INTRODUCTION

Not all mechanical faults require that the automatic transmission/transaxle be removed from the vehicle. Faults that can usually be repaired with the unit still in the vehicle include any valve-body-related concerns.

Depending on the transmission/transaxle, it may be possible to disassemble and repair many mechanical components of the unit while it remains in the vehicle. Parts and components that may be replaced with the transmission/transaxle still in the vehicle include the following:

- Pressure switches
- Transmission range switch
- Turbine and output speed sensors
- Extension housing gasket
- Drive axle seals
- Valve body replacement

ASE TEST TOPICS

1. Inspect, adjust, and replace manual valve shift linkage, cables, bushings, and transmission range sensor/switch (inhibitor/neutral safety switch).

The manual linkage is adjustable on most automatic transmissions. This ensures the manual valve is positioned correctly relative to the gear selector. Detents are internal to the transmission and keep the manual valve aligned with the selected position.

The manual linkage should be adjusted if the starter engagements occur in the wrong position or the transmission detents do not align correctly relative to the gear range pointer. The procedure will vary with vehicle makes and models. Figure 1.

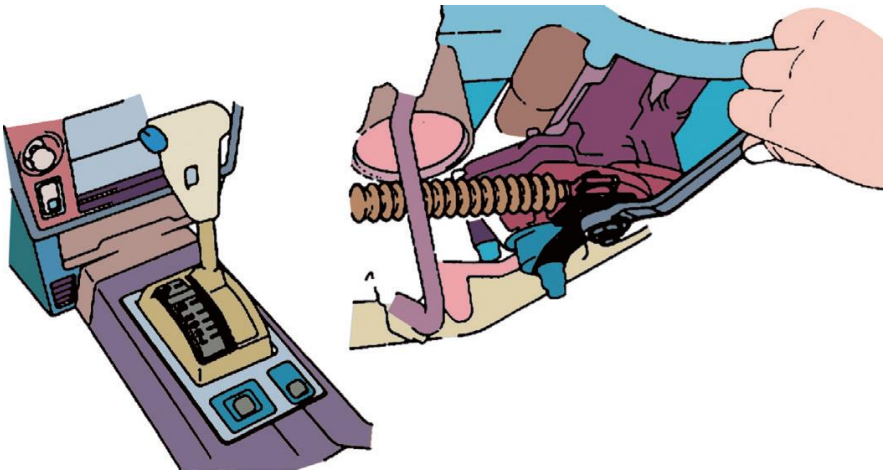

Figure 1. With the selector in Park, adjust the cable under the vehicle to match.

The transmission range (TR) switch (sensor) is used as an input to the PCM/TCM, which indicates the drive range requested by the driver. The transmission range switch is usually located on the outside of the case on the transmission/transaxle housing and attached to the shifter. As the gear range selector is moved, the TR switch can make a variety of switch connections for each gear range. These inputs allow the TCM to determine which gear range has been selected. Figure 2.

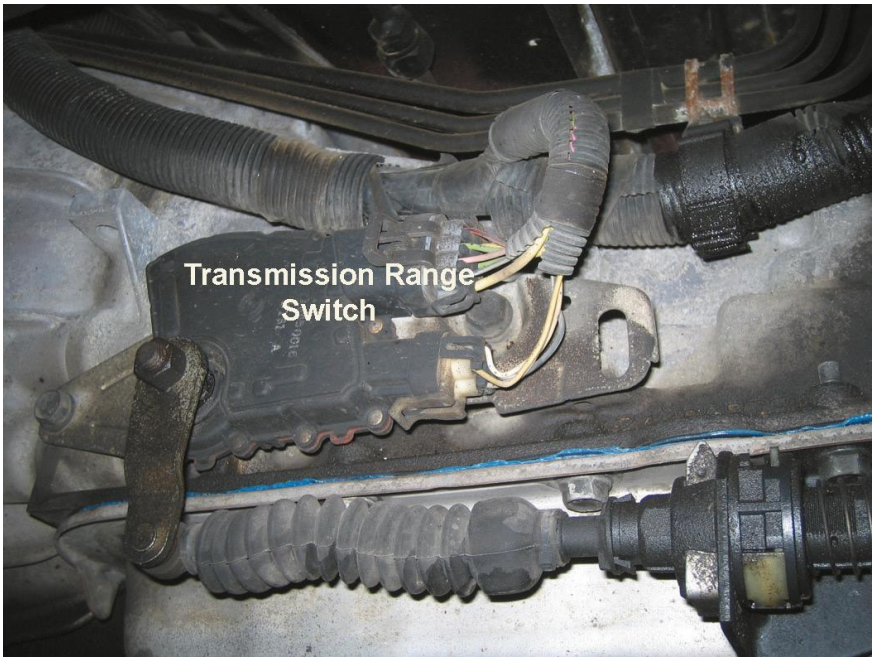

Figure 2. TR switch on the side of the transmission.

