INTRODUCTION

The clutch assembly is located between the engine and the transmission/transaxle. The main purpose of a clutch is to disconnect engine power from the transmission/transaxle to permit the engine to remain running when the vehicle is stopped with the transmission in gear and to permit the transmission/transaxle to be shifted. Figure 1.

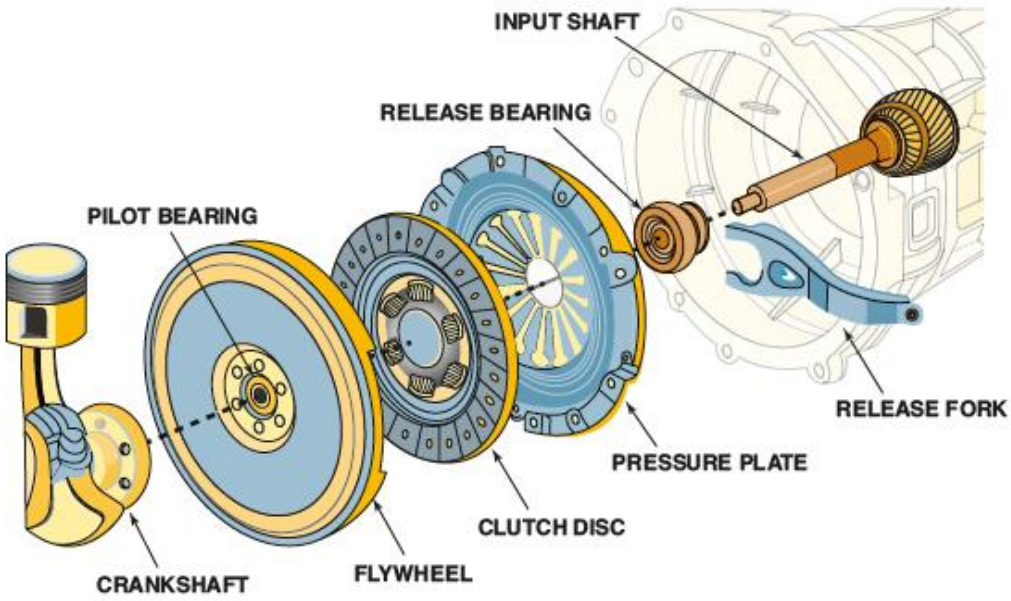

Figure 1. The clutch disconnects or connects the engine flywheel to the transmission input shaft.

A clutch assembly consists of a clutch disc that is splined to the input shaft of the transmission/transaxle. When the driver depresses the clutch pedal, a release bearing, also called a throwout bearing, is forced against the diaphragm spring, part of the clutch cover assembly. This lifts the pressure plate releasing the clutch disc. The clutch cover assembly is bolted to and rotates with the flywheel. Figure 2.

