INTRODUCTION

Before removing the transmission/ transaxle for replacement or repair, be sure that the unit is properly identified. This identification is critical because of the following:

- The final drive ratio in transaxles can vary depending on the application.
- The internal gear ratios can vary depending on exact application of the unit.
- Sometimes the vehicle identification number (VIN) is needed to obtain the correct parts, but more often the transmission/transaxle identification number, also called the tag number, is the identification needed to be assured of ordering and receiving the proper parts. Figure 1.

Figure 1. Transmission ID tag.

C1 Removal and Installation

1. Remove and install transmission/transaxle; inspect engine core plugs, rear crankshaft seal, transmission dowel pins, dowel pin holes, and mating surfaces.

Removing an automatic transmission/ transaxle from a vehicle includes many steps. Always follow the vehicle manufacturer's recommended procedures. Most procedures include the following steps.

STEP 1 Disconnect the negative (−) battery cable from the battery.

STEP 2 Hoist the vehicle safely and drain the fluid from the unit.

STEP 3 Remove the driveshaft or drive axle shafts.

STEP 4 Disconnect all cooler lines, linkage, and electrical connections. Be sure to label each to ensure proper reinstallation.

STEP 5 Disconnect the torque converter from the flex (drive) plate of the engine.

STEP 6 On FWD vehicles, support the engine before disconnecting transaxle. Figure 2.

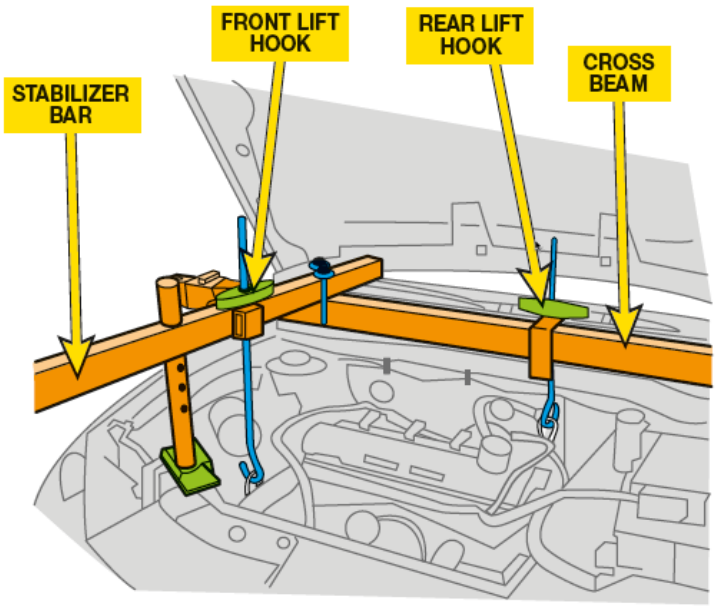

Figure 2. Engine support tool for FWD vehicles.

STEP 7 Remove the transmission/transaxle mounting fasteners.

STEP 8 Support the transmission/transaxle on a jack and remove the attaching bolts at the bell housing of the engine. Figure 3.

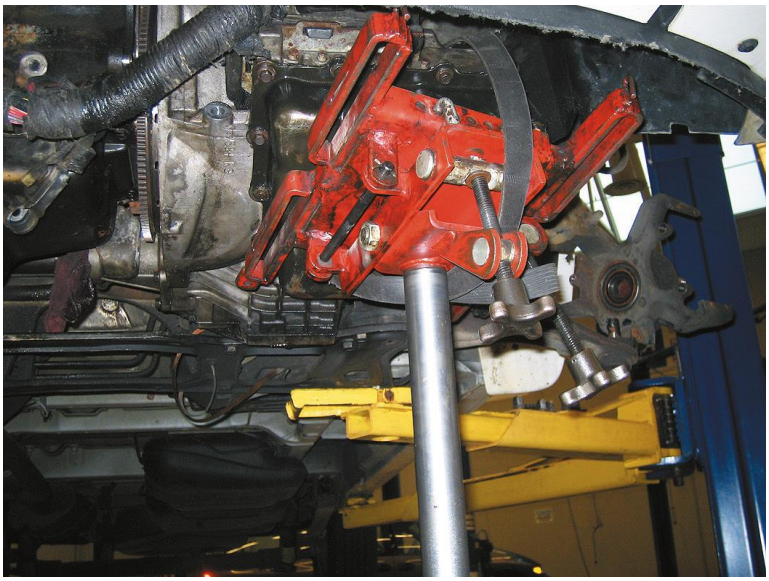

Figure 3. Use a transmission jack for safety.

STEP 9 Remove the transmission/transaxle from the vehicle.

2. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, crankshaft pilot bore, and converter pump drive surfaces.

The torque converter should be checked to make sure it is in usable condition when the transmission is removed. Figure 4.

- Check the mounting drive studs or threaded holes and lugs for physical damage.
- Check the pilot area for damage.
- Check the hub for signs of seal or bushing area wear.
- Check the pump drive tangs or lugs for wear or damage.
- Check the starter ring gear, if used, for wear or damage