2. Inspect and replace external seals and gaskets.

A chisel, slide hammer, or seal puller can be used to remove a seal after the shaft has been removed. Be careful when installing the seal over a shaft or a shaft into a seal. The sharp lip of the seal is easily cut or torn. The lip of the seal should always be lubricated to prevent wear. Automatic transmission assembly lube, petroleum jelly, or automatic transmission fluid (ATF) can be used for a lubricant. Figure 3.

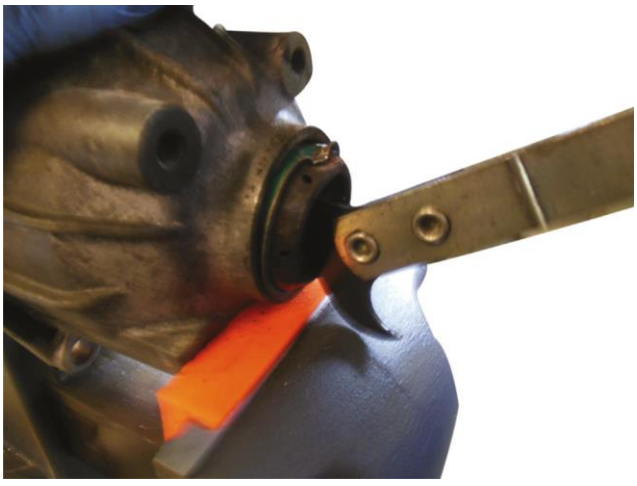

Figure 3. Seal puller.

3. Inspect and replace driveshaft yoke, drive axle joints, bushings, and seals.

The driveshaft must travel up and down as the vehicle moves over bumps and dips in the road while rotating and transmitting engine power to the drive wheels. The driveshaft and universal joints should be carefully inspected during transmission repair.

The best way to check the yoke and U-joint is to remove the driveshaft from the vehicle and move each joint in all directions. A good U-joint should be free to move without binding. One way to replace the transmission yoke is to use a vise and two sockets to remove the U-joint. One socket fits over the bearing cup and the other fits on the bearing to press-fit the cups from the crosspiece. Figure 4.

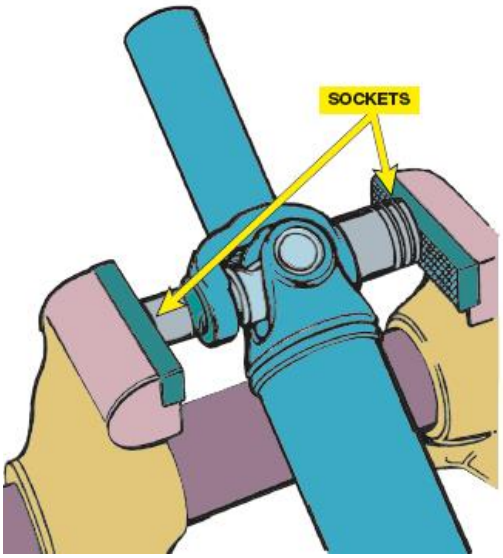

Figure 4. Removing the yoke using sockets and a bench vise.

Front-wheel-drive (FWD) vehicles use drive axles with constant velocity (CV) joints at the front wheels. The outer joints are attached to the front wheels. They are more likely to suffer from road hazards that often can cut through the protective outer flexible boot. The most common repair is to replace the complete drive axle. Figure 5.

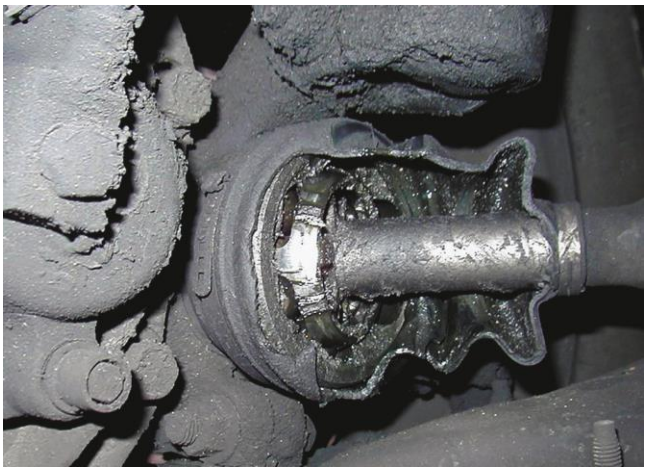

Figure 5. FWD outer CV joint damage.