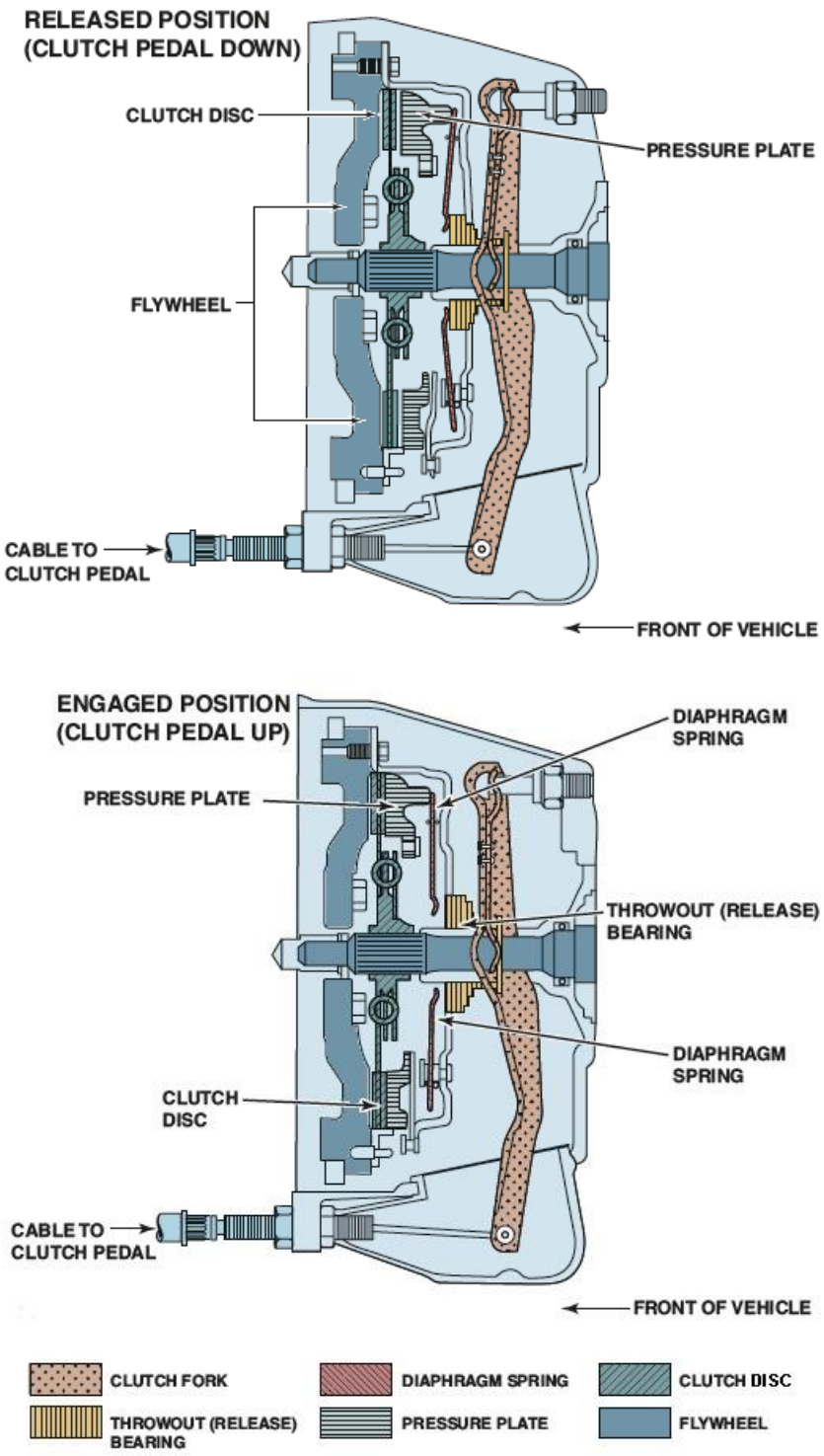

Figure 2. Clutch released (top) and clutch engaged (bottom).

ASE TEST TOPICS

1. Diagnose clutch noise, binding, slippage, pulsation, chatter, pedal feel/effort, and release problems; determine needed repairs.

To check for clutch slippage, shift the transmission into a high gear and let out the clutch pedal smoothly. The engine should stall immediately. A delay indicates slow engagement and slipping.

Hard shifting into gear from neutral, sometimes accompanied by gear clash, can be caused by a clutch that is not releasing completely. With the engine running at idle speed and the transmission in neutral, push in the clutch pedal, wait two seconds, and shift the transmission into reverse (a non-synchronized gear). The shift should occur silently. Gear clash or grinding indicates a dragging clutch.

Some other possible clutch problems:

- Clutch grabs. Possible causes include the following:
  - Clutch disc has oil on the surface.
  - Clutch linkage is binding.
- Clutch noises. Possible causes include the following:
  - Pilot bearing is defective or worn.
  - Release bearing is defective or worn.

2. Inspect, adjust, and replace clutch pedal linkage, brackets, bushings, pivots, springs, and electrical switches/sensors.

The typical maintenance and service items for clutch linkage includes the following:

- Checking clutch pedal free travel or free play
- Inspecting mechanical linkage systems Figure 3.
- Checking the fluid level in hydraulic systems.