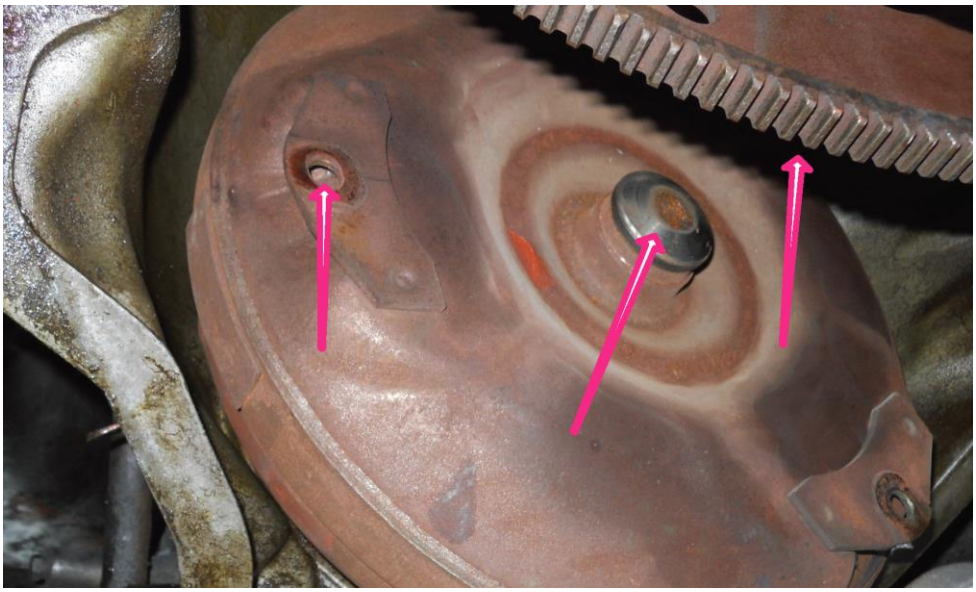

Figure 4. Inspection points for the torque converter and flexplate.

3. Install torque converter and establish correct converter-to-pump engagement; inspect converter free movement for pilot engagement during transmission installation.

Installing a transmission is the reverse of the removal procedure. The last operation in the removal is usually the first step in the installation. Installation of an automatic transmission or transaxle usually involves the following steps:

STEP 1 Before installing the transmission, make sure that the transmission alignment dowels and the wiring harness are in place.

STEP 2 Slide the torque converter onto the front of the transmission. Make sure the converter drive tangs fully engage the pump. Figure 5.

Figure 5. Notches in the converter hub must be aligned with the pump drive tangs.

STEP 3 Raise the transmission into position and slide it to place it against the engine. Make sure the converter is free to turn. CAUTION: Do not use the bolts to pull the transmission/transaxle to the engine block.

STEP 4 Install the transmission-to-engine bolts and tighten them to the correct torque. Re-check the converter for free movement.

STEP 5 Place the transmission supports into position, lower the transmission onto the mounts, and tighten the mounting bolts to the correct torque.

STEP 6 Slide the converter forward to align with the flex plate. Install the bolts and tighten them to the correct torque.

STEP 7 Connect the cooler lines and tighten them to the correct torque. CAUTION: Flush the cooler and lines before connecting them to the transmission.

STEP 8 Replace the driveshaft(s) and tighten any retaining bolts to the correct torque.

STEP 9 Reconnect all linkage and wire connections that were disconnected, making sure they are routed properly.

After installation, the transmission should be filled with the correct amount of ATF and the engine started. Adjust the fluid level after starting the engine and operating the transmission in the different gear ranges.

4. Inspect, test, flush or replace transmission fluid cooler cooler/warmer, thermostat, thermal bypass valve(s), and lines.

Fluid flushing typically uses a chemical to dissolve varnish and other deposits. If the flush is needed to remove solid debris, there must be enough flow velocity to break the material loose and carry it out of the component. More efficient flush machines will pulsate the flow to increase the cleaning power. In severe cases, such as a plugged cooler, the flush can be set up to pump the solvent into the cooler outlet and remove it from the inlet.

5. Inspect brackets, cables, linkage, wiring harnesses, connectors, fuel lines, heat shields, inspection covers, vents, cooler lines, brake lines, and related components for proper routing and installation.

Reconnect all linkage and wire connections that were disconnected, making sure they are routed properly. Figure 6.

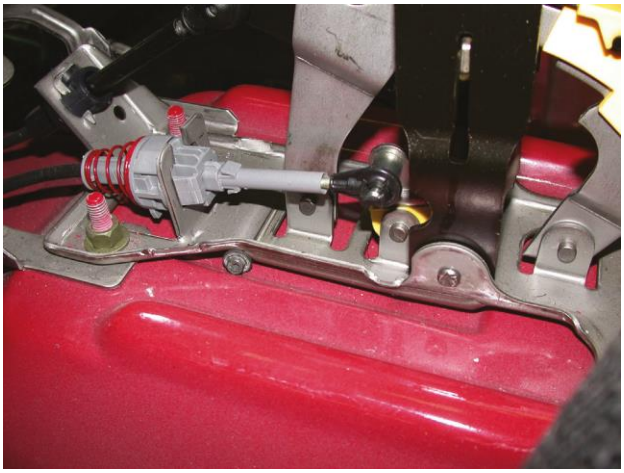

Figure 6. Check that cables are installed and routed properly.

6. Connect diagnostic scan tool to vehicle; access, verify, and update software calibration settings and solenoid/valve body calibration codes; perform control module re-learn and adaptation (basic settings) procedures as needed.

For an electronic transmission/transaxle to operate correctly, a “fast learn” or a “quick learn” should be performed with a scan tool before the vehicle is driven. This action will get the adaptive settings close to what they should be and will help prevent damage to the unit if this procedure is not done.

One example of the process:

- Use a scan tool capable of performing the fast-learn procedure.
- Select the fast learn or “Adapts (clear)” process from the scan tool menu. Figure 7.
- Place the transmission in “drive” with the vehicle stationary. The TCM will individually apply the clutches and calculate the clutch volume index.
- Place the transmission in “reverse” with the vehicle stationary. The TCM will individually apply the clutches and calculate the clutch volume index.

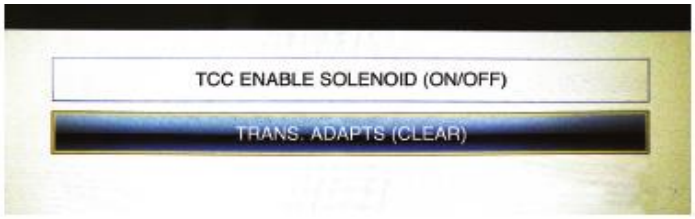

Figure 7. Clearing the adaptive settings.

