counter Shaft into the transmission main case.

   Note: Place the back of the upper Counter Shaft into the rear Counter Shaft bearing bore and carefully swing the Counter Shaft into place.

3. Place the Main Drive Gear on a bench and install the Input Shaft into the splines of the Main Drive Gear.

4. Install the snap ring that retains the Input Shaft to the Main Drive Gear. Place one corner of he snap ring in the main drive gear groove. With a small screwdriver, slowly work around the input shaft until the snap ring is fully seated.

5. Install the Input Shaft and Main Drive Gear as an assembly into the transmission main case.

   Note: Counter Shaft bearings must not be installed to complete the installation.

6. Install the Input Shaft Spacer on the Input Shaft.

7. Place the Input Shaft Bearing over the Input Shaft. Using the Input Shaft Bearing Driver, press the bearing onto the Input Shaft and into the transmission main case.

Note: Drive the bearing into the transmission main case and wiggle the Input Shaft assembly back out. Continue driving the bearing onto the Input Shaft. Repeat this process until there is enough room to install the Input Shaft snap ring.

8. Install the Input Shaft snap ring.

9. Line up the marked tooth on the lower Counter Shaft with the two marked teeth on the main drive gear.

10. Using the rear Counter Shaft bearing driver, drive the rear bearing onto the lower Counter Shaft and into the intermediate wall of the transmission main case until there is enough room to install the rear Counter Shaft bearing snap ring.

11. Install the rear lower Counter Shaft bearing snap ring.

12. Install the front lower Counter Shaft bearing onto the Counter Shaft and into the bore of the transmission main case.

Note: Using an old race for the front Counter Shaft bearings helps keep the rollers in place during installation.

13. Install the front lower Counter Shaft bearing retaining washer and bolt and torque to 90–120 lb-ft.

14. Place the upper reverse idler on top of the lower Counter Shaft; tuck it as close to the side of the case as possible.

15. Using a J-Hook, install the Main Shaft Assembly into the transmission main case by placing the rear of the Main Shaft through the opening in the intermediate wall and lowering the front of the Main Shaft into place. Pull the Main Shaft forward and pilot the tip into the Input Shaft bushing.

Note: Reverse gear needs to be tucked into first gear (over the 1st–Reverse sliding clutch) during installation to ensure adequate room to position the Main Shaft.

Caution: The front sliding clutch (4th–5th) can slide off the Main Shaft during installation.

16. Install the rear Main Shaft bearing partially into the case to aid in supporting the Main Shaft assembly.

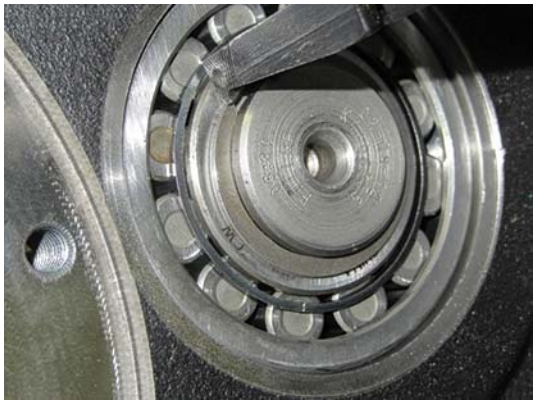
Note: Ensure the Reverse gear remains tucked against 1st gear.

17. Line up the marked tooth on the upper Counter Shaft with the two marked teeth on the main drive gear.

Note: Ensure the lower Counter Shaft is still in time with the main drive gear before moving the upper Counter Shaft into place.

18. Using the rear Counter Shaft bearing driver, drive the rear bearing onto the upper Counter Shaft and into the intermediate wall of the transmission main case until there is enough room to install the rear Counter Shaft bearing snap ring.

19. Install the rear upper Counter Shaft bearing snap ring.

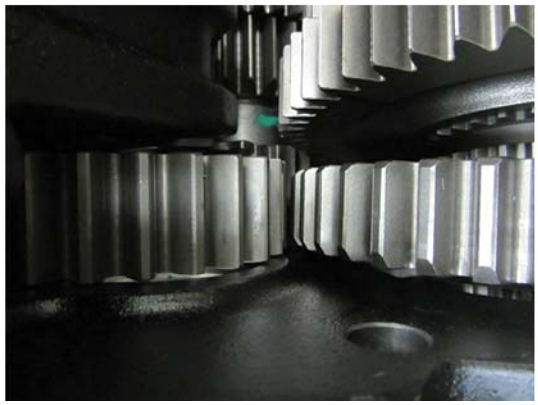


20. Install the front upper Counter Shaft bearing onto the Counter Shaft and into the bore of the transmission main case.

Note: Using an old race for the front Counter Shaft bearings helps keep the rollers in place during installation.

21. Install the front lower Counter Shaft bearing retaining washer and bolt and torque to 90–120 lb-ft.

22. Place the eccentric washer over the upper reverse idler shaft. Pilot the shaft into the reverse idler gear leaving room to slip the front thrust washer into place.



23. Thread a 5/8-18" x 2" bolt into the back of the upper Reverse Idler Shaft. Using a hand maul and soft bar, drive the Reverse Idler Shaft into the bore until there is enough room to install the spiral snap ring on the front of the shaft.

Note: The cap screw fastening the front Counter Shaft bearing retainers to the Counter Shaft is the same size and thread pitch needed for the reverse idler bore.

24. Install a new spiral lock retainer on the upper Reverse Idler Shaft.

25. Remove the rear Main Shaft bearing and pull the Reverse gear back into place in between the two reverse idlers. Ensure the reverse gear is pulled as far to the rear of the case as possible.

Note: Placing a hand maul in between the 1st and Reverse gear will assist in keeping the reverse gear in position.

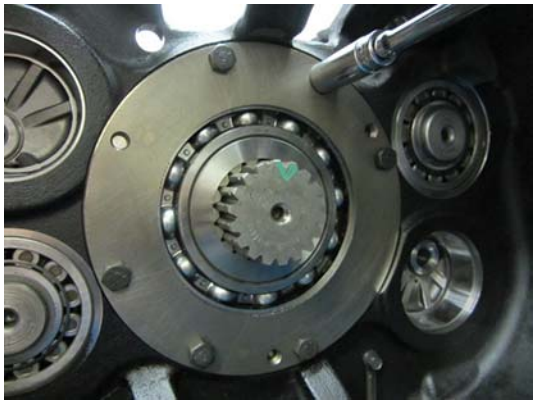
26. Install the keyed washer into the Reverse gear.

27. Install the Reverse gear snap ring, place one corner into the groove in the gear and, using two small screwdrivers, pry it into place working slowly around the Main Shaft unit the snap ring is fully seated.

28. Install the rear Main Shaft bearing onto the Main Shaft. Using a plastic hammer or hammer and brass drift, drive the bearing into the bore of the intermediate wall.

Note: The rear Main Shaft bearing is splined and has a double open tooth area that goes over the key of the Main Shaft, similar to the Main Shaft sliding clutches.

29. Install the rear Main Shaft bearing retaining plate and cap screws; torque the six cap screws to 35–45 lb-ft.



30. Install the auxiliary drive gear onto the transmission main case Main Shaft.

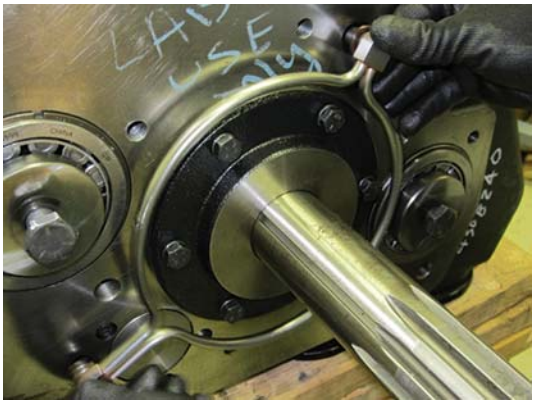
31. Install the auxiliary gear drive snap ring.

Note: If the snap ring will not fit into the groove verify that the Main Shaft is pulled to the rear of the transmission.

32. Install both upper and lower auxiliary Counter Shaft front bearing races into the transmission main case intermediate wall.

33. Install the Reverse Idler Feed Tube and metal clip.

34. Install the oiling system halo through the bores in the front of the transmission main case until all o-rings are fully seated.



35. Install the Front Bearing Cover and gasket.

Important: Confirm the oil return path from the Front Bearing Cover and the gasket return port are aligned.

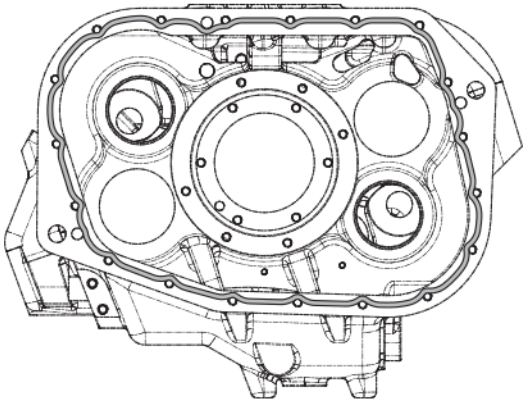
36. Install the six cap screws that fasten the Front Bearing Cover to the transmission main case. Torque the cap screws to 35–45 lb-ft.

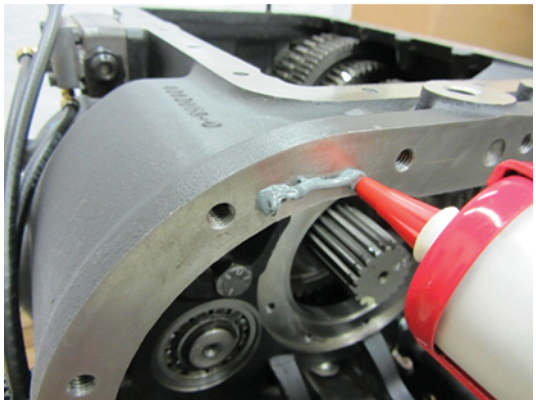
Auxiliary Section Installation

1. Ensure that the auxiliary Counter Shaft support straps are still installed and all three cap screws are snug.

2. Apply Loctite 5810A RTV or anaerobic 5188 sealant to the auxiliary case to main case joint, using an 1/8" bead apply the sealant inward of all cap screws holes.

   Note: Follow the pattern in the image below. Parts must be assembled within 30 minutes of applying sealant. The area must be clean of contaminants, ensure surfaces are adequately prepped.





3. Using an overhead crane, lift the auxiliary case assembly and line up the two holes in the auxiliary case with the transmission main case alignment pins. Push the case forward toward the transmission main case.

   Note: Verify the auxiliary counter shafts are still timed to the auxiliary reduction gear before installing. This will allow for easier installation and timing to the auxiliary drive gear.

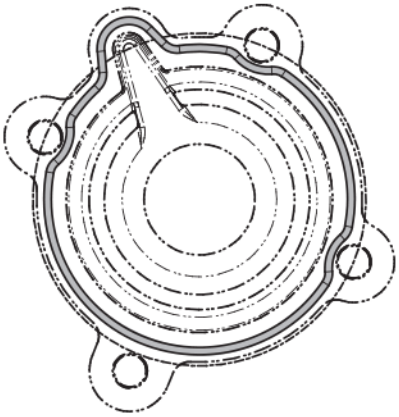
4. Once the auxiliary case is pushed as far into the transmission main case as possible, remove the auxiliary section lifting bracket. Loosen the auxiliary Counter Shaft support strap cap screws and fully seat the auxiliary case to the transmission main case.

   Note: Fully seating the auxiliary section to the transmission main case should take light force; do not draw it in with bolts. If the auxiliary section will not come flush with the transmission main case, a timing issue with the auxiliary section gearing may be the cause.

5. Install the 19 cap screws that fasten the auxiliary section to the transmission main case. Torque bolts to 35–45 lb-ft.