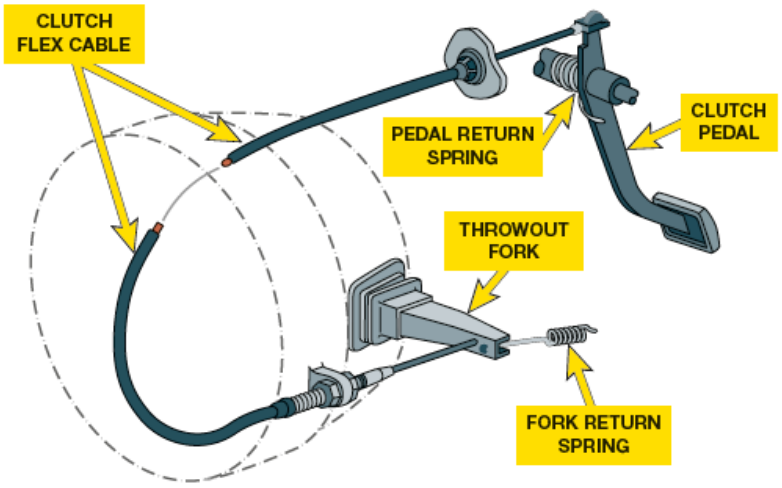

Figure 3. Clutch cable and pedal assembly.

A clutch pedal position switch is used to signal the starter circuit that the clutch is disengaged which prevents starter operation unless the clutch pedal is depressed. Figure 4.

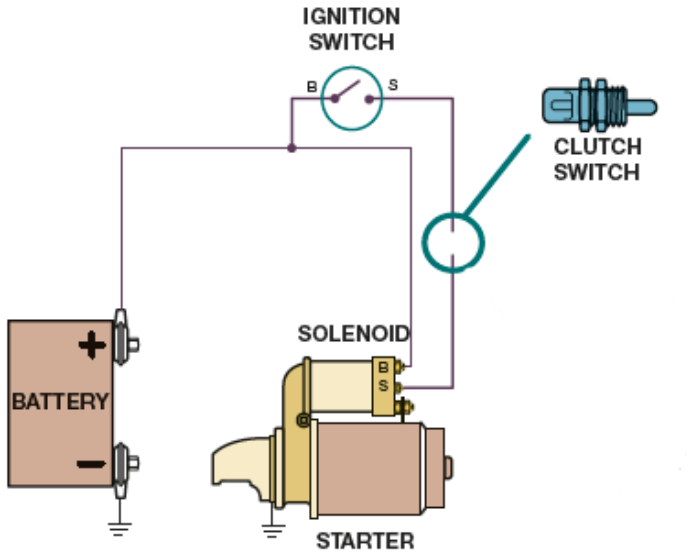

Figure 4. Check the clutch switch plunger and wiring.

3. Inspect, adjust, replace, and bleed hydraulic clutch slave/release cylinder, master cylinder, lines, hoses, delay valve(s) and accumulator/damper; clean and flush hydraulic system; refill with proper fluid.

A small clutch master cylinder, located on the bulkhead and operated by the clutch pedal, and an actuator cylinder located near the release (throwout) bearing is a very common method of connecting the clutch pedal to the release fork. Some vehicles use an actuator cylinder that is mounted on the exterior of the bell housing. Many systems use an actuator cylinder that is concentric to the bearing retainer and has the release bearing connected directly to it. Figure 5.