C2 Disassembly and Assembly

1. Disassemble, clean, and inspect transmission case, sub-assemblies, mating surfaces, and thread condition. Cleanliness is a must during a transmission overhaul. Many shops steam clean, or pressure wash the outside of the transmission as soon as it is removed from the vehicle. Most transmission shops use a teardown bench that has a steel top designed to catch the fluid and drain it into a catch pan. During disassembly, the transmission is placed on the bench and disassembled as needed.

NOTE: Before disassembly input and output shaft end play should be measured (explained in Task 4). Some manufacturers specify a preload measurement on the final drive assembly in a transaxle before disassembly.

Valve body. The first teardown step is to remove the oil pan, filter, and valve body. Remove the pan, inspect for debris, wash the pan in solvent, and air dry it.

Next, the filter and gasket are removed and set aside for comparison with the new filter.

The valve body is then removed and set aside for cleaning and inspection. Inspect for check balls as the valve body is removed and note their location. Figure 8.

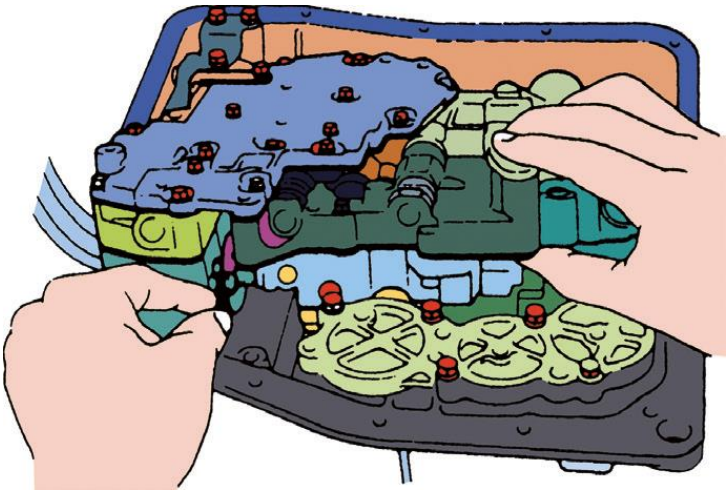

Figure 8. Removing the valve body.

Accumulator covers and pistons. Round retaining rings are removed after the accumulator piston plate/cover is compressed using a special tool.

Pump. After measuring endplay and preload, the pump can be removed. The pump assembly is the front cover that holds the gear train inside the case on RWD transmissions. Its removal allows the disassembly of the rest of the internal parts. Figure 9.

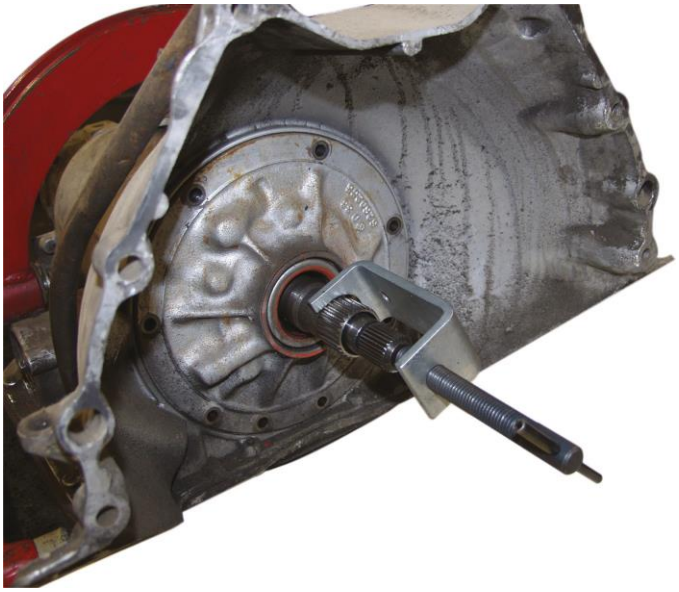

Figure 9. A special tool is used to pull the pump from the case.

Some transaxles use a chain and sprockets for gear train input. The main gear train and pump is behind the valve body. Note the position of the master link when removing the chain; this indicates the correct orientation during reassembly. Figure 10.

Figure 10. The master link is facing UP and should be reinstalled the same way.

Case. Service information should be followed for the disassembly procedure. To complete transmission disassembly:

- Remove band servos and bands (if equipped).
- Remove the driving clutch assemblies.
- Remove the extension housing.
- The planetary gear train can be slid out of the case as one assembly on some transmissions.

- On rear-wheel-drive (RWD) transmissions, remove any remaining parts as required by the manufacturer's instructions. On transaxles, remove the final drive gears and differential plus any other remaining parts. Figure 11.

Figure 11. Removing the final drive and differential assembly from a transaxle.

2. Inspect and measure fluid pump and drive components; determine needed actions or repairs.

Check the pump by visual inspection, carefully checking the areas where wear normally occurs. Inspect the following areas for wear:

- Sides of the gears or rotors.
- Body and cover where the gears move. Figure 12.
- Flanks of the gear teeth/rotor lobes for score marks
- Pump bushing

Figure 12. Inspect the pump housing.

Manufacturers sometimes publish clearance specifications for the pump wear locations. These clearances can be checked using a feeler gauge. A worn pump requires replacement with a new or rebuilt unit. Figure 13.