4. Check condition and operation of engine cooling system; inspect transmission cooler/warmer, thermostat(s), thermal bypass valve(s), control valves, lines and fittings.

Probably the greatest problem for transmission fluid is heat. Excess heat significantly shortens the life of ATF. Excess temperatures cause the fluid to break down and form gum or varnish. This can cause valve sticking or reduce the fluid flow in certain circuits. All automatic transmissions use a cooler to help remove excess heat. Figure 6.

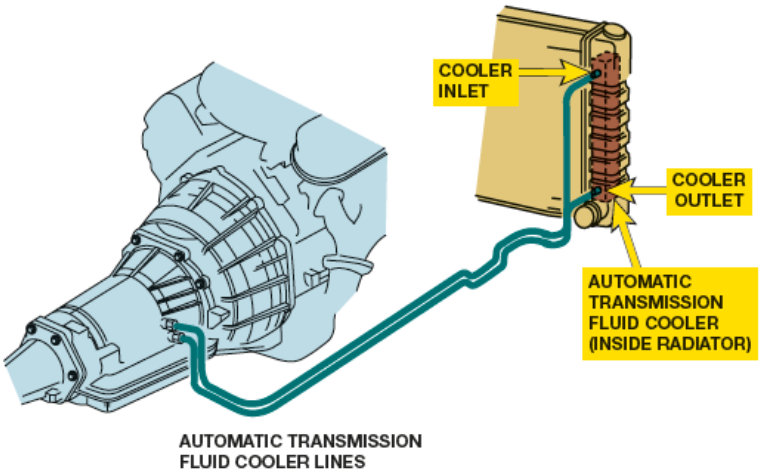

Figure 6. Fluid cooling system.

Transmissions are expected to perform over a wide range of temperatures. Cold fluids are much thicker than hot fluids. On a cold day, the first shifts tend to be sluggish because the fluid moves slowly through the orifices and small openings. Some transmissions use fluid heaters to improve cold operation. Figure 7.

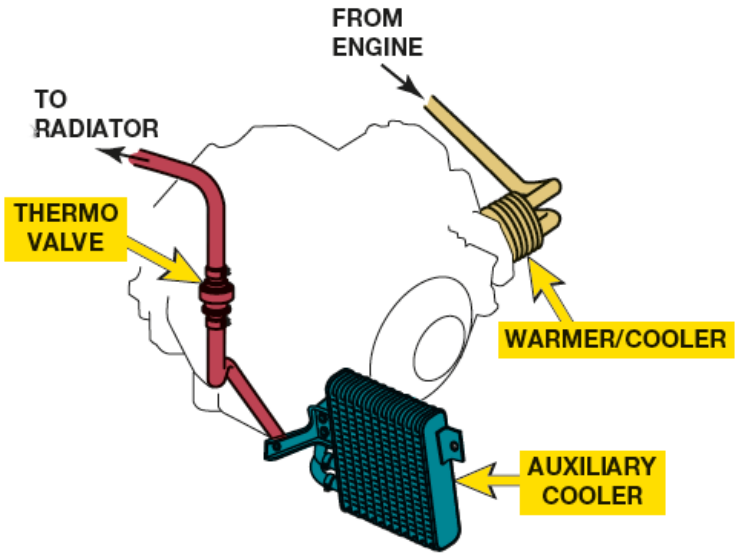

Figure 7. ATF warmer/cooler. Engine coolant from the engine block flows through the passages in the warmer/cooler. The thermostatic valve improves the ATF warm-up times and maintains ATF temperature within the optimum operating range between 170°F and 180°F (77°C and 82°C).

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

6. Torque valve body fasteners to specification using the proper sequence.

The valve body in most rear-wheel-drive transmissions is located inside the transmission oil pan at the bottom of the case. A transaxle valve body may be at the bottom of the case, on the backside of the torque converter housing, or on the top or side of the transaxle housing depending on the specific application.

Despite its complexity, the valve body is one of the more reliable parts in a transmission, probably because the valves are so well lubricated. In a way, valves do little, as they move only slightly and only once in a while. Figure 8. The biggest “enemies” of a valve body include the following:

- Dirt (from dirty fluid or dirt getting into the fluid through the dipstick tube or opening).
- Overheated fluid, which can cause varnish buildup on the valves and bores.
- Solenoids can fail and being magnetic, can attract iron and steel particles which can restrict their flow and prevent them from working properly in many cases.