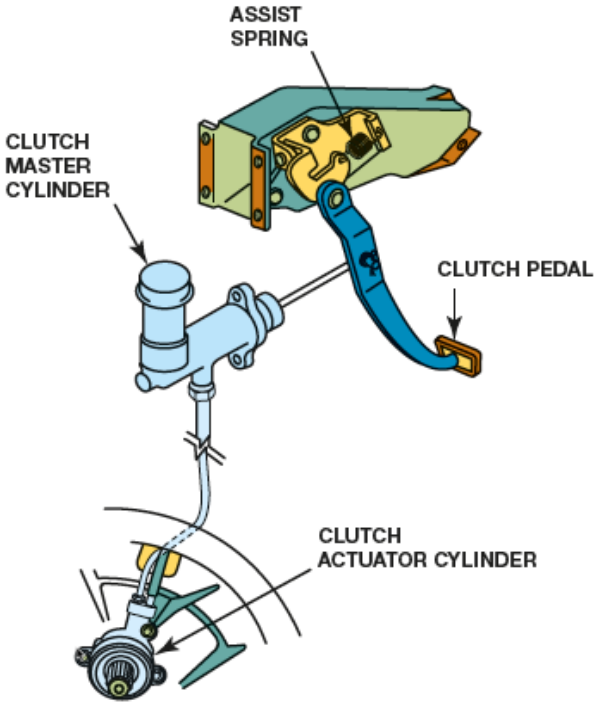

Figure 5. Hydraulic clutch system.

Clutch hydraulic fluid level is checked by looking at the fluid level at the clutch master cylinder reservoir. Many reservoirs will be marked to indicate the correct fluid level. Brake fluid meeting the DOT 3 designated specification is the most commonly used fluid used in hydraulic clutch systems.

In many cases, a clutch hydraulic system can be bled by gravity bleeding while in others, a helper may be needed. Figure 6.

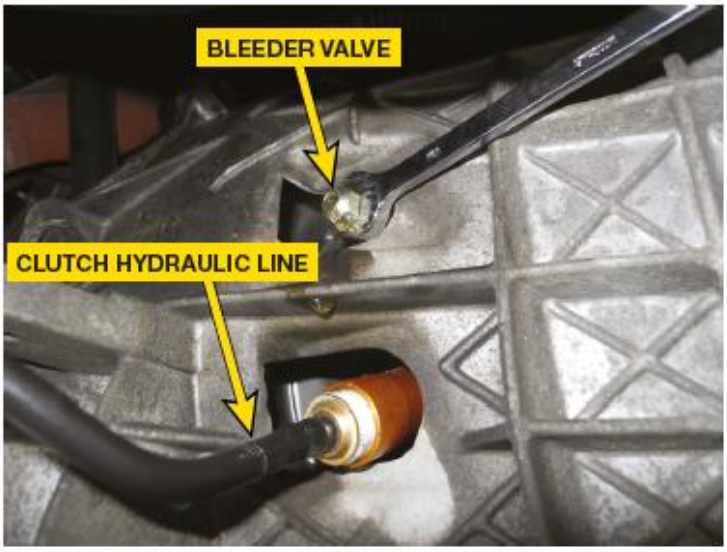

Figure 6. Open the bleeder valve to release any trapped air.

4. Inspect, adjust, and replace release (throw-out) bearing, bearing retainer, lever, and pivot.

The release (throwout) bearing rides on the transmission front bearing retainer. The release bearing presses against the diaphragm spring fingers. This lifts the pressure plate so that it no longer clamps the friction disc against the flywheel. The release bearing is the point where the fixed, stationary clutch operating system meets the rapidly spinning clutch assembly. Figure 7.