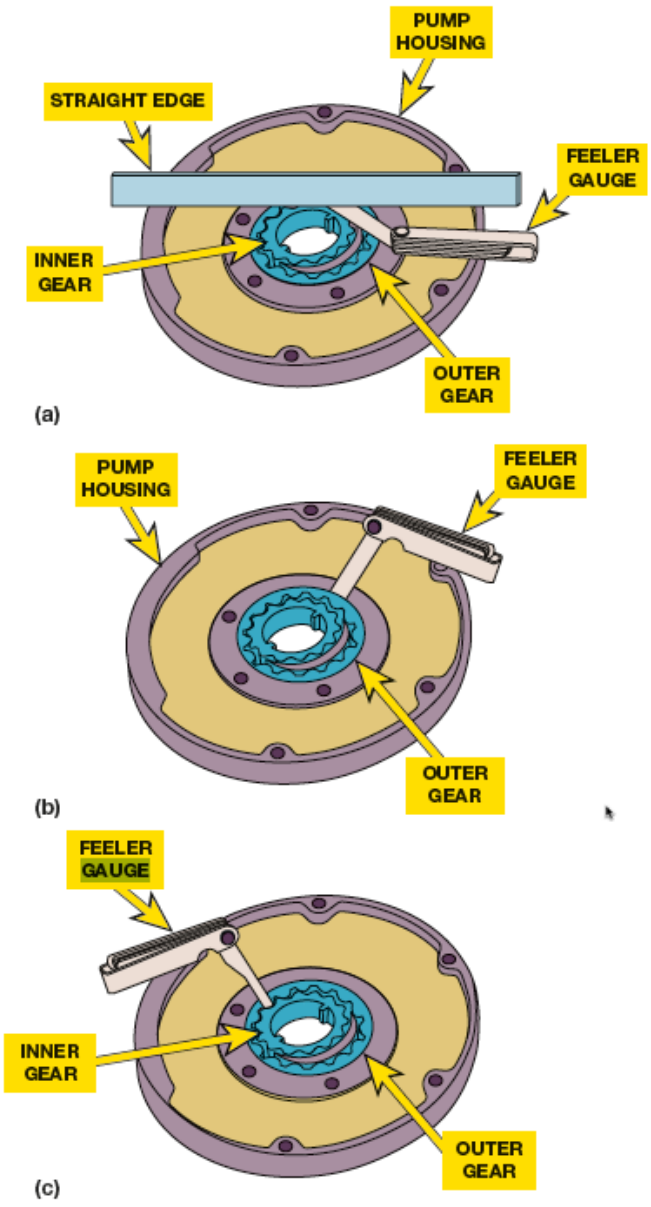

Figure 13. Measuring clearances with a feeler gauge.

3. Check bearing preload; inspect, measure, and adjust as needed.

Before disassembling a transaxle, measure the preload of the final drive side bearings, using a special tool and an inch pound torque wrench. Record the reading for reference when reassembling the transaxle.

4. Check end play; inspect, measure, and adjust as needed.

It is standard practice to measure the input shaft end play before removing the pump. End play is the in-and-out movement of the shaft. If the end play is excessive, there is internal wear, which must be corrected during the rebuild. End play is normally measured using a dial indicator. Figure 14.

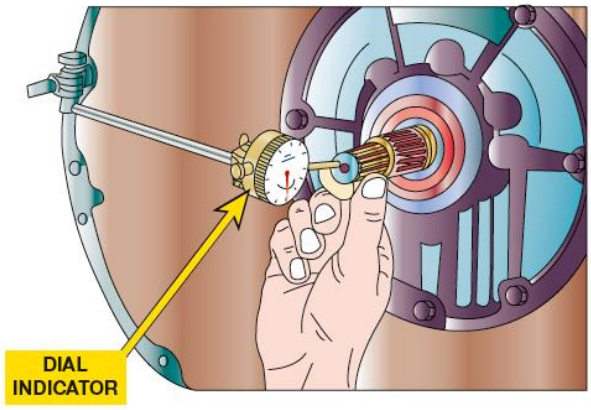

Figure 14. Measuring end play.

5. Inspect shafts (including shaft splines, lubrication feed holes, bushings, journals); determine needed actions or repairs.

Shafts in the transmission are often fitted with sealing rings that can cause wear to the ring and shaft. Rubbing action takes place between one side of the sealing ring and the shaft groove. Some sliding action also takes place between the ring and the bore. End play allows the bore along with the drum to move forward and backward on the shaft, causing wear.

There should be a maximum of about 0.003 inch (0.07 mm) of groove wear, and the sides of the groove should be smooth and straight. Small imperfections can be smoothed using a small file. Excessive or tapered wear requires shaft replacement. Figure 15.

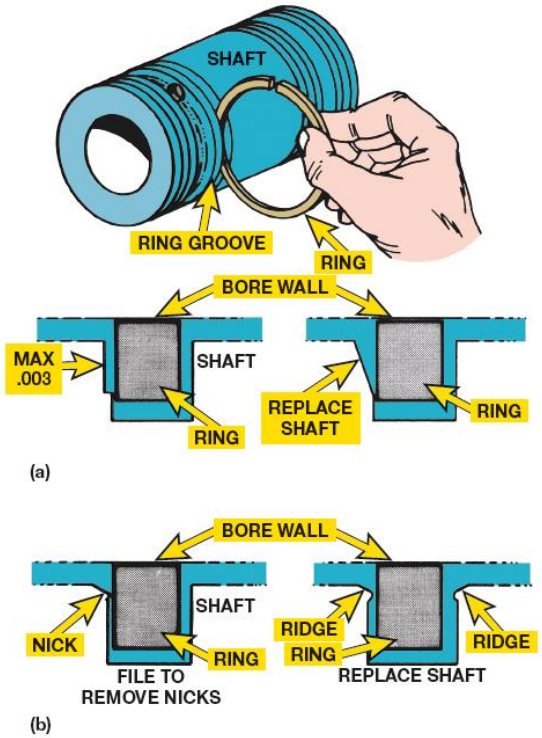

Figure 15. Checking shaft wear.

A metal sealing ring, either open/plain end or hook ring, should be checked by placing it in its bore. There should be a tight and close fit between the outer diameter of the ring and the bore. Open-end metal rings should have a slight gap, about 0.002 to 0.015 inch (0.05 to 0.3 mm). Figure 16.