6. Install required shim into rear auxiliary Counter Shaft bearing bore. Apply to the Counter Shaft bearing cover position on the auxiliary case and install cover. Torque cap screws to 30–35 lb-ft.

Note: Follow the pattern in the image below. Parts must be assembled within 30 minutes of applying sealant. The area must be clean of contaminants, ensure surfaces are adequately prepped.

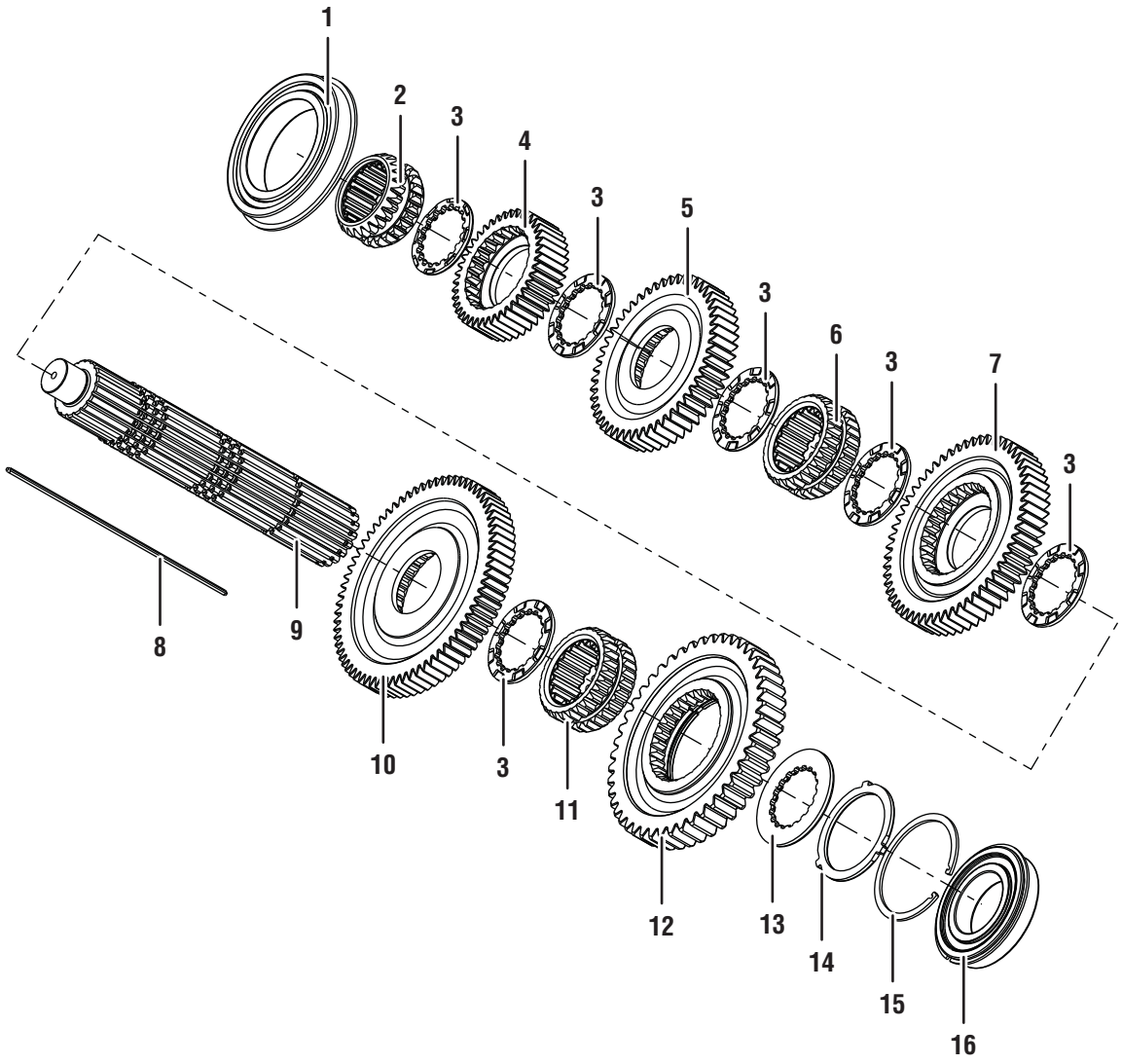


Main Case Main Shaft Disassembly

Special Instructions
None

Special Tools
None

Component Identification



1. Input Bearing
2. 4/5 Sliding Clutch
3. Main Shaft Washers (x6)
4. 5th Gear
5. 3rd Gear
6. 2/3 Sliding Clutch
7. 2nd Gear
8. Main Shaft Key
9. Main Shaft
10. 1st Gear
11. 1/R Sliding Clutch
12. Reverse Gear
13. Washer
14. Spacer
15. Snap Ring
16. Auxiliary Bearing

Main Case Main Shaft Disassembly

1. Remove the front (4th and 5th gear) sliding clutch from the Main Shaft

2. From the rear of the Main Shaft, remove the key from the Main Shaft keyway.

   Note: When removing no-burn washers or spacers, note their location on the Main Shaft to facilitate reassembly. Keep each washer with the corresponding gear it was mated against.

3. Remove the rear spacer from the Main Shaft.

4. Remove the Reverse gear from the Main Shaft.

5. Remove the 1st–Reverse gear sliding clutch from the Main Shaft.

6. Remove the 1st no-burn washer and 1st gear from the Main Shaft.

7. Remove the 2nd no-burn washer from the Main Shaft.

8. Remove 2nd gear from the Main Shaft.

9. Remove the 3rd no-burn washer from the Main Shaft.

10. Remove the 2nd–3rd gear sliding Clutch.

11. Remove the 4th no-burn washer and 3rd gear.

12. Remove the 5th no-burn washer from the Main Shaft.

13. Remove 4th gear (5th for direct drive) from the Main Shaft.

14. Remove the last no-burn washer from the Main Shaft.

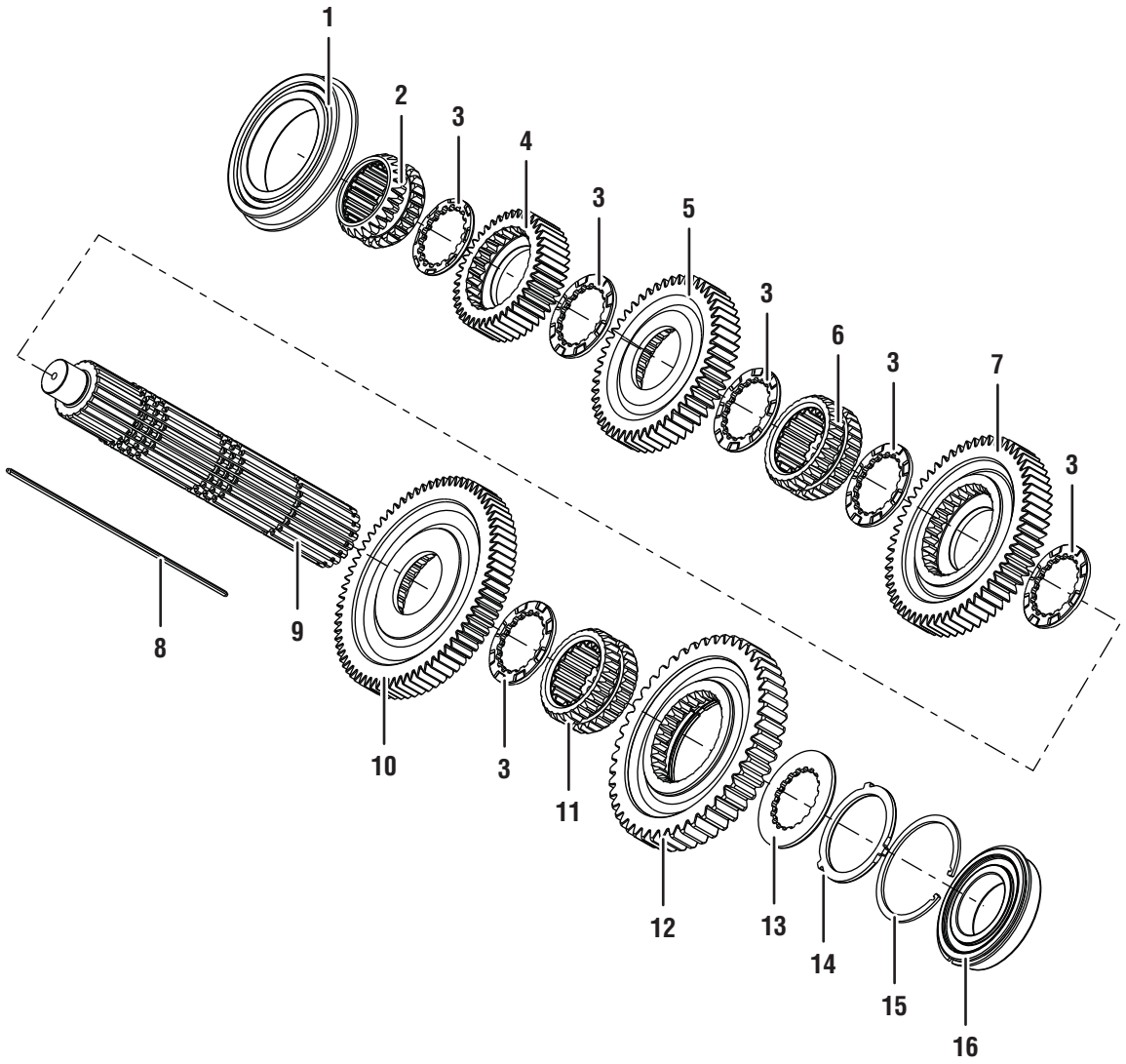
Note: The last or furthest forward no-burn washer is smaller than the rest. This is specific for the front of the Main Shaft as the 4th–5th gear sliding clutch is smaller than the 1st–Reverse and 2nd–3rd gear sliding clutches.

Main Case Main Shaft Assembly

Special Instructions
None

Special Tools
None

Component Identification

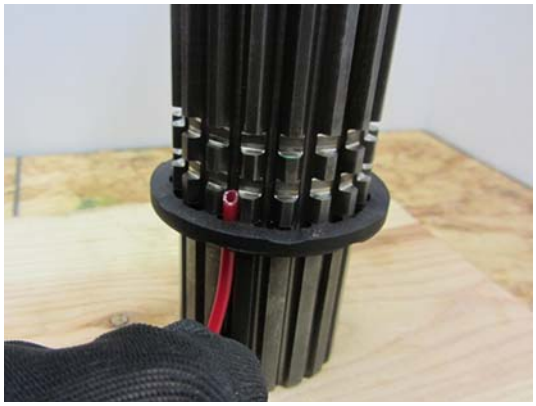


1. Input Bearing
2. 4/5 Sliding Clutch
3. Main Shaft Washers (x6)
4. 5th Gear
5. 3rd Gear
6. 2/3 Sliding Clutch
7. 2nd Gear
8. Main Shaft Key
9. Main Shaft
10. 1st Gear
11. 1/R Sliding Clutch
12. Reverse Gear
13. Washer
14. Spacer
15. Snap Ring
16. Auxiliary Bearing

Main Case Main Shaft Assembly

1. Place the main shaft vertical and hold the noise in a vise or a pilot hole in a piece of wood.

2. Install the first no-burn washer which is the smaller one.
3. Use a piece of 5/32" air line to push up through the key way groove to lock the no-burn washers in place as the main shaft is built.

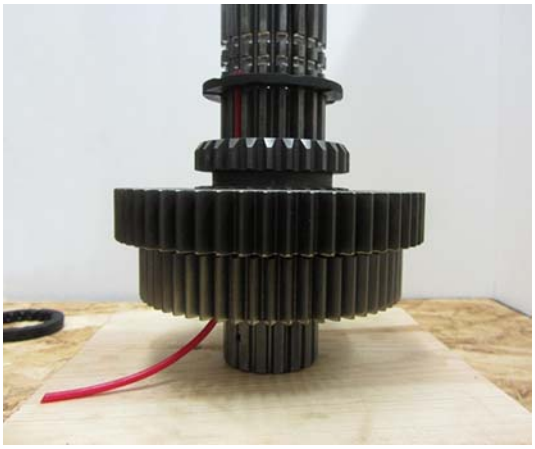


4. Install the overdrive gear or direct drive gear (depending on the model of the transmission) and the no-burn washer. Rotate the washer and push the air line through.