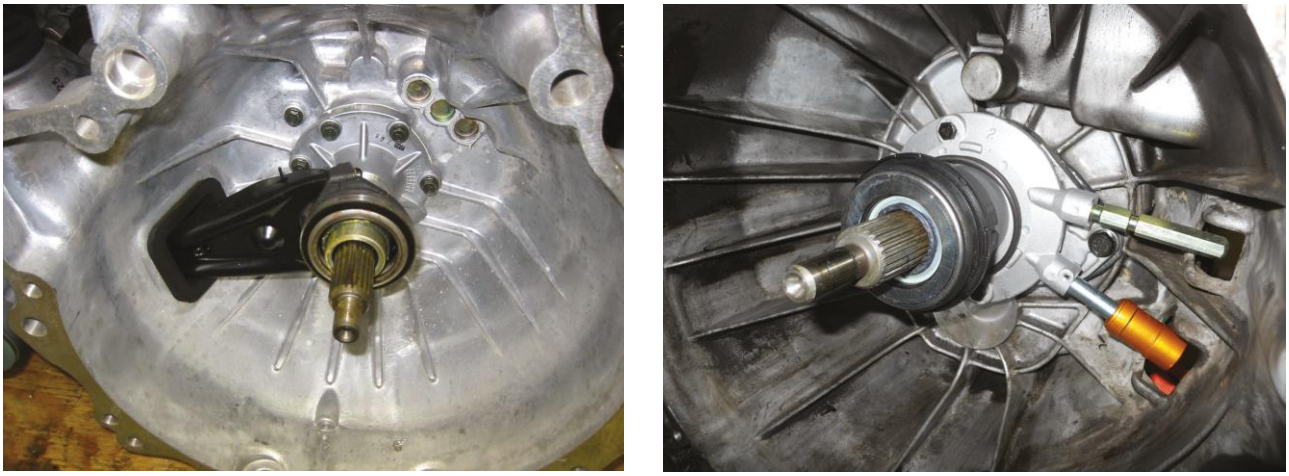

Figure 7. Release bearing and fork (left) and combined actuator cylinder and release bearing (right).

Most clutch release bearings are ball bearings. Other than feeling for roughness or seeing obvious wear or discoloration, there are no effective bench checks for release bearings. This is the reason why they are normally replaced along with the disc and pressure plate.

5. Inspect, adjust and replace clutch disc and pressure plate assembly; inspect input shaft pilot and splines.

Clutch replacement normally involves replacing four items, Figure 8.

1. Pressure plate assembly
2. Clutch disc
3. Release bearing
4. Pilot bearing

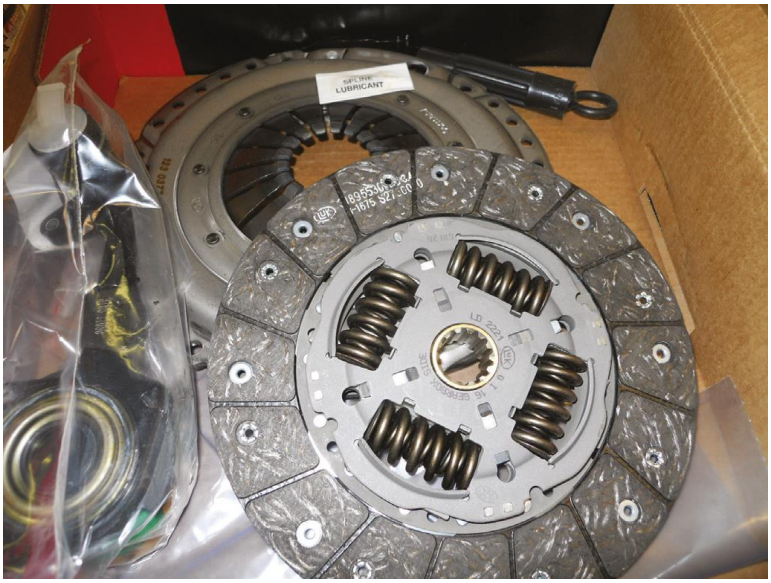

Figure 8. A typical clutch kit, which includes the clutch disc, pressure plate, and release (throwout) bearing as well as grease for the spline and a clutch disc alignment tool.

If installing a used disc, it should be checked for all of the following:

- Facing thickness
- Damper spring condition
- Wear of the hub splines

With a new disc, rivet head depth will be about 0.050 inch (1.2 mm). A disc with less than 0.015 to 0.020 inch (0.38 to 0.5 mm) should be replaced. Figure 9.

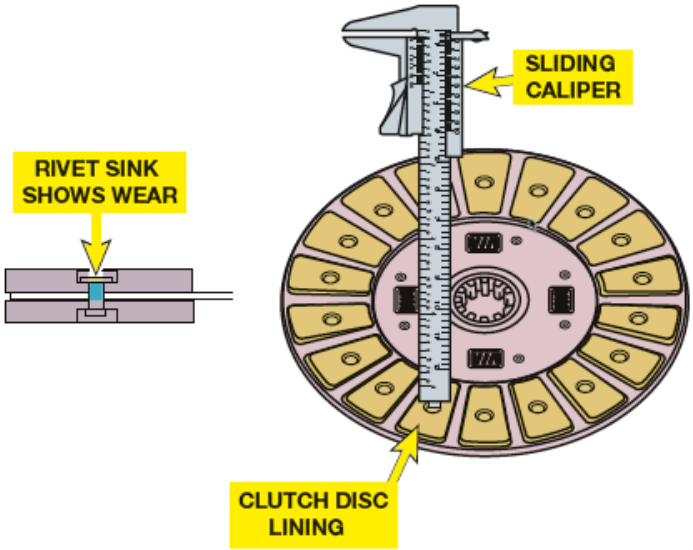

Figure 9. Checking clutch disc lining for wear.