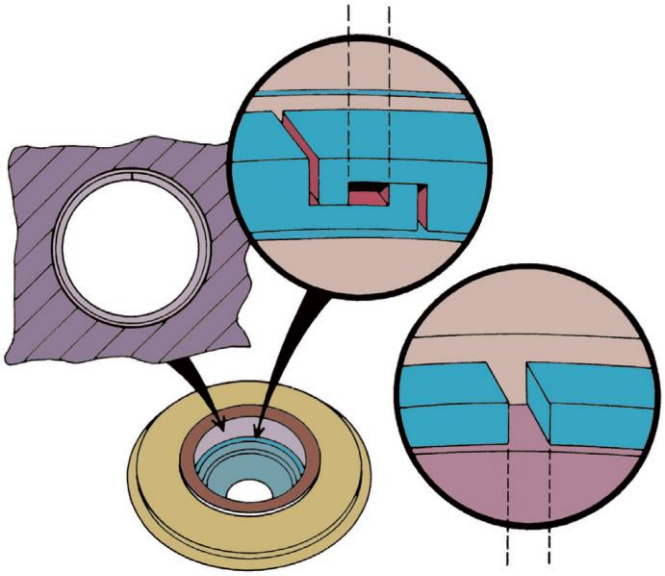

Figure 16. Metal sealing rings.

Scarf-cut, Teflon sealing rings are installed by placing them in the groove with the ends lapped in the correct direction. Uncut Teflon rings require two special tools for installation:

- An installing tool.
- Resizing tool.

7. Inspect and/or measure bushings, thrust washers, and bearings; determine needed actions or repairs.

Bushings and bearings are used to support rotating shafts. Bushings are plain metal bearings that require a flow of ATF lubricant to reduce friction. Bearings have much less friction because they have rolling members, either balls or rollers, as well as a lubricant to reduce friction. Figure 17.

Figure 17. Tapered roller bearing and adjusting shim.

Thrust washers are used to separate rotating parts from each other or from stationary parts. Thrust washers can be made from plastic, fiber, or bronze- or tin-lined iron. When end-play positioning is critical or thrust loads are very high, a radial needle bearing commonly called a Torrington is used. Figure 18.

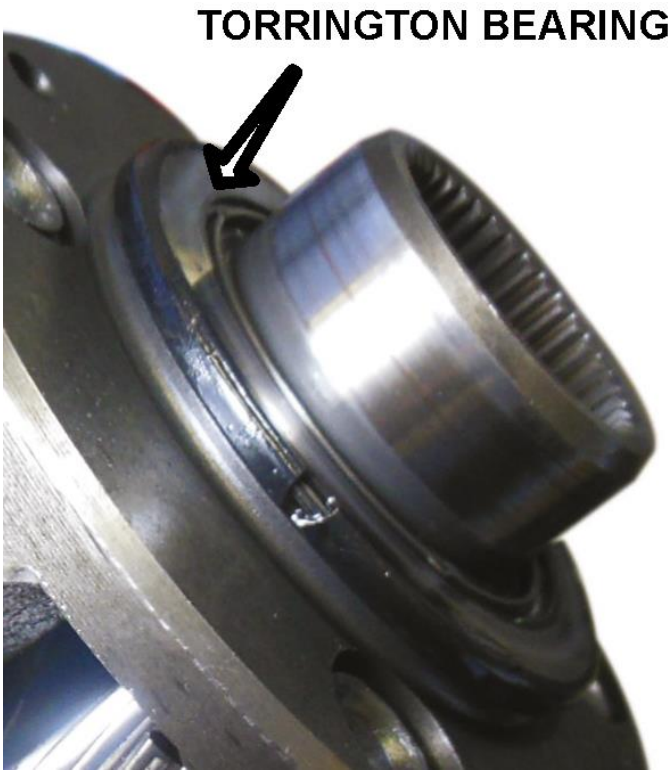

Figure 18. A Torrington bearing supports side thrust forces.

The front (pump) and rear (extension housing) bushings are usually replaced during every transmission rebuild. If the bore is straight, the bushing is normally pressed or driven straight out the other end of the bore. Figure 19.

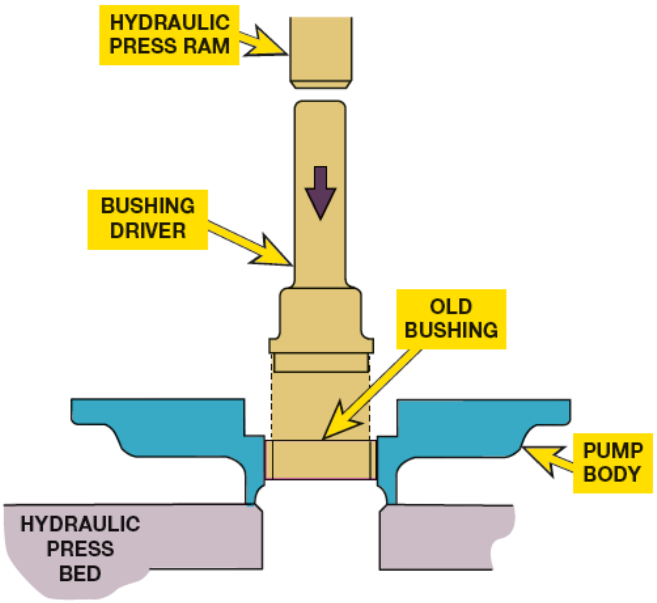

Figure. 19. Bushings are removed and installed using a hydraulic press.

8. Inspect and measure components of the planetary gear assembly; determine needed actions or repairs.

Servicing gear sets is primarily a visual inspection of the various gears and a side play and rotation check of the planet gears. In some cases, there is also an end-play check of the assembled gear train to ensure the thrust washers are not worn excessively. Figures 20 and 21.

Figure 20. Damaged gear sets are replaced.

Figure 21. Measuring pinion gear side clearance.

9. Inspect case bores, passages, bushings, vents, mating surfaces, and dowel pins.

Several areas of the case should be checked or serviced after it has been cleaned. These include the bushings, all fluid passages, the valve body worm tracks (grooves for the valve body fluid flow), all bolt threads, the clutch plate lugs, and the governor bore, if equipped.