5. Install the 3rd gear and no-burn washer. Rotate the no-burn washer and push the air line through.

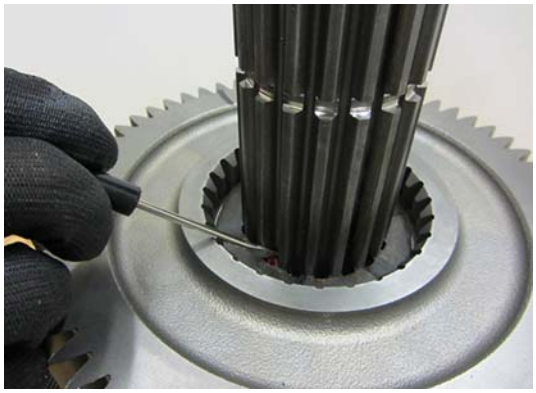
6. Install the 2nd/3rd sliding clutch. Make sure the wide slot on the sliding clutch aligns with the keyway.

7. Install the no-burn washer. Rotate the no-burn washer and push the air line through.



8. Install 2nd gear and the no-burn washer. Rotate the no-burn washer and push the air line through.

9. Install the low gear and no-burn washer. Rotate the no-burn washer and push the air line through.

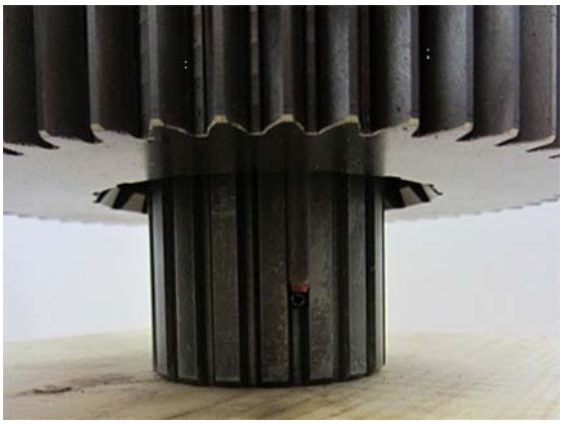


10. Install the low/reverse sliding clutch. Align the wide slot on the sliding clutch with the keyway.

11. Install the reverse gear on the main shaft and slide it over the sliding clutch with the snap ring groove facing rearward for installation.

12. Install the last no-burn washer. Rotate the washer and push the air line through.

13. Install the key and push the air line down through the main shaft until it contacts the roll pin.



14. Remove the main shaft assembly from the holding device. Flip the main shaft up and install the direct/overdrive sliding clutch with the wide slot aligned with the keyway.

Reverse Switch Testing, Removal and Installation

Special Instructions

The Reverse Switch is a normally open ball switch. When the Transmission is shifted into reverse, a ramp on the Reverse Shift Yoke contacts and raises a pin. The pin depresses the ball on the switch, which closes the switch contact, allowing current to flow through the switch and light up the vehicle backup lights.

Special Tools

None

Component Identification

1. Reverse Switch
2. Gasket
3. Actuating Pin

Reverse Switch Testing, Removal and Installation

Testing

1. Disconnect the wiring from the switch by lifting the Connector Locking Tab and pulling the connector out of the Switch.
2. Connect an ohm meter to test for continuity.
3. Place the transmission Shift Lever in any position except reverse. If the switch is working properly, the ohm meter should read open or infinity. If it is not, remove the switch and recheck it for continuity. Replace as necessary.
4. Place the transmission Shift Lever in the reverse position. If the switch is working properly, the ohm meter should register continuity or a small reading. If it does not, remove the switch and recheck it for continuity. Replace as necessary. Also, check for the presence of the Reverse Pin.

Removal

1. Disconnect the OEM wiring. Remove the Reverse Switch using a 22 mm or 7/8" deep well socket or box end wrench.
2. Check for the presence of the Reverse Pin in the bore under the switch.
3. While watching the Reverse Pin, move the transmission Shifter between the reverse position and any gear. The pin should raise when the transmission is shifted to reverse and lower when the transmission is in Neutral. If the pin does not raise and lower, inspect it to see if something is causing it to stick, and inspect it for wear. Also, remove the Shift Tower and check for wear on the Reverse Yoke Ramp. This ramp can be seen through the Shifter opening.
4. Remove the pin from the bore with a magnet and check it for excessive wear. If it is worn, replace it.

Installation

1. Insert the Reverse Pin in the Reverse Switch bore. (The Reverse Pin is longer than the Neutral Pin.)
2. Install the gasket on the Switch.
3. Install the Reverse Switch. Torque to 15–20 lb-ft (20–27 N•m).
4. Connect the OEM Wiring Connector, making sure the Locking Tab engages properly.

Neutral Switch Testing, Removal and Installation

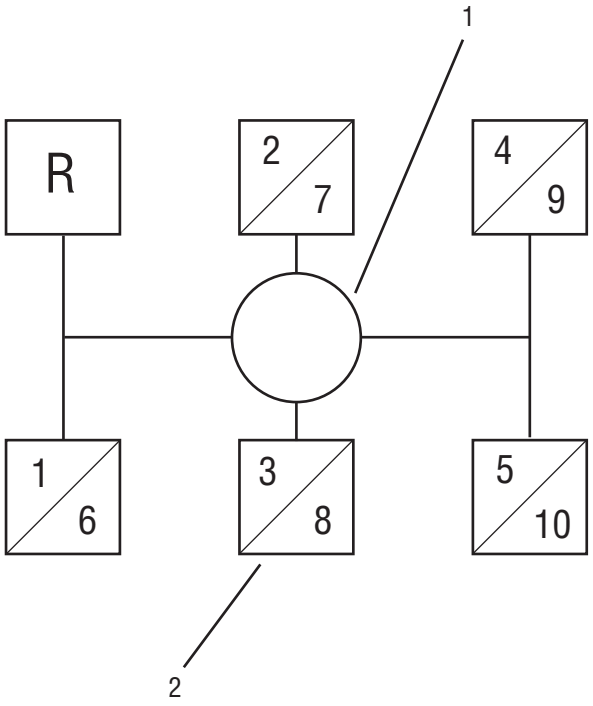
Special Instructions

The Neutral Switch is a normally closed switch. An electrical current flows through it when the Transmission Shifter is in the center Neutral position. When the Transmission Shifter is in gear or a side Neutral position, the switch is open and no current flows through it

Special Tools

None

Component Identification



1. Center Neutral Position (Neutral Switch Active)
2. Shift Position Diagram

Neutral Switch Testing, Removal and Installation

Testing

1. Disconnect the wiring from the switch by lifting the Connector Locking Tab and pulling the Connector out of the Switch.
2. Connect an ohm meter to check for continuity or a small reading.
3. Place the transmission Shift Lever in the center Neutral position. The ohm meter should register continuity or a small reading. If it does, go to the next step. If it does not, remove the switch and replace it according to the removal instructions below.
4. Shift the transmission into all gear positions. The ohm meter should read open or infinity. If it does not, remove the switch, recheck it for continuity and replace it as necessary. Also, check for the presence of the Neutral Switch Pin.

Removal

Note: If the Ohm Meter responds as indicated in the test procedure, do not perform this procedure as the Switch is in good working condition.

1. Remove the Switch using a 22 mm or 7/8" deep well socket or box end wrench.
2. Check for the presence of the Neutral Pin in the bore under the Switch.
3. While watching the Neutral Pin, move the Transmission in and out of gear. The Pin should raise up when the Transmission is in gear and lower when the transmission is in Neutral. If the Pin does not operate properly, remove the Pin with a magnet and check it for wear. If necessary, remove the Shift Bar Housing and check the Shift Shaft for wear.
4. Remove the Pin from the bore with a magnet and check it for excessive wear. If it is worn, replace it.
5. If the Pin is present and not worn, replace the switch with a new one.

Installation

1. Insert the Neutral Pin in the Neutral switch bore. (The Neutral Pin is shorter than the Reverse Pin.)
2. Lubricate the o-ring on the switch.
3. Install the Neutral Switch. Torque to 15–20 lb-ft (20–27 N•m).
4. Connect the Wiring Connector to the switch, making sure the Locking Tab engages properly.

General Troubleshooting

The chart on the following pages contains some of the most common problems that may occur with this transmission along with the most common causes and solutions.

Complaint	Cause	What to Do Next
Noise: Growl/Rumble	Torsional Vibration. [Noise may be most pronounced when Transmission is in a “float” (low torque) condition. May also be confined to a particular vehicle speed.]	Check driveline angles for proper U-joint working angles. Check driveline for out of balance or damage. Check U-joints for proper phasing. Check Clutch Assembly for broken damper springs. Check for inadequate clutch disc damping.
	Transmission bearing or gear failure. [Noise may be most pronounced under hard pull or coast (high torque).]	Check transmission oil for excessive metal particles.
Noise: Growl/Rumble at Idle (Idle Gear Rattle)	Excess engine torsional vibration at idle.	Check for low engine RPM. Check for uneven engine cylinder performance. Check for proper clutch damper operation.
Noise: High-Pitched Whine	Gear noise. Isolate as to axle or transmission noise. If transmission, isolate to specific gear or gears.	Check for worn or defective shift lever isolator. Check for direct cab or bracket contact with transmission (“grounding”). Check for proper driveline U-joint working angles. Check for damaged or worn gearing.

Complaint	Cause	What to Do Next
Hard Lever Shifting (Shift Lever is hard to gear into or out of gear)	Master clutch dragging.	Check driveline angles for proper U-joint working angles. Check driveline for out of balance or damage. Check U-joints for proper phasing. Check clutch assembly for broken damper springs. Check for inadequate clutch disc damping.
	Shift linkage problem (remote shifter).	Check shift linkage or cables for proper adjustment, binding, lubrication or wear.
	Shift Bar Housing problem.	Check Shift Bar Housing components for binding, wear or damage.
	Transmission Main Shaft problem.	Check mainshaft for twist. Check sliding clutches for binding, damage, or excessive wear.
	Driver technique.	Driver not familiar or skilled with proper double-clutching technique. Driver contacting the clutch brake during shifts.
Shift Lever Jumpout (Shift Lever comes out of gear on rough roads)	Loose or worn engine mounts.	Check engine mounts for damage, wear or excessive looseness.
	Shift lever problem.	Check shift lever floor boot for binding or stretching. Check shift lever isolator for excessive looseness or wear. Check for excessive offset or overhang on the shift lever. Check for extra equipment or extra weight added to shift lever or knob.
	Worn or broke detent spring or mechanism.	Check for broken detent spring. Check for excessive wear on the detent key of detent plunger. Replace detent spring with heavier spring or add additional spring.
Shift Lever Slip-out (Transmission comes out of gear under torque)	Internal transmission problem.	Check for excessively worn or damaged sliding clutches or shift yokes.
Transmission Goes into Neutral (Shift lever doesn't move)	Low air pressure.	Check air regulator pressure.
	Internal transmission problem.	Check for excessively worn or damaged range sliding clutch or yoke.

Complaint	Cause	What to Do Next
No Range Shift or Slow Range Shift (Also see “Air System Troubleshooting”)	Transmission air system problem.	Perform air system troubleshooting procedure. Check for proper air signal from master valve. Check air module test ports for proper air delivery.
	Range cylinder problem.	Check for failed or damaged range piston, piston bar or cylinder. Check for failed or loose range piston snap ring.
	Range yoke assembly problem.	Check for failed or damaged range yoke. Check for failed or loose range yoke snap rings. Check for excessively long fastener installed in rear support hole. Check for binding between range yoke bar and range alignment lock cover.
	Range synchronizer problem.	Check for failed or damaged Range Synchronizer, Sliding Clutch, or Mating Gear. Check for excessively worn Range Synchronizer Friction Material.
Grinding Noise on Range Shift	Driver not preselecting range shift.	Instruct driver to preselect range shifts.
	Range synchronizer worn or defective.	Check range synchronizer and mating parts for excessive wear or damage.