6. Inspect pilot bearing/bushing inner and outer bores; inspect and replace pilot bearing/bushing.

The engine end of a transmission input (clutch) shaft is supported by a pilot bearing that is pressed into the end of the crankshaft. Figure 10.

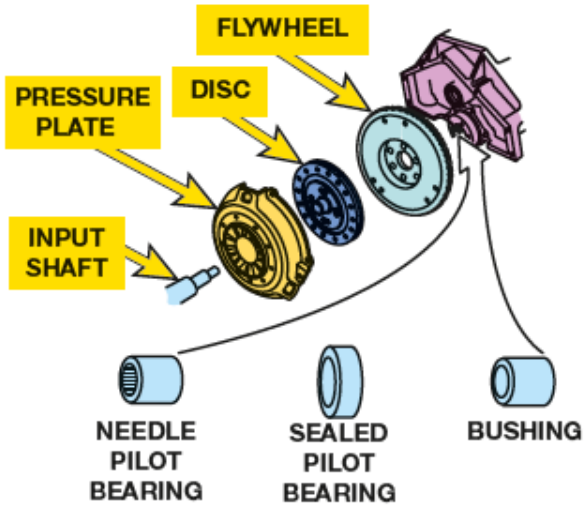

Figure 10. Types of pilot bearings.

Vehicle manufacturers recommend the use of a special puller to remove the pilot bearing.

Front-wheel-drive vehicles with a transaxle usually have an input shaft supported by a pair of bearings and a short input shaft. This design does not need a pilot bushing or bearing to support the engine end of the input shaft.

7. Inspect and measure flywheel and ring gear; inspect dual-mass flywheel where required; repair or replace as necessary.

The friction surface of the flywheel should be checked for the following:

- Grooves
- Nicks
- Heat damage (discoloration or cracks caused by excessive heat)

Any of these indicates that the flywheel needs to be resurfaced or replaced.

An external ring gear is pressed or welded onto the flywheel along its outer circumference. The ring gear should be inspected for worn or chipped gear teeth. Figure 11.

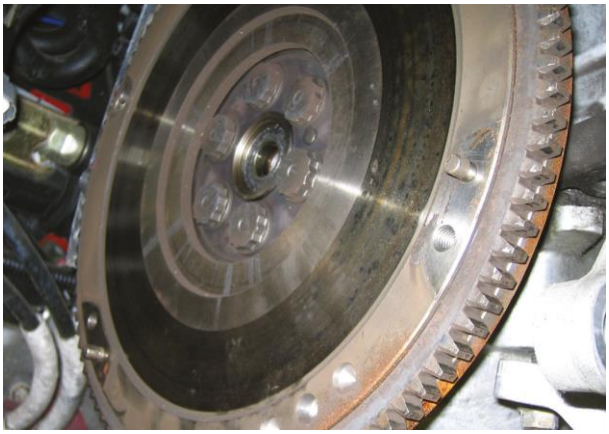

Figure 11. Inspect the ring gear teeth.

A dual mass flywheel consists of two separate flywheels connected at the center, with damper springs, friction material, and ball bearings between the two that allows some movement between the primary and secondary flywheel. By allowing a slight amount of movement between the two flywheels, the damper springs absorb engine torque peaks and normal vibration to provide smoother drive train operation. Figure 12.