Check for warpage in the worm track area. Warpage can produce a cross leak, which is a leak from one passage to another. Case warpage is checked by placing a precision straightedge over the area to be checked and trying to slide a feeler gauge between the case and straightedge. Check service information for the specified maximum warpage, which is usually less than 0.002 inch (0.05 mm).

10. Inspect valve body mating surfaces, bores, valves, solenoids, springs, sleeves, retainers, brackets, check balls, screens, spacer plates, and gaskets; determine needed actions or repairs.

Some valve body checks are:

Check mating surfaces with a straightedge and feeler gauge.

Each valve should be dipped in ATF before installation. The reassembly procedure is generally the reverse of the disassembly procedure. As each valve is installed, make sure that it moves freely in its bore.

Many technicians consider solenoids, especially PWM solenoids, to be “wear items” and automatically replace them if the transmission experiences problems after about 90,000 miles (150,000 km).

If a faulty check spacer plate seat is suspected, place the ball on its seat and hold a shop light behind the transfer plate. Light shining between the ball and the spacer plate indicates a problem. Figure 22.

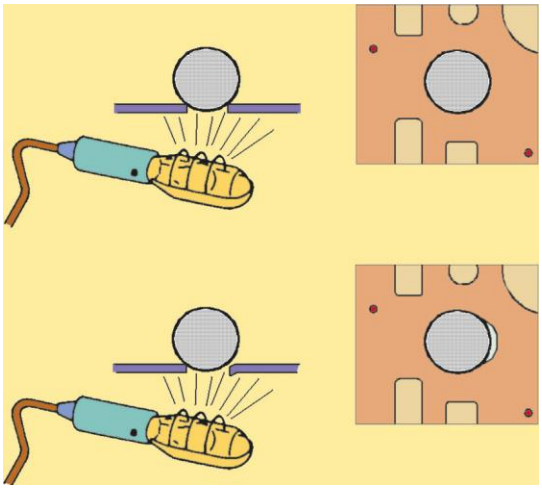

Figure 22. Light leaking around the ball and seat indicates a worn spacer plate.

Ensure that all check balls and filter screens are replaced in their proper locations. Be sure to tighten each fastener to the correct torque. Figure 23.

Figure 23. Use assembly lube to keep check balls in position during reassembly.

11. Inspect transmission/transaxle drive chains, sprockets, belts, pulleys/sheaves, gears, bearings, and bushings; determine needed actions or repairs.

Inspect drive chain sprockets for wear. Be sure to install the drive chain in its original position. If installed backwards a gear whine may occur. Figure 24.

Figure 24. Transaxle drive chain installation.

12. Inspect and measure transaxle final drive components; repair, replace and/or adjust as necessary.

Transaxle differentials should be checked to make sure that the differential gears, thrust washers, and the differential pinion shaft are in good condition. Checking gear clearance using a dial indicator can determine if the differential gears are out of specification. Figure 25.

Figure 25. Checking differential gear free play.

The transaxle final drive side bearings usually require a preload adjustment using a shim behind the bearing cup. The final drive and case are first assembled without the shim and then measured for end play. Then follow service information to calculate the required shim, which is installed behind the cup. Figures 26 and 27.

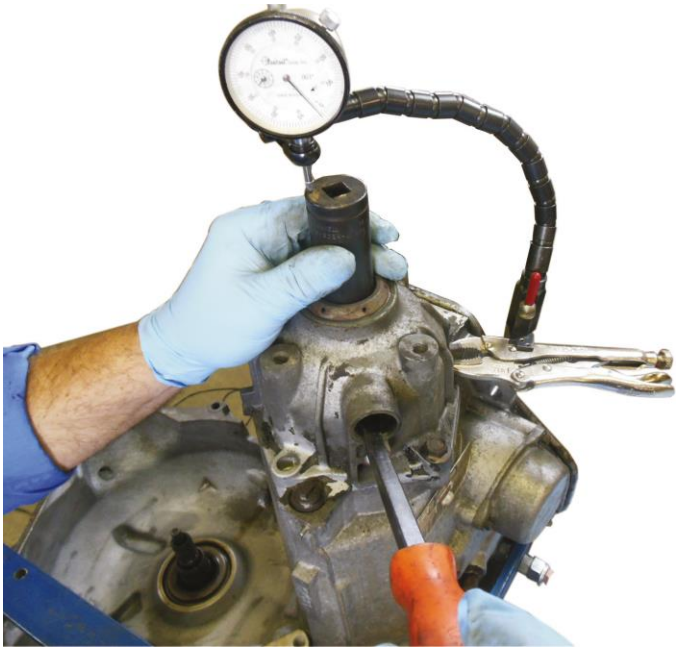

Figure 26. Measuring final drive end play.

Figure 27. The selective shim is installed behind the bearing cup to give the proper bearing preload.

13. Assemble, adjust, and install transmission/transaxle after repair per service information and/or TSBs.

I Installing a transmission is the reverse of the removal procedure. The last operation in the removal is usually the first step in the installation. Installation of an automatic transmission or transaxle usually involves the following steps:

STEP 1 Before installing the transmission, make sure that the transmission alignment dowels and the wiring harness are in place.

STEP 2 Slide the torque converter onto the front of the transmission. Make sure the converter drive tangs fully engage the pump.

STEP 3 Raise the transmission into position and slide it to place it against the engine. Make sure the converter is free to turn. CAUTION: Do not use the bolts to pull the transmission/transaxle to the engine block.

STEP 4 Install the transmission-to-engine bolts and tighten them to the correct torque. Re-check the converter for free movement.

STEP 5 Place the transmission supports into position, lower the transmission onto the mounts, and tighten the mounting bolts to the correct torque.

STEP 6 Slide the converter forward to align with the flex plate. Install the bolts and tighten them to the correct torque.

STEP 7 Connect the cooler lines and tighten them to the correct torque. CAUTION: Flush the cooler and lines before connecting them to the transmission.