Most valve body service operations consist of the following:

- Disassembly
- Cleaning
- Checking for free movement
- Replacing defective solenoids
- Replacing all filter screens
- Reassembly

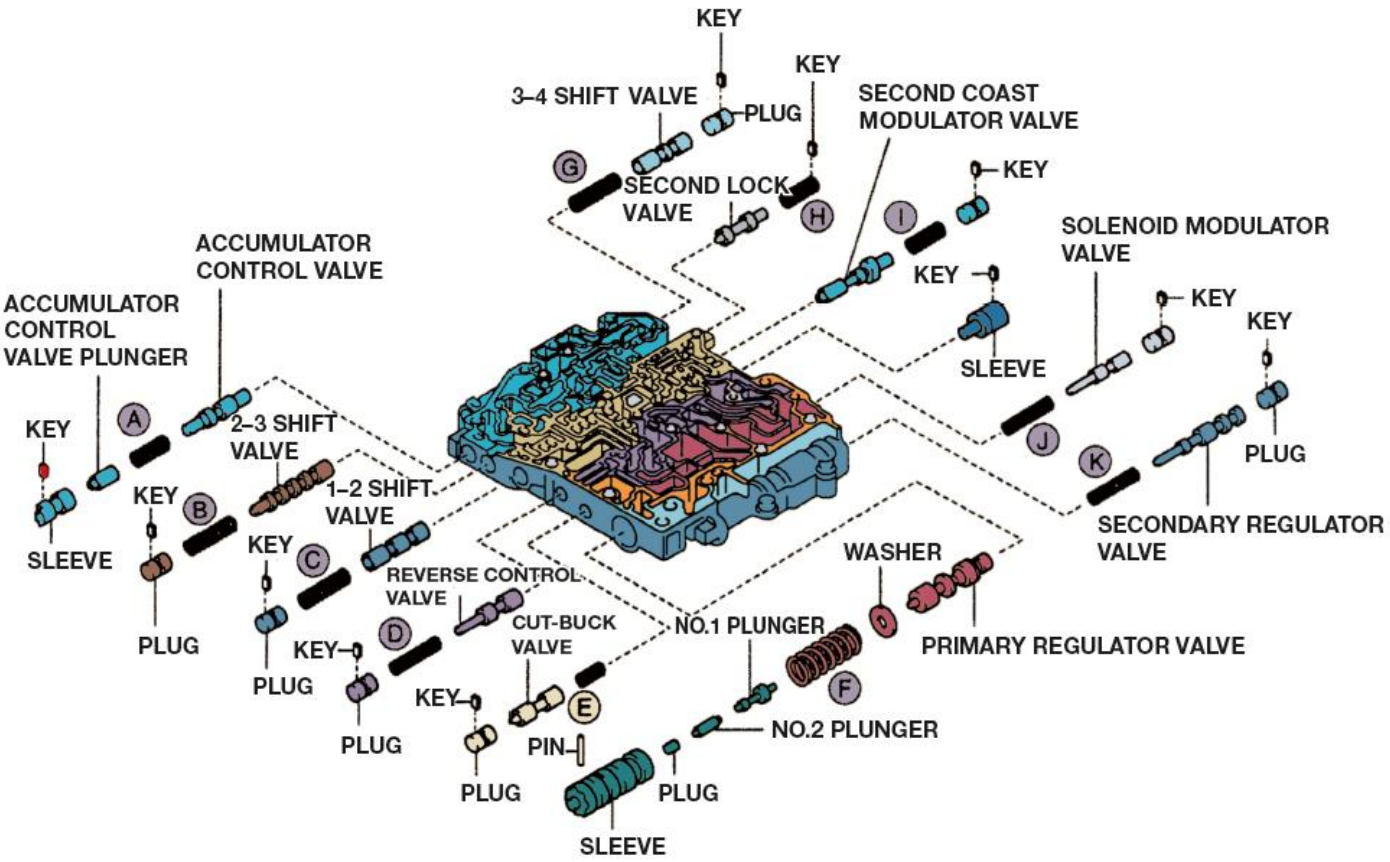

Figure 8. Typical valve body, valves, and retainers.

Most technicians place a lint-free shop cloth(s) or a carpet scrap under the valve body while disassembling it. The cloth helps keep the check balls, screws, and pins from rolling away and might prevent a nick or dent in a valve if one happens to drop.

The free fall test is a standard check for a sticking valve. Hold the valve body so the bore is vertical. In this position, a steel valve should fall freely from one end of the bore to the other and it should at least fall through the area of normal valve movement. Any valve that does not fall freely is sticking, which can be a fault of the valve, the bore, or both. Figure 9.