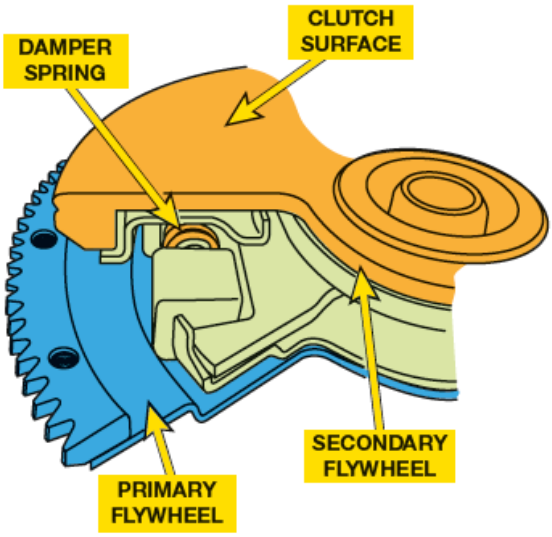

Figure 12. Dual-mass flywheel.

If the dual-mass flywheel fails, the symptoms are rattling or clunking noises during clutch engagement, vibrations, and reduced performance.

8. Inspect engine block, clutch (bell) housing, transmission case mating surfaces, and alignment dowels; inspect engine core plugs, rear main engine seal, and other sources of fluid contamination; determine needed repairs.

There should not be any oil or grease residue inside the bell housing. If oil is present, check for a leaking front bearing retainer seal, engine oil galleys plugs, back of the intake manifold, or rear main bearing seal. Figure 13.

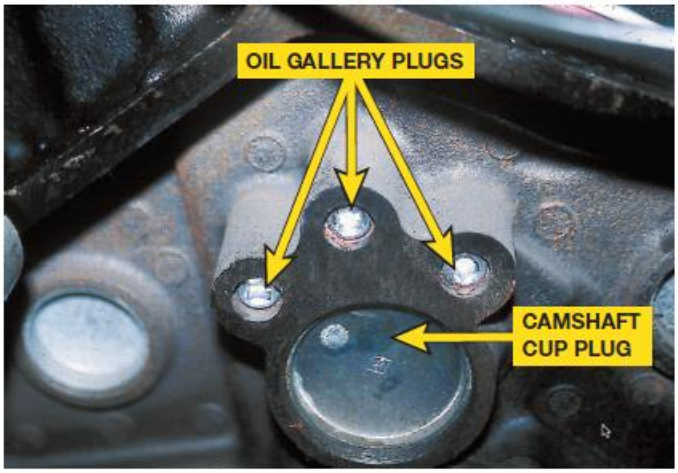

Figure 13. Check oil gallery plugs for leaks.

If there has been early failure of the pilot or release bearings, clutch pedal vibration, or the transmission is jumping out of gear, the face and bore surfaces of the bell housing should be checked for excessive runout and warpage.

9. Measure flywheel runout and crankshaft endplay; determine needed repairs.

The flywheel should be checked for excessive runout. Face or axial runout is checked by positioning a dial indicator with the indicating stylus at the outer edge of the flywheel face. Rotate the flywheel while watching the dial indicator. Maintain an even pressure, either inward or outward, to maintain zero crankshaft end play. The variation in reading is the amount of axial runout. Figure 14.

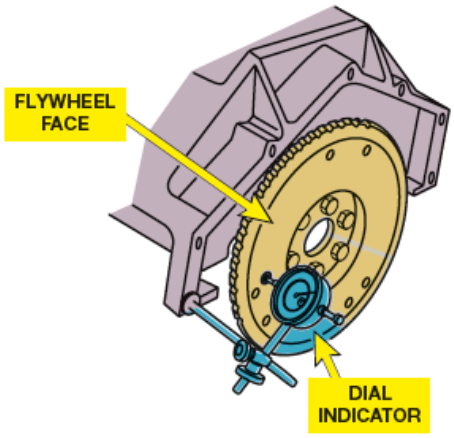

Figure 14. Measuring flywheel runout and crankshaft end play.

Push and pull on the flywheel in a direction that is parallel to the crankshaft. The dial indicator measures crankshaft end play, which should be about 0.002 to 0.010 inch (0.05 to 0.25 mm).

10. Inspect, replace, and align powertrain 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. The mount may need to be aligned using bolts through slotted holes in the mount or vehicle frame.