STEP 8 Replace the driveshaft(s) and tighten any retaining bolts to the correct torque.

STEP 9 Reconnect all linkage and wire connections that were disconnected, making sure they are routed properly.

After installation, the transmission should be filled with the correct amount of ATF and the engine started. Adjust the fluid level after starting the engine and operating the transmission in the different gear ranges.

C3 Friction and Reaction Units

1. Inspect components of the hydraulic clutch pack assembly; determine needed actions or repairs.

Driving devices are usually multiple-plate disc clutches. An automatic transmission shifts when hydraulic pressure applies or releases a clutch. Hydraulic pressure causes the clutch or servo piston to move, taking up the clearance, and then squeezes the parts together. Figure 28.

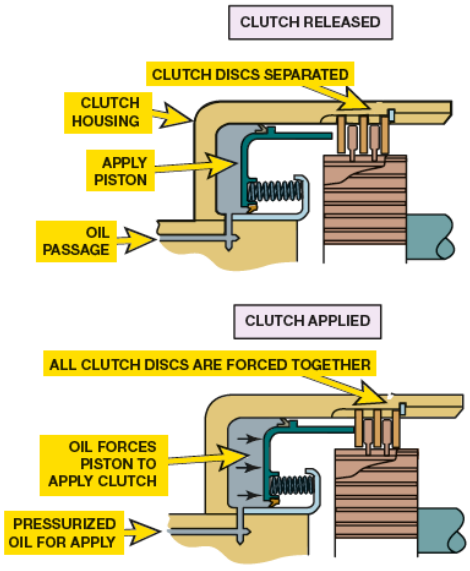

Figure 28. Clutch operation.

Clutch plate removal first requires taking the snap ring out of its groove using a screwdriver or a seal pick. The pressure plate and clutch plates are removed next. Figure 29.

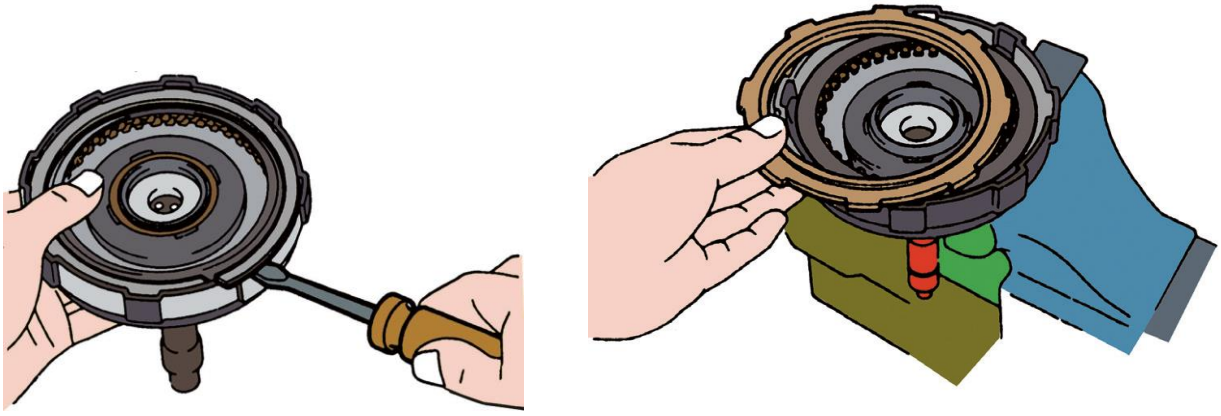

Figure 29. Remove the snapring and then the pressure plate and clutch plates.

A spring compressor is usually required to remove the piston return spring(s) and retainer. With the piston out, remove the old seals, wash the parts in solvent, and dry them using compressed air. To reassemble:

- Soak all frictions plates in ATF.
- Install the new seals.
- Thoroughly lubricate the seals and bore.
- Carefully install the piston completely into the bore.
- Replace the return springs and retainer.

2. Measure clutch pack clearance; adjust as necessary.

Clutch pack clearance, also called piston travel, is normally measured using a feeler gauge placed between the pressure plate and the snap ring. If selective parts do not correct the clearance or are not available, clutch clearance can be reduced by using extra-thick steel plates or by adding an extra unlined steel or lined friction plate. Figure 30.

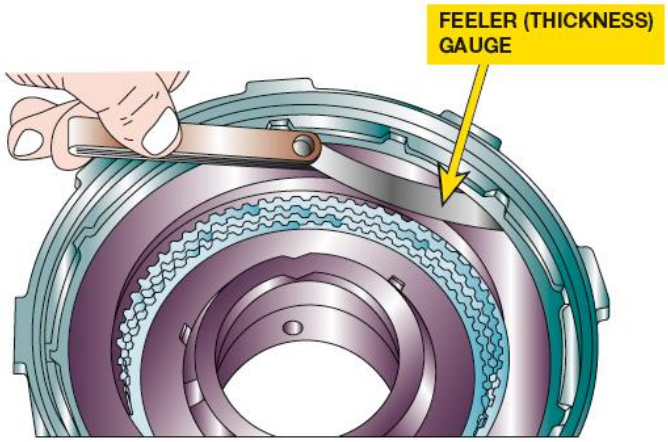

Figure 30. Measuring clutch pack clearance.

3. Air test the operation of clutch and servo assemblies; determine needed actions or repairs.

Air testing is a valuable diagnostic tool, which is also used as a final quality-control check during transmission assembly. Air tests are used to tell if a clutch or band servo operates, and if the passages are properly sealed. Figure 31.