Tool Specifications

Some repair procedures pictured in this manual show the use of specialized tools. Their actual use is recommended as they make transmission repair easier and faster and prevent costly damage to critical parts. For the most part, ordinary mechanic's tools such as socket wrenches, screwdrivers, etc., and other standard shop items such as a press, mauls and soft bars are the only tools needed to successfully disassemble and reassemble any Eaton® Fuller® transmission.

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

General Tools

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

Tool	Purpose
0–100 lb-ft (0–135 N•m) 1/2" (12.7 mm) drive Torque Wrench	General torquing of fasteners [typically 15–80 lb-ft (20–108 N•m)].
0–50 lb-in (0–5.62 N•m) 3/8" (9.52 mm) drive Torque Wrench	General torquing of fasteners.
0–30 lb-in 1/4" drive Torque Wrench	Torquing of cap screws to 7 lb-in during auxiliary Counter Shaft bearing endplay setting procedure.
Large Brass Drift 3/4" x 12" (19 mm x 304.8 mm)	Protect shafts and bearings during removal.
Large Dead Blow Hammer or Maul 32 ounces	Provide force for shaft and bearing removal.
2 Air Pressure Gauges 0–150 PSI (0–10.34 BAR)	Troubleshoot and verify correct operation of air system.
Snap Ring Pliers—Large Standard External	Remove the snap rings at auxiliary drive gear, Input Shaft bearing and Counter Shaft bearings.
Feeler Gauges	Set Main Shaft washer endplay and auxiliary tapered bearing endplay.
Rolling Head (Crow's Foot) Prybar	Remove the auxiliary drive gear bearing.
Universal Bushing Driver	Remove and install clutch housing bushings. Bushing OD = 1.125", ID = 1.000".

Special Tools

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

Roadranger Tool Number	Tool	Purpose
	Output Yoke Puller	May be required to remove a rusted output yoke.
RR1006TR	Auxiliary Section Hanger	Support, or hang, the auxiliary section in the horizontal position.
RR1007TR	Auxiliary Counter Shaft Support and Shim Tool	Hold the auxiliary Counter Shafts in position while installing the auxiliary section in the horizontal position, also to simplify the checking and setting of the auxiliary Counter Shaft bearing endplay.
	Shift Lever Spring Installation Tool (Tension Spring Driver)	Install the shift tower tension spring.
RR1010TR	Slide Hammer	Remove the output seal and reverse idler shafts. Requires 1/2"-13 threads. (Optional: idler shaft can be driven out from front.)
RR1012TR-3	Bearing Puller	Remove front section Counter Shaft bearings.
RR1012TR-2	Bearing Driver	Install front section Counter Shaft bearings
RR1012TR-4	Bearing Driver	Install the front Counter Shaft rear bearings
RR1002TR	Counter Shaft Support Tools (2)	Support and locate the front section Counter Shafts during bearing removal and installation.
RR1005TR	Input Bearing Driver	Install input bearing on Input Shaft.
RR1012TR-5	Bearing Driver	Install the auxiliary Counter Shaft tapered bearings.
RR1004TR	Main Shaft Hook	Assist in lifting of Main shaft from front section.
RR1023TR	Input Bearing Puller	Remove input bearing.
RR1011TR	Bearing Race Puller	Remove the auxiliary Counter Shaft tapered bearing outer races
RR1001TR	Output Seal Driver	Install output seal.
RR1001TR-1	Output Seal Slinger Driver	Install output seal slinger.

Eaton® Aftermarket Parts

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

Eaton Tool Number	Tool	Purpose
4301157 included in kit K-2394	5/32" Air Line Release Tool	Remove 5/32" air lines from push-to-connect fittings.
4301158 included in kit K-2394	Air Line Cutting Tool	Cut plastic air lines smoothly and squarely.

Special Tools Manufacturer

Below is the address and phone number of the company that makes tools specifically for Eaton® Fuller® transmissions:

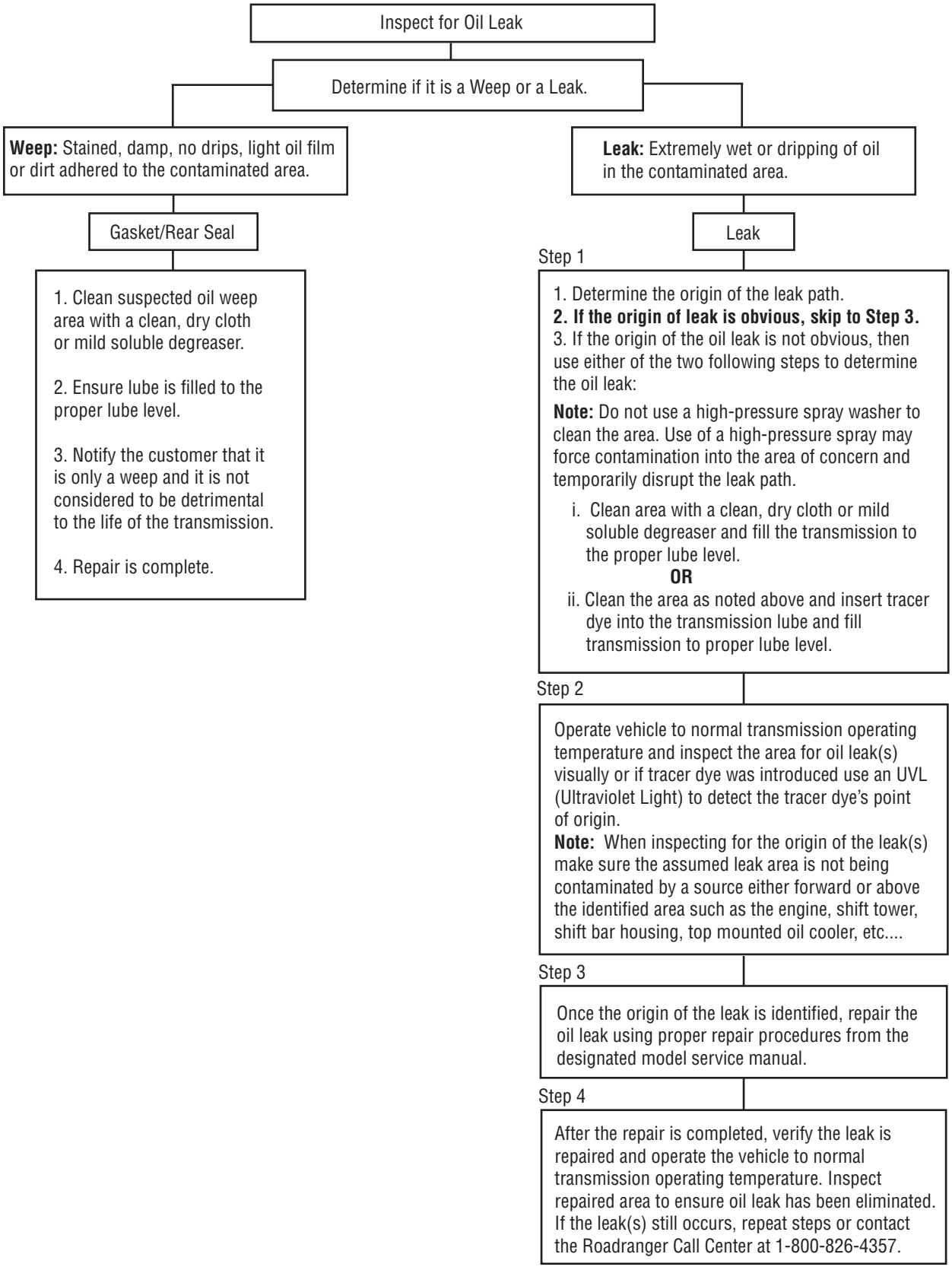
K-Line Tools
315 Garden Ave.
Holland, MI 49424
800-824-5546
www.klineind.com

Shop Equipment

The following tool will be needed to complete the removal and installation of the Eaton® Fuller® transmission.

- 20-ton capacity press

Oil Leak Inspection Process



Inspection Procedure

Before reassembling the transmission, check each part carefully for abnormal wear, excessive wear or damage to determine if the part is suitable for reuse. When replacement is necessary, use only genuine Eaton® Fuller® Transmission parts to assure continued performance and extended life from your unit.

Since the cost of a new part is generally a small fraction of the total cost of downtime and labor, avoid reusing a questionable part. This could lead to additional repairs and expense soon after assembly. Consideration should also be given to the history of the unit, mileage, application, etc., when determining the reuse or replacement of any transmission part.

Bearings

- Wash all bearings in clean solvent. Check balls, rollers and raceways for pitting, discoloration and spalled areas.
- Replace bearings that are pitted, discolored, spalled or damaged during disassembly
- Lubricate bearings that are not pitted, discolored or spalled and check for axial and radial clearances.
- Replace bearings with excessive clearances.
- Check bearing fit. Bearing inner races should be tight to shaft; outer races slightly tight to slightly loose in case bore. If the bearing spins freely in the bore, the case should be replaced.

Bearing Covers

- Check covers for wear from thrust of adjacent bearing. Replace covers damaged from thrust of bearing outer race.
- Check cover bores for wear. Replace those worn or oversized.

Clutch Release Parts

- Replace yokes worn at cam surfaces and bearing carrier worn at contact pads.
- Check pedal shafts. Replace those worn at bushing surfaces.

Gears

- Check gear teeth for frosting and pitting. Frosting of gear teeth faces presents no threat of transmission failure. Often in continued operation of the unit, frosted gears “heal” and do not progress to the pitting stage. In most cases, gears with light to moderate pitted teeth have considerable gear life remaining and can be reused, but gears in the advanced stage of pitting should be replaced.
- Check gears with clutching teeth abnormally worn, tapered or reduced in length from clashing during shifting. Replace gears found in any of these conditions.
- Check axial clearance of gears.

Gear Shift Lever Housing Assembly

- Check spring tension on Shift Lever. Replace tension spring if lever moves too freely. If housing is disassembled, check the Gear Shift Lever bottom end and shift finger assembly for wear.
- Replace both gears if excessively worn.

Gray Iron Parts

- Check all gray iron parts for cracks and breaks.
- Replace damaged parts.

Oil Return Threads and Seals

- Check oil return threads on the Input Shaft. If return action of threads has been destroyed, replace the Input Shaft.
- Check oil seal in rear bearing cover. If sealing action of lip has been destroyed, replace seal.

O-Rings

- Check all o-rings for cracks or distortion. Replace if worn.

Reverse Idler Gear Assemblies

- Check for excessive wear from action of roller bearings.

Shift Bar Housing Assembly

- Check for wear on shift yokes and block at pads and lever slot. Replace excessively worn parts.
- Check yokes for correct alignment. Replace sprung yokes.
- If housing has been disassembled, check shift shaft and all related parts for wear.

Sliding Clutches

- Check all shift yokes and yoke slots in sliding clutches for extreme wear or discoloration from heat.
- Check engaging teeth of sliding clutches for partial engagement pattern.

Splines

- Check splines on all shafts for abnormal wear. If sliding clutch gears, companion flange or clutch hub has wear marks in the spline sides, replace the specific shaft affected.