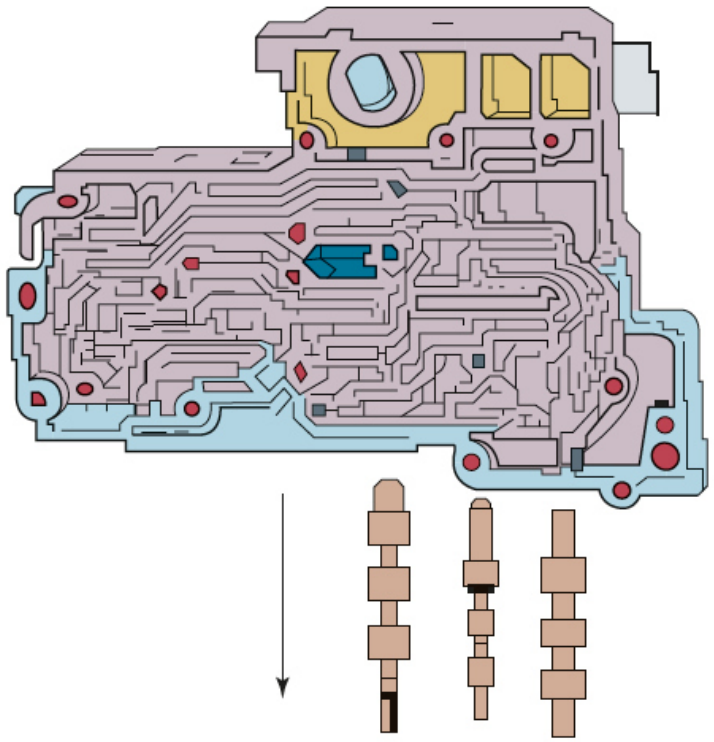

Figure 9. Free fall test.

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).

When installing the valve body be sure to tighten each fastener to the correct torque, usually with an inch/pound torque wrench. The bolts should be tightened in the proper sequence as shown in service information. Figure 10.

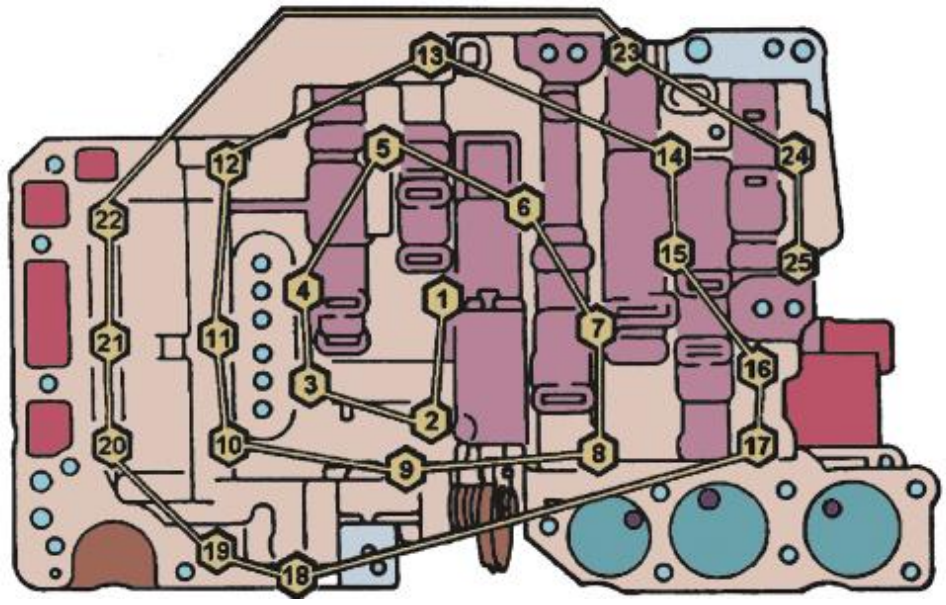

Figure 10. The valve body bolts should be tightened in order, usually starting from the center and working in an outward spiral.

7. Inspect accumulator and servo bores, pistons, seals, pins/pin bores, springs, and retainers; determine needed actions or repairs.

Each accumulator has its own spring and piston configuration. They may look alike, but there are slight differences. Improper assembly will cause shift timing and quality problems. Figure 11. Accumulator bore size can be checked by placing the accumulator into its bore and filling the passages with ATF. The bore should be repaired if the fluid leaks out too quickly.