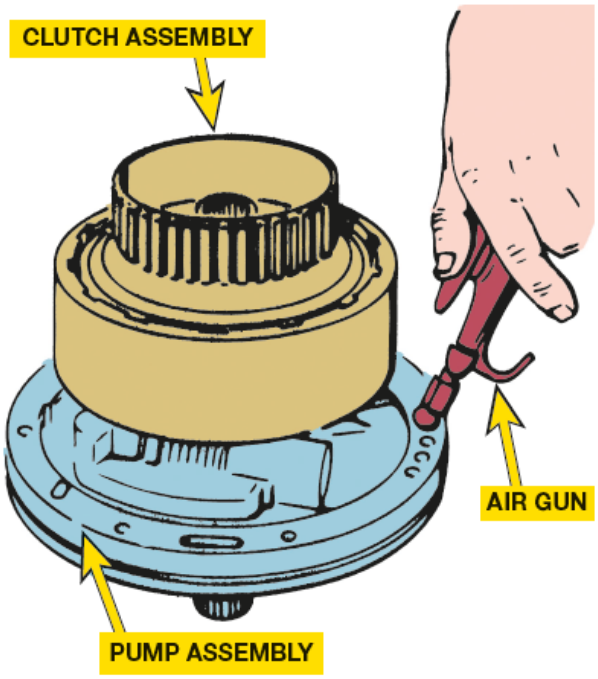

Figure 31. Air testing a clutch assembly.

Clutches When air is applied to a clutch, a “kachunk” noise indicates the clutch applied. Removal of the air gun should result in the sound of a clutch release.

Band servos When air is applied, the band should apply with a very small amount of air leakage. Removal of the air gun from the passage should result in band release.

4. Inspect components of one-way clutch assemblies; determine needed actions or repairs.

One-way clutches are visually inspected during transmission disassembly and reassembly. The commonly encountered problems are severe wear from poor lubrication or metal fragments peeling from a failed part or wear or scoring of the race(s), rollers, or sprags. After assembly, they should be tested to ensure that they rotate freely in the proper direction and lock up in the opposite direction. Figure 32.

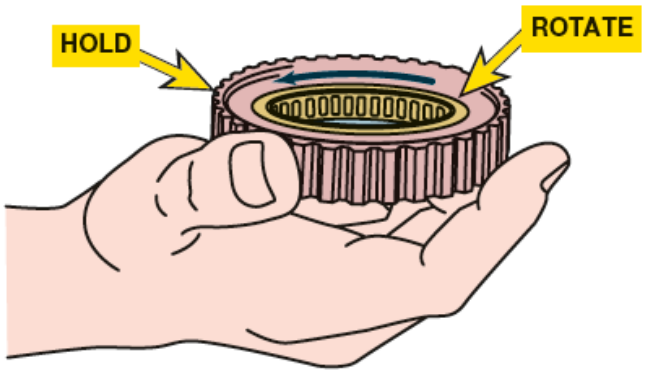

Figure 32. Service information states that this one-way roller clutch should be installed as shown. Check by holding the outer race so that the inner race is free to rotate counterclockwise as shown.

5. Inspect bands and drums (housings/cylinders); replace and/or adjust as necessary.

A band is a circular strip of metal that has lining bonded to the inner surface. It wraps around the smooth outer surface of a drum. When applied it keeps the drum from rotating. Figure 33.

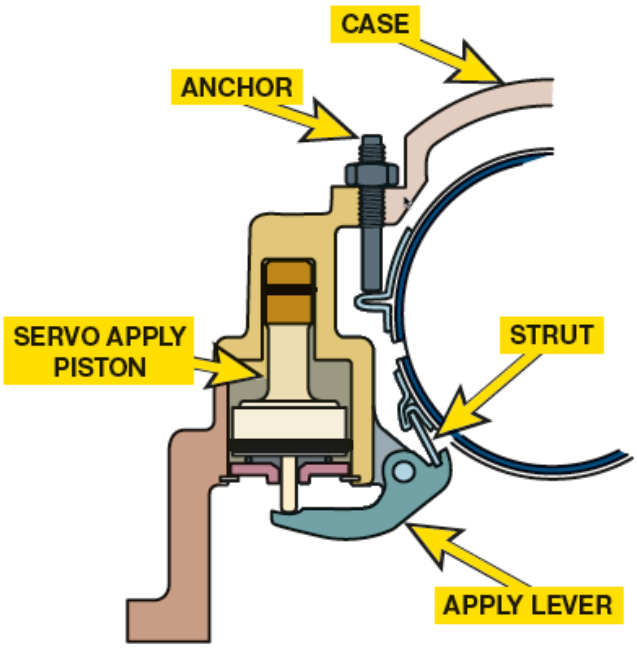

Figure 33. Band and servo assembly. A non-adjustable band will have a second strut in place or the adjusting screw.

Most bands use thin linings and are not adjustable. Some older transmissions have threaded adjusters extending through the case to allow adjustment of the band. Service information should be checked to determine the exact adjustment procedure for each particular vehicle. To readjust a band, the usual procedure includes the following steps:

STEP 1 Loosen the lock nut on the adjuster screw several turns.

STEP 2 Tighten the adjuster screw to the specified torque. Figure 34.

STEP 3 Mark the adjusting screw position, and then back it off the specified number of turns. Hold the adjuster screw stationary and retighten the lock nut to the specified torque.

STEP 4 Road test the vehicle to check the adjustment.

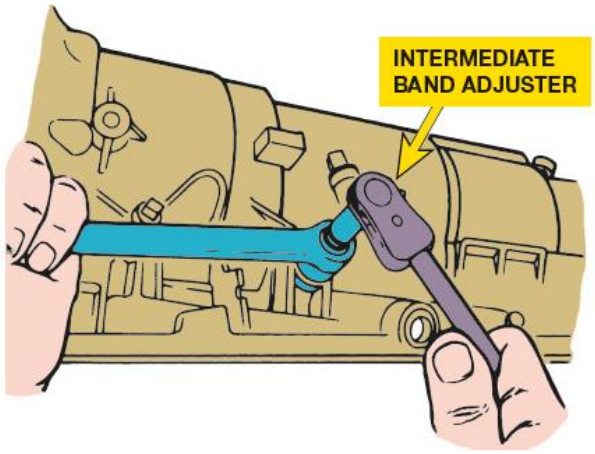

Figure 34. Band adjustment.