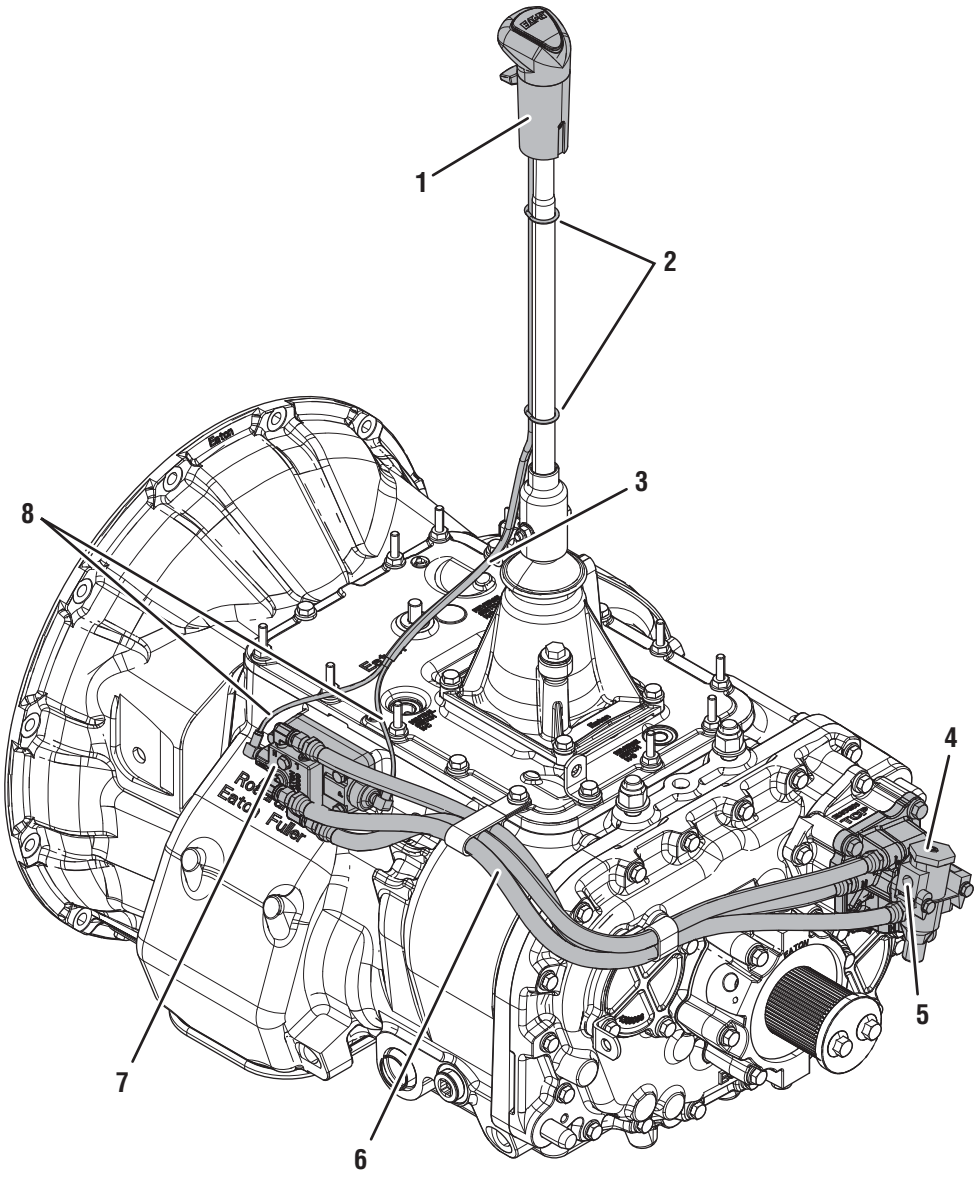
Synchronizer Assembly

- Check synchronizer for burrs, uneven and excessive wear at contact surface, and metal particles.
- Check blocker pins for excessive wear or looseness.
- Check synchronizer contact surfaces on the synchronizer cups for wear.

Washers

- Check surfaces of all washers. Washers scored or reduced in thickness should be replaced.

Air System Overview and Basic Troubleshooting



1. Roadranger Valve
2. O-Rings
3. Sheathing
4. Air Filter/Regulator
5.Air Inlet Port (OEM Supplied)
6. 1/4" I.D. Air Lines
7. Slave Valve
8. 1/8" O.D. Air Lines

The Range Shift Air System consists of the Air Filter Regulator, Slave Valve, Roadranger® Valve, Range Cylinder, fittings and connecting air lines. See Air System Schematics.

Constant air from the Air Filter Regulator is supplied to the "S" or Supply Port of the Slave Valve and passed through to the inlet or "S" Port of the Roadranger Valve.

While in Low Range

The Roadranger Valve is open and air is returned to the Slave Valve at the "P" or End Port. This signals the valve to supply air in line between the Low Range or "L" Port of the Slave Valve and the Low Range Port of the range cylinder housing. Air received at this port moves the range piston to the rear and causes the auxiliary low range gear to become engaged.

While in High Range

The Roadranger Valve is closed and air is not returned to the Slave Valve. This signals the Slave Valve to supply air in line between the High Range or "H" Port of the valve and the High Range Port of the range cylinder cover. Air received at this port moves the range piston forward to engage the auxiliary drive gear with the sliding clutch and bypass the low range gear set.

Range shifts can be made *only* when the Gear Shift Lever is in, or passing through, Neutral. Thus, the range desired can be *preselected* while the Shift Lever is in a gear position. As the lever is moved through Neutral, the actuating plunger in the Shift Bar Housing releases the Slave Valve Piston, allowing it to move to the selected range position.

Basic Troubleshooting

If the transmission fails to make a range shift or shifts too slowly, the fault may be in the Range Shift Air System or actuating components of the Shift Bar Housing assembly Slave Valve on the side of the transmission.

To locate the trouble, the following checks should be made with normal vehicle air pressure applied to the system, but with the engine off.

Caution: Never work under the vehicle while the engine is running as personal injury may result from the sudden or unintended movement of vehicle under power.

Incorrect Air Line Hook Ups

With the Gear Shift Lever in Neutral, move the control that provides range selection up and down.

1. If the air lines are crossed between the Range Valve and Slave Valve, there will be constant air flowing from the exhaust port of the Range Valve while in high range.
2. If the air lines are crossed between the Slave Valve and range cylinder, the transmission gearing will not correspond with the range selection. A low range selection will result in a high range engagement and vice versa.

Air Leaks

With the Gear Shift Lever in Neutral, coat all air lines and fittings with soapy water and check for leaks, moving the control that provides range selection up and down.

1. If there is a steady leak from the exhaust port of the Range Valve, o-rings and/or related parts of the Range Valve are defective.
2. If there is a steady leak from the breather of the Slave Valve, an o-ring in the valve is defective or there is a leak past o-rings of the range cylinder piston.
3. If the transmission fails to shift into low range or is slow to make the range shift and the case is pressurized, see the "Air Filter Regulator" section.
4. Tighten all loose connections and replace defective o-rings and parts.

Air Filter Regulator

With the Gear Shift Lever in Neutral, check the breather of the Air Filter Regulator assembly. There should be no air leaking from this port. The complete assembly should be replaced if a steady leak is found.

Cut off the vehicle air supply to the Air Filter Regulator assembly, disconnect the air line at the fitting in Supply Outlet and install an air gauge in the opened port. Bring the vehicle air pressure to normal. Regulated air pressure should be 57–63 PSI.

Important: Do not adjust screw at bottom of regulator to obtain correct readings. The Air Filter Regulator has been preadjusted within the correct operating limits.

Note: Any deviation from these limits, especially with regulators that have been in operation for some time, is likely to be caused by dirt or worn parts. Replace the complete assembly, as the air regulator is not serviceable and verify that the new Filter Regulator has the correct air pressure.

Roadranger Valve

With the Gear Shift Lever in Neutral, select high range and disconnect the 5/32" O.D. air line at the outlet or “P” Port of Roadranger valve.

1. When low range is selected, a steady blast of air will flow from the opened port. Select high range to shut off air flow. This indicates the Roadranger Valve is operating properly. Reconnect air line.
2. If the Roadranger Valve does not operate properly, check for restrictions and air leaks. Leaks indicate defective or worn o-rings.

High Range Operation

With the Gear Shift Lever in Neutral, select low range and disconnect the 1/4" I.D. air line at the port of range cylinder cover. Make sure this line leads from the High Range or “H” Port of the Slave Valve.

1. When high range is selected, a steady blast of air should flow from disconnected line. Select low range to shut off air flow.
2. Move the Shift Lever to a gear position and select high range. There should be no air flowing from disconnected line. Return the Gear Shift Lever to the Neutral position. There should now be a steady flow of air from disconnected line. Select low range to shut off air flow and reconnect air line.
3. If the air system does not operate accordingly, the Slave Valve or actuating components of the Shift Bar Housing assembly are defective.

Low Range Operation

With the Gear Shift Lever in Neutral, select high range and disconnect the 1/4" I.D. air line at the fitting on range cylinder housing. Make sure this line leads from the low range or “L” Port of the Slave Valve.

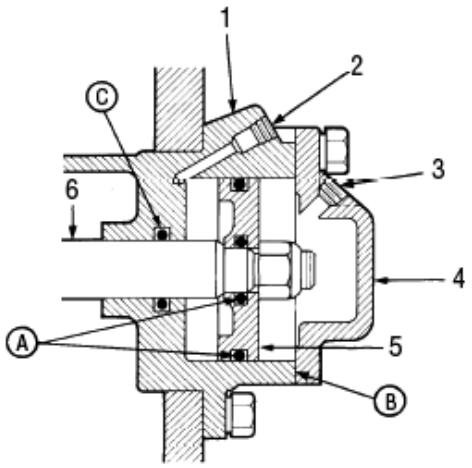
1. When low range is selected, a steady blast of air should flow from the disconnected line. Select high range to shut off air flow.
2. Move the Shift Lever to a gear position and select low range. There should be no air flowing from the disconnected line. Return the Gear Shift Lever to the Neutral position. There should now be a steady flow of air from the disconnected line. Select high range to shut off air flow and reconnect air line.
3. If the air system does not operate accordingly, the Slave Valve or actuating components of the Shift Bar Housing assembly are defective.

Range Cylinder

If any of the seals in the Range Cylinder assembly are defective, the range shift will be affected.

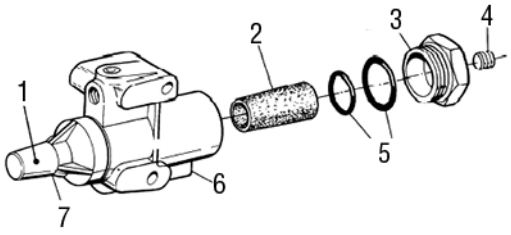
1. Leak at either “A” o-rings results in complete failure to make a range shift; steady flow of air from breather of the Slave Valve in both ranges.
2. Leak at “B” o-ring results in a steady flow of air to the atmosphere while in high range.
3. Leak at “C” o-ring results in a slow shift to low range and pressurizing of the transmission case.