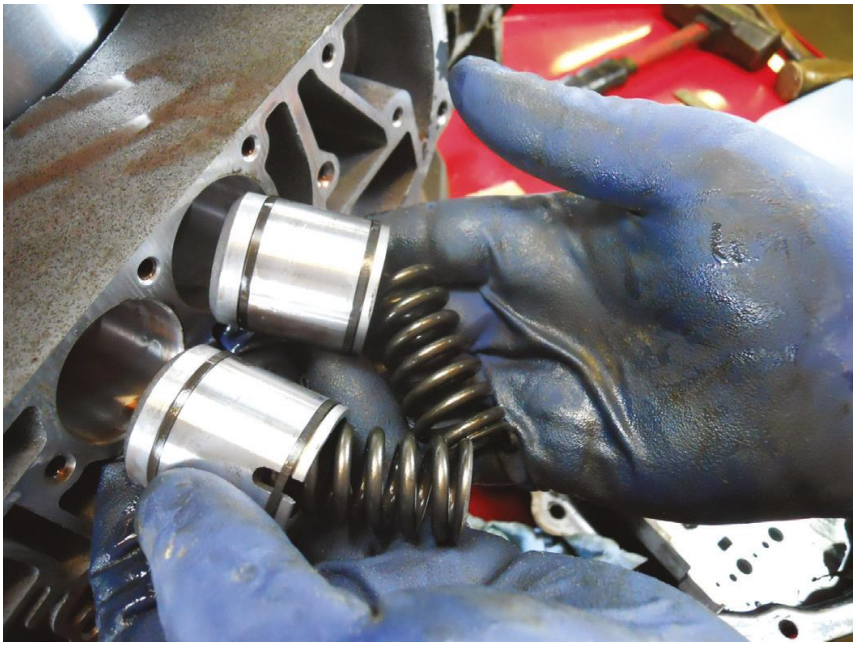

Figure 11. The accumulators used in a Chrysler 41TE look the same but use different springs.

8. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits including control modules, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; inspect, test, and verify control module inputs, outputs, and data communications.

A digital voltmeter (DVM) measures the pressure or potential of electricity in units of volts. A voltmeter is connected to a circuit in parallel. Voltage can be measured by selecting either AC or DC volts. The DC volts (DCV) setting is the most common for automotive testing. Use this setting to measure battery voltage and voltage to all lighting and accessory circuits. Figure 12.

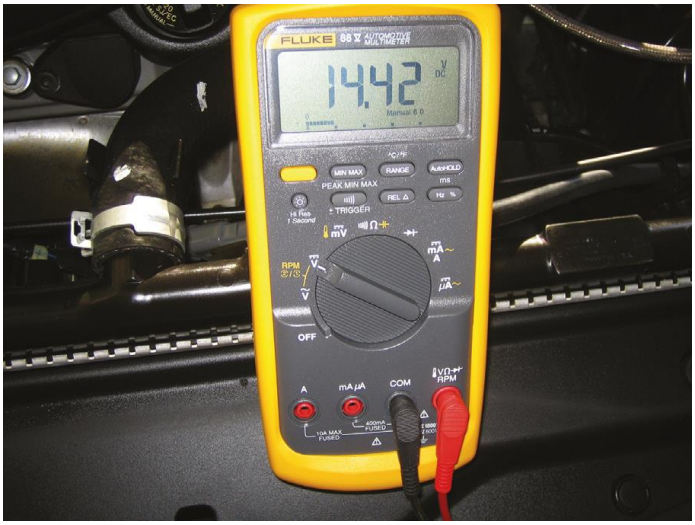

Figure 12. A digital voltmeter measuring battery voltage.

An electronic system cannot function without adequate power or a good ground. The power and ground connections are often overlooked. After determining there is a problem in the electronic system, check B+ voltage at the battery and then at the TCM and transmission power relay if there is one. There should be at least 12.6 volts with the engine off and 13.6 to 15 volts with the engine running. Figure 13.