Range Cylinder Assembly



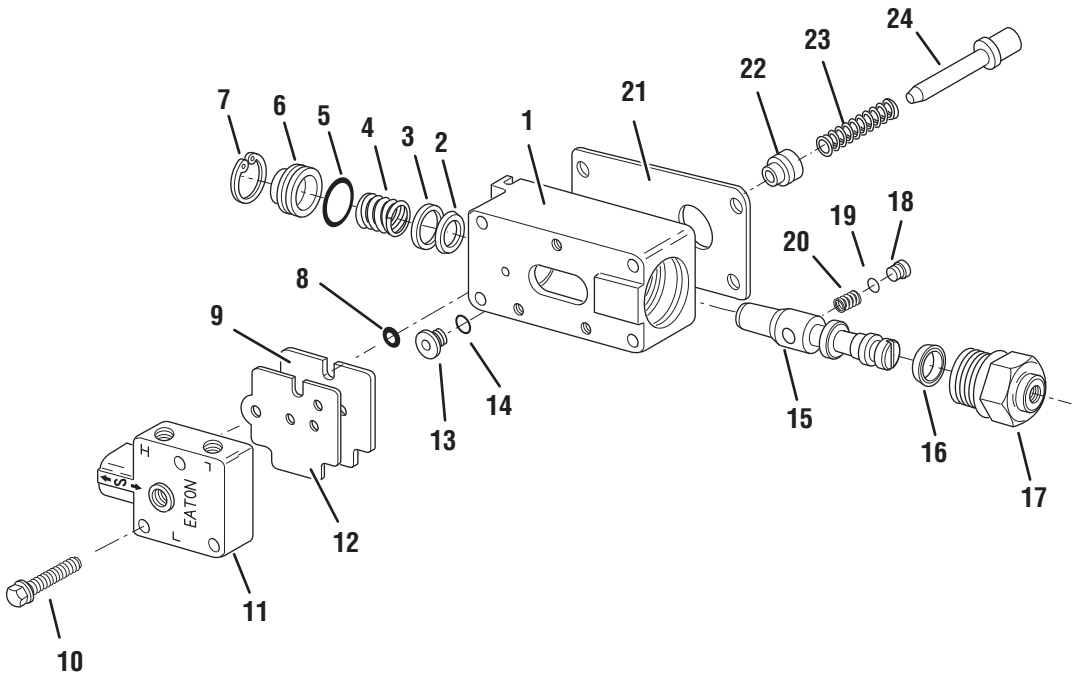
1. Housing
2. Low Range Air Port
3. High Range Air Port
4. Cover
5. Piston
6. Yoke Bar

Filter Assembly



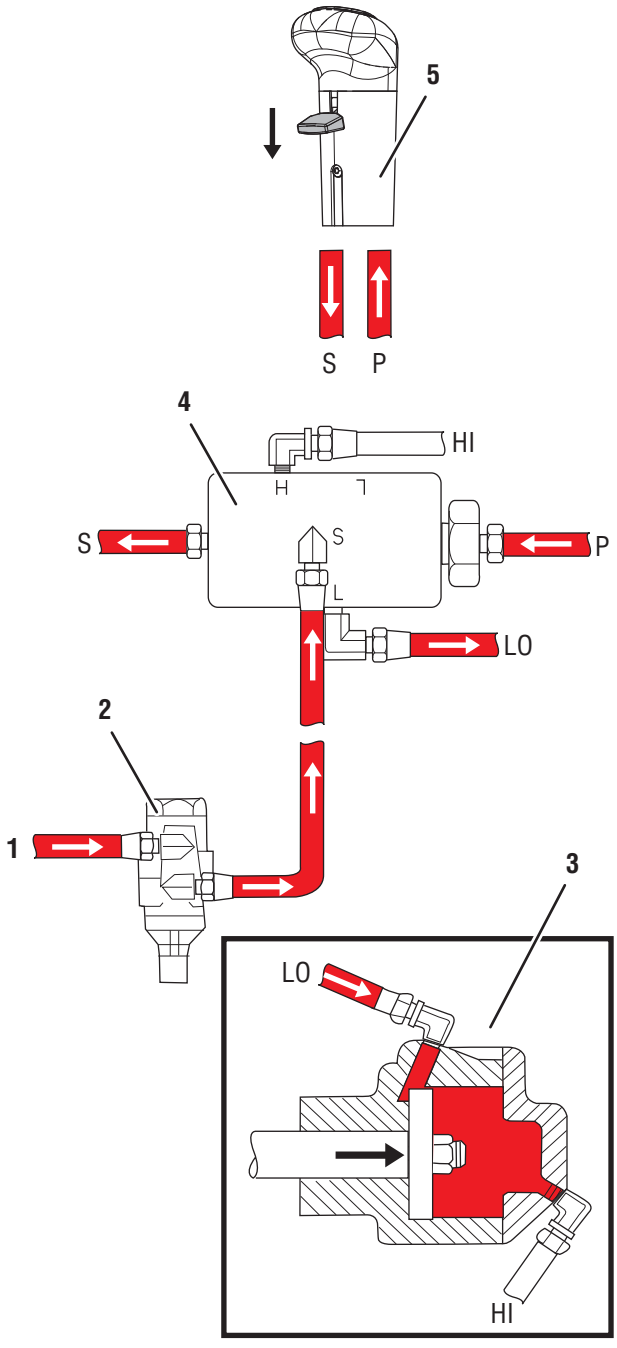
1. Breather Port
2. Filter Element
3. End Cap
4. Plug
5. O-Rings
6. Housing
7. Air Regulator

Slave Valve Assembly



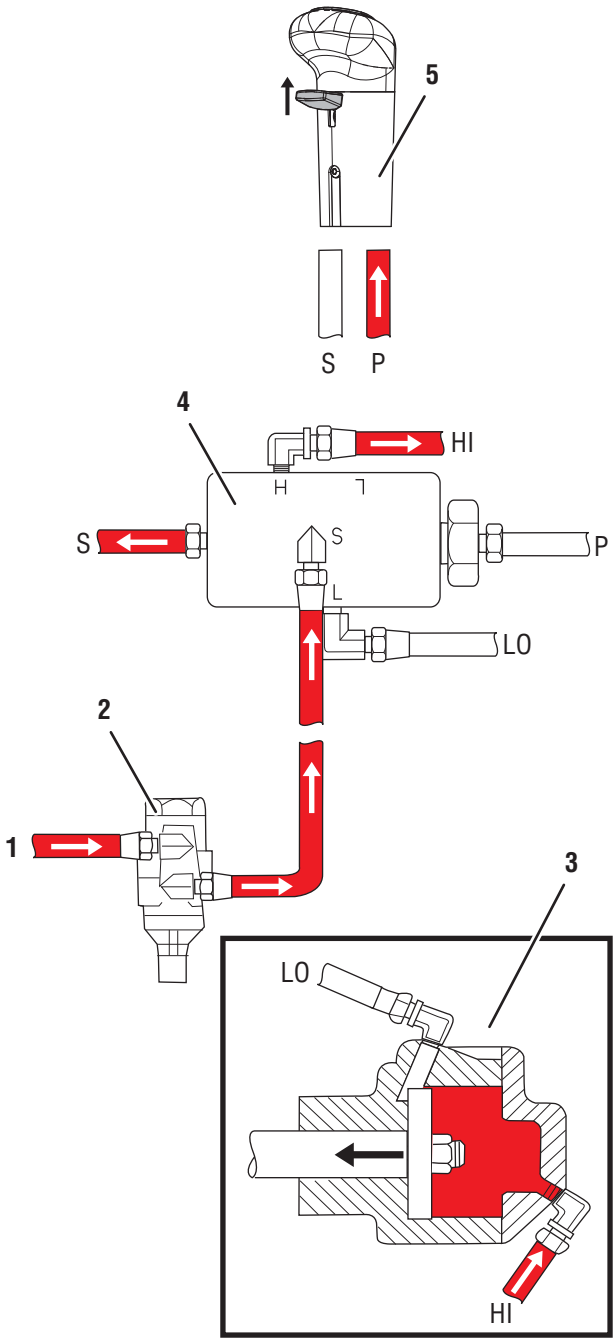
1. Slave Valve Assembly
2. U-seal
3. Washer
4. Spring
5. O-ring
6. Plug
7. Snap Ring
8. O-rings
9. Plate
10. Capscrew
11. Cap
12. Gasket
13. Seal
14. O-ring
15. Piston
16. U-seal
17. Cap
18. Seal
19. O-ring
20. Spring
21. Gasket
22. Sleeve
23. Spring
24. Plunger Pin

Fuller Advantage 10-Speed (2-Speed Auxiliary) LO Range



1. Air from vehicle source
2. Air Filter/Regulator
3. Range Cylinder
4. Slave Valve
5. Roadranger Valve

Fuller Advantage 10-Speed (2-Speed Auxiliary) HI Range



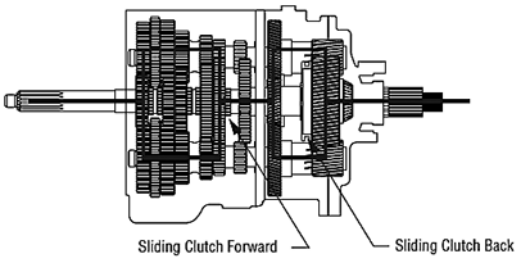
1. Air from vehicle source
2. Air Filter/Regulator
3. Range Cylinder
4. Slave Valve
5. Roadranger Valve

Power Flow

Front Section Power Flow

Note: The heavy lines in the image below outline the power flow description below.

1. Power (torque) from the engine is transferred to the transmission's Input Shaft.
2. The Input Shaft rotates the main drive gear through internal splines in the hub of the gear.
3. The main drive gear meshes with both Counter Shaft driven gears, and the torque is split between both Counter Shafts.
4. Because the Counter Shaft gears are in constant mesh with the Main Shaft gears, all the front section gearing rotates. However, only the engaged Main Shaft gear will have torque. External clutching teeth on the sliding clutch will engage internal clutching teeth on the selected Main Shaft gear. Torque will now be provided from both opposing Counter Shaft gears, into the engaged Main Shaft gear, and through the sliding clutch to the front section Main Shaft.
5. The rear of the front section Main Shaft is splined into the auxiliary drive gear, and torque is now delivered to the auxiliary section.

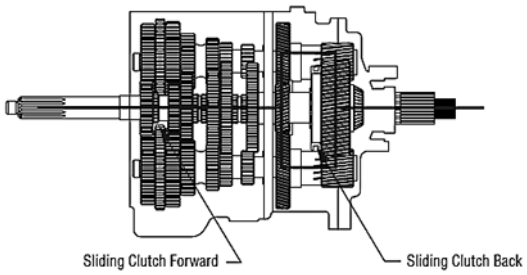


Front Section Torque (1st Gear)

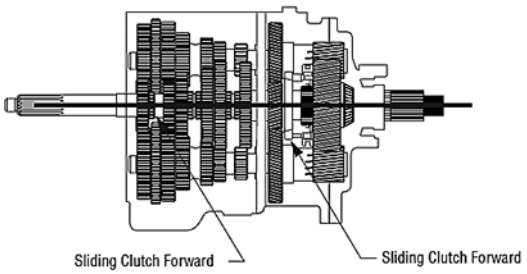
Front Section Power Flow - Direct Gear

In direct gear (5th/10th for FA model, 4th/9th for FAO model), the front sliding clutch is moved forward and engages into the back of the main drive gear. Torque will flow from the Input Shaft to the main drive gear, main drive gear to sliding clutch, sliding clutch straight into the front section main shaft which delivers the torque to the auxiliary drive gear.

Note: All Counter Shaft and Main Shaft gears will rotate, but not all gears will be loaded.



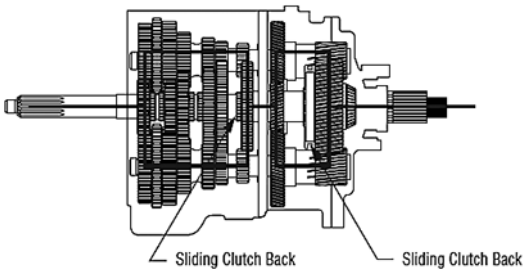
5th Gear FA, 4th Gear FAO



10th Gear FA, 9th Gear FAO

Front Section Power Flow - Reverse Gear

Torque will flow from the Counter Shafts to the Reverse Idler gears. Torque will then flow from the Reverse Idler gears to the Main Shaft reverse gear. Torque will now travel through the Main Shaft reverse gear, the sliding clutch in the reverse position and then to the Main Shaft and auxiliary drive gear

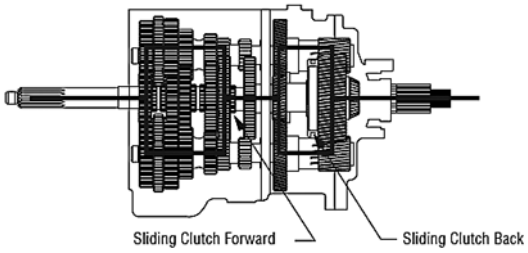


Reverse Gear—Low Range

Auxiliary Section Power Flow - Low Range

The auxiliary drive gear transfers torque to both auxiliary Counter Shafts.