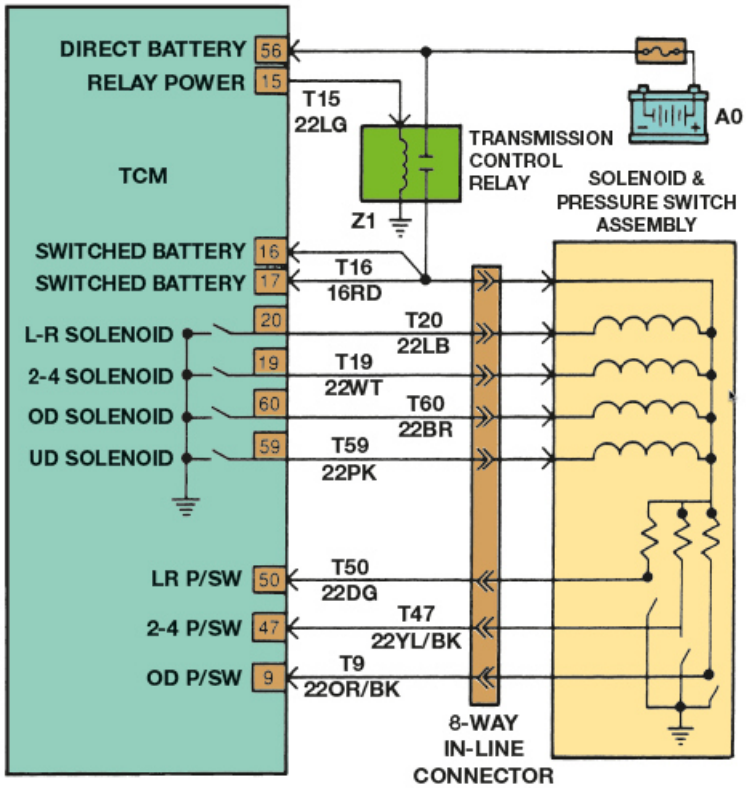

Figure 13. TCM terminals 16 and 17 receive B+ when the transmission relay is energized.

Shift solenoids control the pressure force which in turn controls the position of the shift valves. In Figure 14, ohmmeter A is checking for a grounded solenoid coil; the reading should be infinite. Ohmmeter B is measuring the coil resistance; it should be within the specifications for this solenoid.

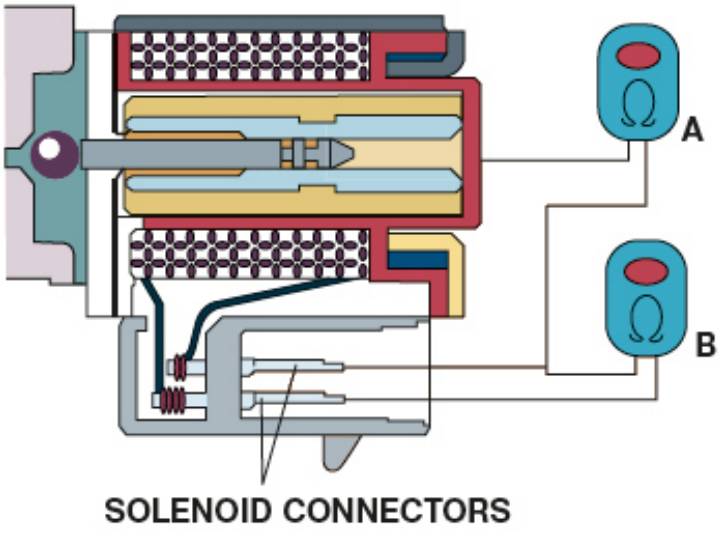

Figure 14. Checking shift solenoid resistance.

Since the 1990s, vehicles have used modules to control the operation of most electrical components. A typical vehicle will have 10 or more modules, and they communicate with each other over data lines or hard wiring, depending on the application. Faults in these systems can cause transmission concerns. Figure 15.

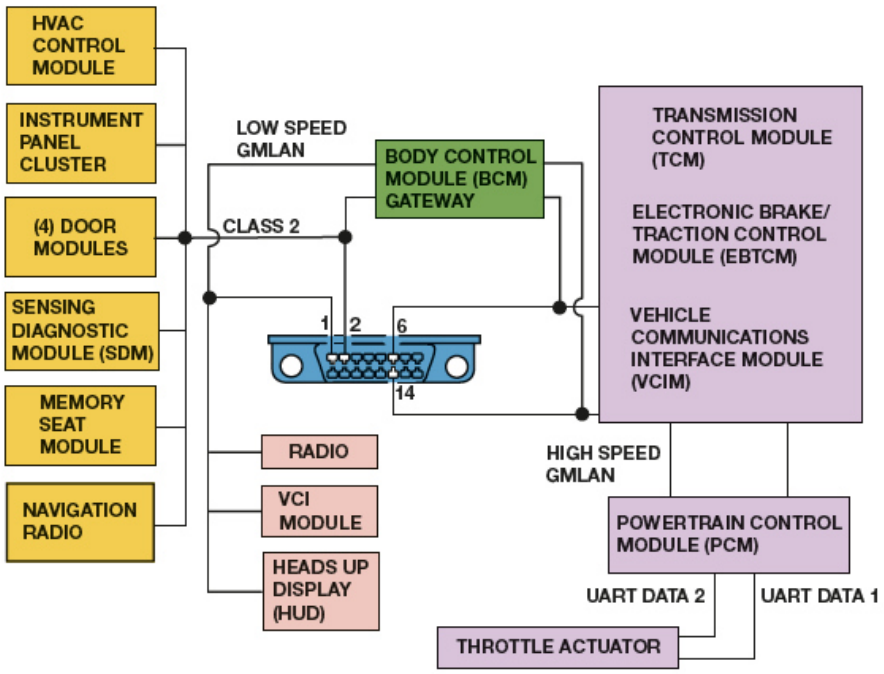

Figure 15. A typical network system shows the transmission control module (TCM)communicates with the PCM over the high speed GMLAN bus.

9. Inspect, replace, and/or align power train mounts.

Powertrain mounts often require replacement due to damage or wear. Defective powertrain (engine and transmission) mounts are replaced by lifting the engine and/or transmission slightly to remove the weight and then removing the mounting bolts. The old mount is then removed, and the new mount is installed. Figure 16.

Figure 16. Replacing a power train mount.

The mount for a rear-wheel-drive (RWD) transmission is aligned by the bolts through slotted holes in the mount. Alignment is required so the engine, transmission, and exhaust system do not contact the frame or body.

10. Replace fluid and filter(s); verify proper fluid level and type (for transmissions with, or without, a dipstick).

Most manufacturers recommend fluid changes every 100,000 miles (160,000 km) under normal driving conditions. Some recommend a fluid change at 50,000 miles (80,000 km). Fluid change recommendations are usually accompanied with a recommendation that the change interval be shortened to as low as 15,000 miles (24,000 km) when the vehicle is used under severe driving conditions.

The procedure for changing the fluid on a specific vehicle can be found in service information. In general, the procedure usually includes the following steps:

STEP 1 Safely hoist the vehicle.

STEP 2 Select the best direction for fluid to spill from the pan. Place a large drain pan in this area and remove all but two of the pan bolts. The remaining two bolts should be at the end away from the drain pan and they serve as the “hinge” for lowering the pan. Figure 17.

Figure 17. Drain the fluid. Some vehicles have a transmission drain plug.

STEP 3 Remove the remaining two bolts and finish draining the pan.

STEP 4 Remove the filter, which is usually attached to the valve body. Watch for any small parts that may come loose with the filter. Set aside the old filter for comparison with the new filter.

STEP 5 Inspect the pan, filter, and pan magnet for debris and varnish buildup. The magnet in most automatic transmission pans is used to collect steel particles to keep them from getting circulated throughout the transmission/transaxle.

STEP 6 Install a new filter using a new gasket or O-ring, and tighten the mounting bolts to the correct torque, if equipped. Some filters use a retaining clip. Figure 18.

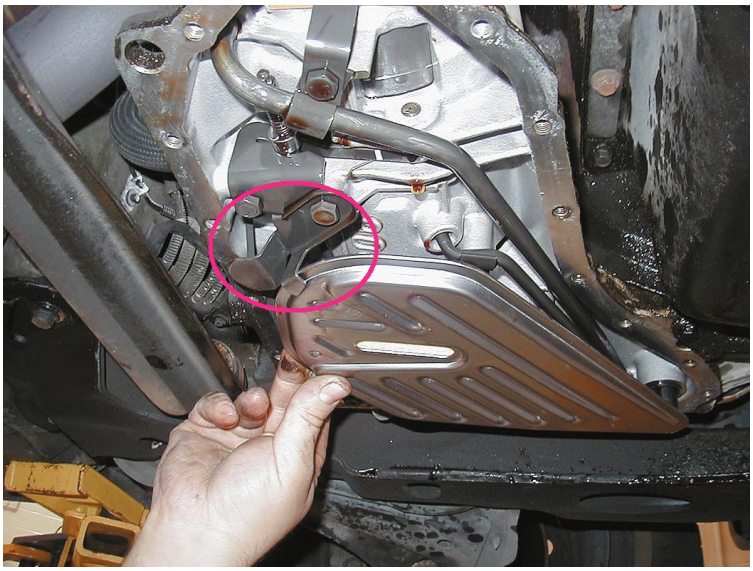

Figure 18. Install the filter and retaining clip.

STEP 7 Clean the oil pan and check and straighten if needed any bends at the pan bolt holes.

STEP 8 Install a new gasket on the pan and install the pan on the transmission.

STEP 9 The bolts should be tightened in a back-and-forth, across-the-pan sequence to the specified torque.

STEP 10 Lower the vehicle and add the proper amount of fluid. A rule of thumb is 4 quarts. Start the engine and check the fluid level. Add additional fluid to correct the level if necessary.

STEP 11 Dispose of the old transmission fluid according to Federal, State, and local laws and regulations.