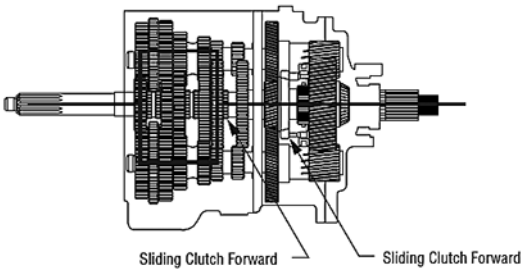
If the auxiliary section is in low range, the range sliding clutch is rearward and engaged into the auxiliary Main Shaft reduction gear, through the range sliding clutch and then into the Output Shaft (auxiliary main shaft).



Low Range (Auxiliary Sliding Clutch Back)

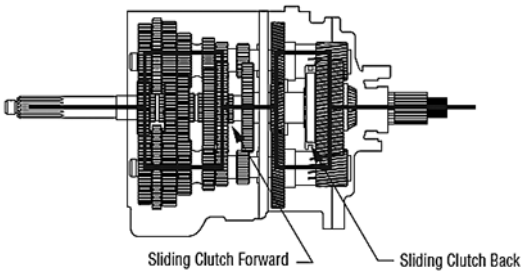
Auxiliary Section Power Flow - High Range

If the auxiliary section is in high range, the range sliding clutch is forward and engaged into the back of the auxiliary drive gear. Torque will flow from the auxiliary drive gear to the range sliding clutch. Because the range sliding clutch has internal splines which connect to the Output Shaft, torque will flow straight through the auxiliary section.

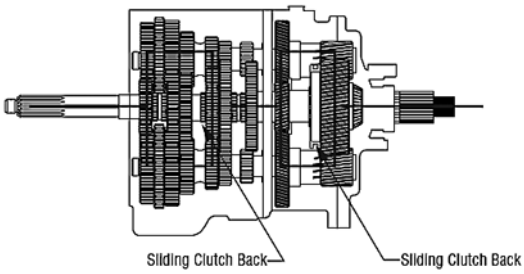


High Range (Auxiliary Sliding Clutch Forward)

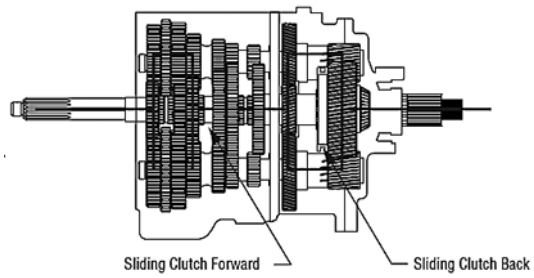
FA/FAO



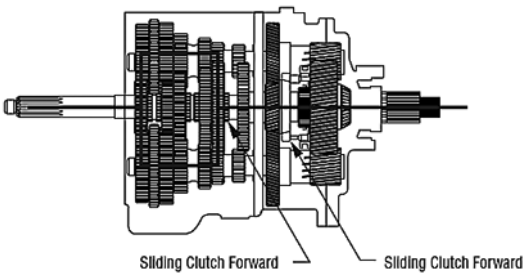
1st Gear



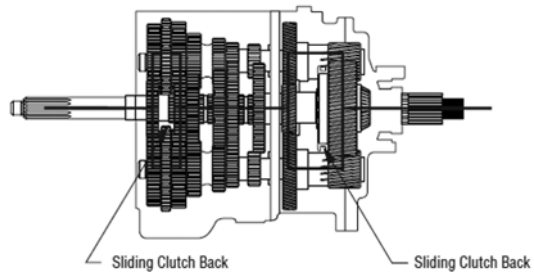
2nd Gear



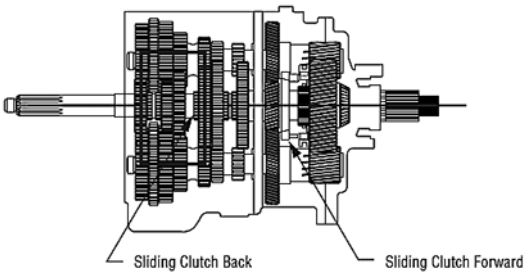
3rd Gear



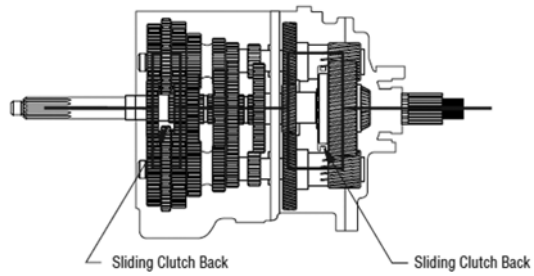
6th Gear



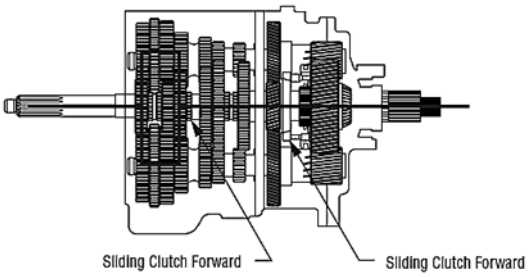
4th Gear—FA/Direct Drive Transmission
5th Gear—FAO/Overdrive Transmission



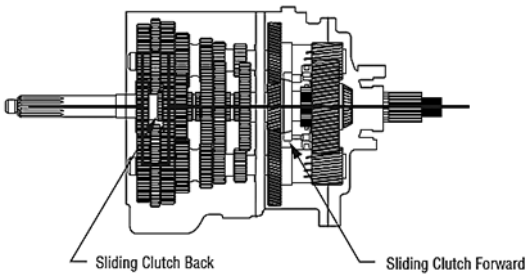
7th Gear



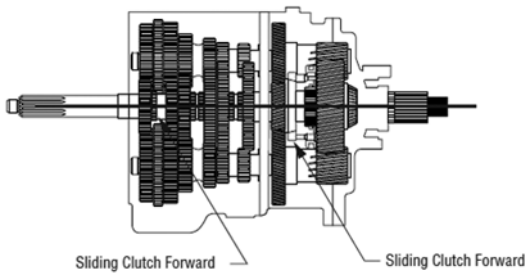
5th Gear—FA/Direct Drive Transmission
4th Gear—FAO/Overdrive Transmission



8th Gear



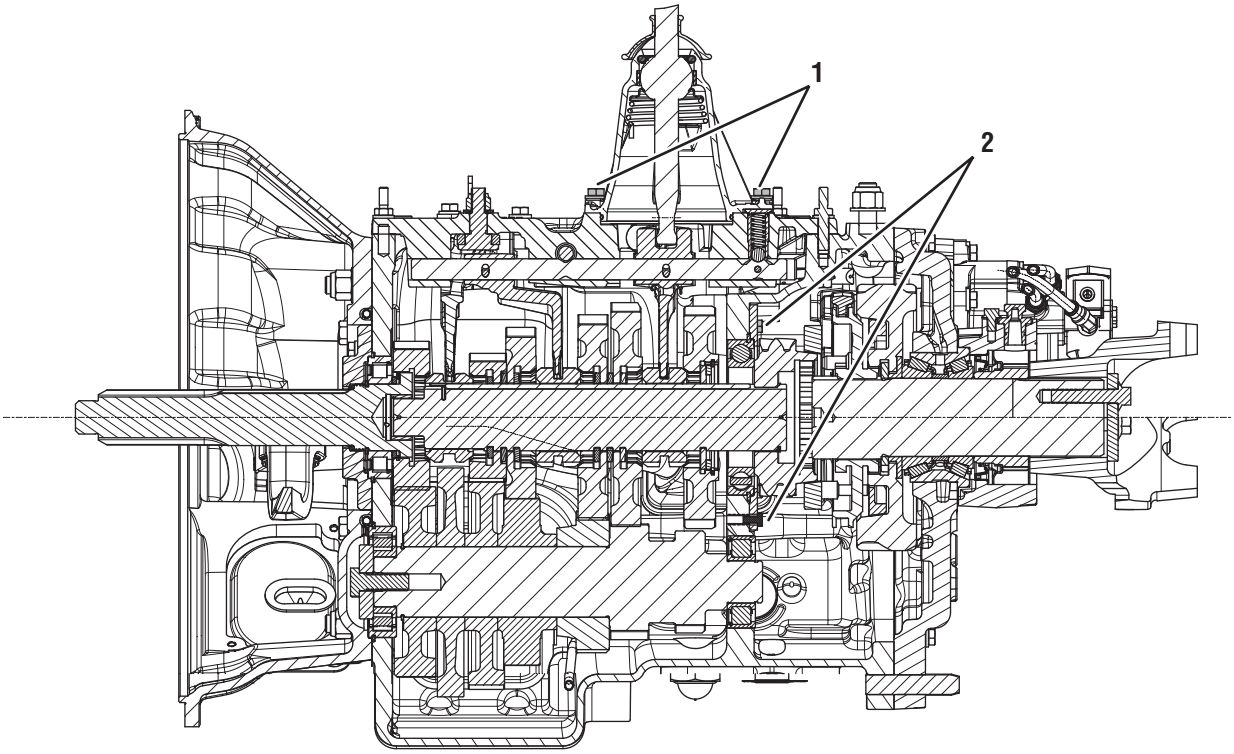
9th Gear—FA/Direct Drive Transmission
10th Gear—FAO/Overdrive Transmission



10th Gear—FA/Direct Drive Transmission
9th Gear—FAO/Overdrive Transmission

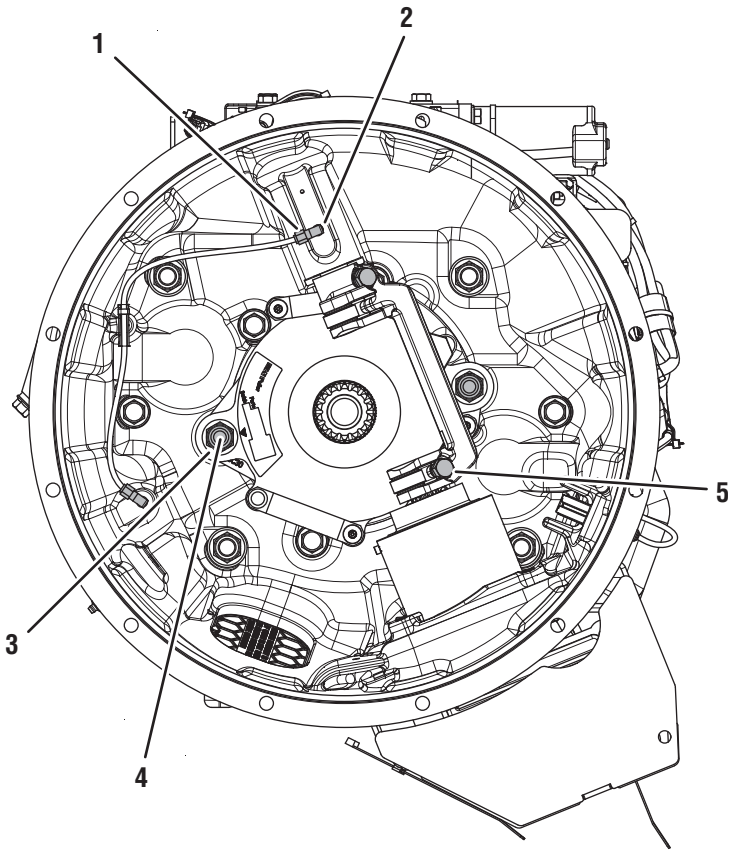
Torque Specifications

Important: Torque specifications not defined in the following diagrams will be referenced in the service procedures.



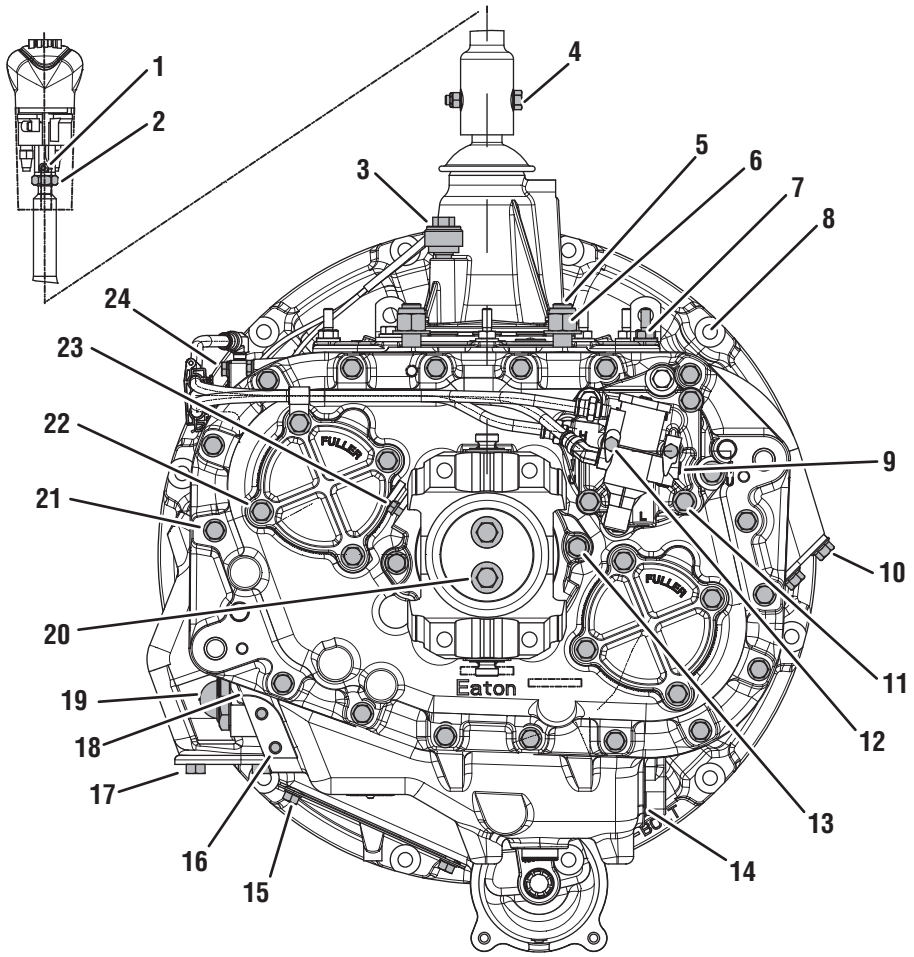
	Description	Qty.	Size	TPI	Torque
1.	*Shift Lever Cap Screws*	*4*	*0.375"*	*16*	*30–40 lb-ft (41–54 N•m)*
2.	*Auxiliary Drive Gear Bearing Retainer Cap Screws*	*6*	*0.375"*	*16*	*35–45 lb-ft (48–61 N•m)*

Torque Specifications



	Description	Qty.	Size	TPI	Torque
1.	*Grease Hose Compression Nuts*	*2*			*3–5 lb-ft (0.34–0.56 N•m)*
2.	*Grease Hose Elbow Fittings*	*2*	*0.25"*	*18 NPTF*	*84–120 lb-ft (9.5–13.6 N•m)*
3.	*LCIB Nuts*	*2*	*0.625"*	*18*	*140–150 lb-ft (190–203 N•m)*
4.	*LCIB Studs*	*2*	*0.625"*	*18 UNC*	*60 lb-ft (81 N•m)* *Drive studs until bottomed*
5.	*Release Yoke Pinch Bolts*	*2*	*0.4375"*	*14*	*35–45 lb-ft (47–61 N•m)*

Torque Specifications



	Description	Qty.	Size	TPI	Torque
1.	*Skirt Attachment Screw*	*1*	*#8*	*32*	*18–24 lb-in (2–2.7 N•m)*
2.	*Master Valve Jam Nut*	*1*	*0.50"*	*13*	*20–25 lb-ft (27–34 N•m)*
3.	*Air Breather*	*1*	*0.125"*	*18 NPTF*	*25–30 lb-in (2.8–3.3 N•m)*
4.	*Shift Shoulder Bolt and Nut*	*1*	*0.3125"*	*18*	*10–12 lb-ft (4–16 N•m)*
5.	*Support Studs*	*2*	*0.625"*	*11*	*80 lb-ft (81 N•m)*
6.	*Support Stud Nuts*	*2*	*0.625"*	*18*	*140–150 lb-ft (190–203 N•m)*
7.	*Double Ended Stud*		*0.375"*	*16*	*35–45 lb-ft (48–61 N•m)*
8.	*Clutch Housing to OEM Flywheel Housing Interface*				*See OEM for torque specification*
9.	*Range/Filter Regulator Plugs*	*3*	*0.125"*	*27 PTF*	*84–120 lb-in (9.5–13.6 N•m)*
10.	*6-Bolt PTO Cover Cap Screws*	*6*	*0.375"*	*16*	*40–45 lb-ft (54–61 N•m)*
11.	*Range Shift Cylinder Cover Cap Screws*	*8*	*0.375"*	*16*	*30–35 lb-ft (41–47 N•m)*

	Description	Qty.	Size	TPI	Torque
12.	Air Filter Regulator Cap Screws	2	0.25"	20	8–12 lb-ft (11–16 N•m)
13.	Rear Bearing cover Cap Screws	6	0.375"	16	30–35 lb-ft (41–47 N•m)
14.	Thermocouple Plug	1	0.50"		40–50 lb-ft (54–67 N•m)
15.	Hand Hole Cover Cap Screws	4	0.321"	18	14–18 lb-ft (19–24 N•m)
16.	Provision for PTO Bracket	2	0.375"	16	30–35 lb-ft (41–47 N•m)
17.	8-Bolt PTO Cover Cap Screws	8	0.4375"	14	50–65 lb-ft (68–88 N•m)
18.	Oil Fill Plug	1	1.0625"	12	35–50 lb-ft (47–67 N•m)
19.	Oil Level Sight Glass Plug	1	0.625"	12	60–70 lb-ft (82–95 N•m)
20.	Output Yoke Retainer Bolts	2	M12	1.25	84–92 lb-ft (113–124 N•m)
21.	Auxiliary Housing Cap Screws	19	0.375"	16	35–45 lb-ft (48–61 N•m)
22.	Auxiliary Counter Shaft Rear Bearing Cover Cap Screws	8	0.375"	16	30–35 lb-ft (41–47 N•m)
23.	Speed Sensor Retaining Bolt	1	0.25"	20	8–12 lb-ft (11–16 N•m)
24.	Slave Air Valve Cap Screws	8	0.3125"	18	8–12 lb-ft (10–16 N•m)

Lubrication Specifications

Caution: Do not introduce additives and friction modifiers.

Caution: Never mix standard oils and synthetic transmission oils in the same transmission. When switching between types of lubricants, all areas of each affected component must be thoroughly drained.

Caution: Do not mix lubricants of different grades.

Note: For a list of Eaton Approved Synthetic Lubricants, see TCMT0021 *Roadranger® Lubricant Products* or call 1-800-826-HELP (4357).

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

Note: For lubrication change and inspection intervals, see TCMT0021 *Roadranger® Lubricant Products*.

Note: Please refer to CLSM0200 *Eaton Heavy-Duty Clutches* for clutch lubrication and service guidelines.

Buy From a Reputable Dealer

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

Eaton, Worldwide Marketing Services

P.O. Box 4013

Kalamazoo, MI 49003

Transmission Operating Angles

If the transmission operating angle is more than 12 degrees, or approximately a 21% grade, improper lubrication will occur. The operating angle is the transmission mounting angle in the chassis plus the percent of upgrade (expressed in degrees).

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

Transmission filters should be changed during regular lubrication intervals. Inspection of the transmission filter should be conducted during preventative maintenance checks for damage or corrosion. Replace as necessary.

Operating Temperatures

Transmissions must not be operated at temperatures that are consistently above 250°F (121°C). Operation at temperatures above this limit causes loaded gear tooth temperatures to exceed 350°F (177°C) which will ultimately destroy the heat treatment of the gears.

The following conditions, in any combination, can cause operating temperatures that exceed 250°F (120°C):

- Operating consistently at high loads/slow speeds
- High ambient temperatures
- Restricted air flow around the transmission
- Exhaust system too close to the transmission
- High horsepower operation
- Use of engine retarders

Maintenance and Lubricant Change Intervals

Transmission inspections and lubricant changes are outlined below.

For a list of Eaton Roadranger-approved lubricants, see TCMT0020 *Roadranger® Lubricant Products*.

Interval	Description
First 1,000 to 1,500 miles	Inspect oil levels. Check for leaks.
Every 2,500 miles	Inspect lubricant level. Perform Transmission Inspection.
Every 5 years or 500,000 miles, whichever occurs first	Change oil and filters.

Clutch Greasing Guidelines

To ensure long life and proper operation of the release mechanism of the clutch, it is important to properly lubricate the following areas.

Lubrication

1. **Release Bearing**: The cast iron bearing housing will be equipped with either a standard grease fitting or a lubrication tube extension. If a lubrication tube is not present, it is necessary to remove the inspection cover to gain access to the grease fitting. Apply grease until it purges from the rear of the housing. Grease on the clutch brake friction surface and the transmission Input Shaft will extend the life of the clutch brake and bronze bushings inside the release sleeve.

2. **Release Bearing Wear Pads**: Where the release fork contacts the bearing housing, there are small hardened steel pads. Apply a small amount of grease to the wear pads where the clutch release fork contacts.
3. **Clutch Brake**: The clutch brake friction material is designed to operate with lubricant. While lubricating the release bearing, grease should purge from the housing and contact the clutch brake. This is beneficial for long clutch brake life. If desired, a small amount of grease could be applied to both sides of the clutch brake.
4. **Cross Shaft Bushings**: Lubricate both the left and the right cross-shaft bushings per OEM recommendations.
5. **Clutch Control Linkage**: Lubricate the clutch linkage bell cranks and pivot pins per OEM recommendations.
6. **Pilot Bearing**: The pilot bearing inside the flywheel is a sealed for life bearing and requires no lubrication. Use a premium pilot bearing to prevent clutch drag and early bearing failures (C-3, C-4, C-5 Suffix).

Lubrication Tube Assembly

The Eaton Lubrication Tube Assembly enables the release bearings in Eaton medium- and heavy-duty clutches to be greased without removing the bell housing inspection cover. The lubrication tube hose replaces the original Zerk fitting on the release bearing and protrudes through the bell housing window.

Lubrication Tube Lengths

Length in Inches	Part Number
12"	CLT012
9"	CLT009
8"	CLT008
7"	CLT007
6"	CLT006

Lube Hose Kits/Assemblies for Hydraulic Release System

Kit/Assembly	Description
K-4050	Used with Solo Advantage™ clutches
A-7857	Used with Non-Solo Advantage™ clutches

Recommended Lubrication

Caution: Incorrect grease and improper lube procedures will cause bearing failures, bushing wear-out, and yoke tip and bearing wear pad wear.

For a list of approved lubricants, see TCMT-0021 or call 1-800-826-HELP (4357).

Lubrication Interval

The UltraShift DM clutch does not require any lubrication or adjustment. There is no clutch linkage associated with this product, therefore there is no linkage adjustment or maintenance requirements.

For recommended lubrication intervals, see Manual TCMT-0021, *Roadranger® Lubricant Products,* or call 1-800-826-HELP (4357).

Note: Features and specifications listed in this document are subject to change without notice and represent the maximum capabilities of the software and products with all options installed. Although every attempt has been made to ensure the accuracy of information contained within, Eaton makes no representation about the completeness, correctness or accuracy and assumes no responsibility for any errors or omissions. Features and functionality may vary depending on selected options.

For spec'ing or service assistance, call 1-800-826-HELP (4357) or visit www.eaton.com/roadranger.
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