

DRIVE TRAIN

MANUAL TRANSMISSION

UNDERSTANDING THE MANUAL TRANSMISSION

Because of the way an internal combustion engine breathes, it can produce torque (or twisting force) only within a narrow speed range. Most overhead valve pushrod engines must turn at about 2500 rpm to produce their peak torque. Often by 4500 rpm, they are producing so little torque that continued increases in engine speed produce no power increases.

The torque peak on overhead camshaft engines is, generally, much higher, but much narrower.

The manual transmission and clutch are employed to vary the relationship between engine RPM and the speed of the wheels so that adequate power can be produced under all circumstances. The clutch allows engine torque to be applied to the transmission input shaft gradually, due to mechanical slippage. The vehicle can, consequently, be started smoothly from a full stop.

The transmission changes the ratio between the rotating speeds of the engine and the wheels by the use of gears. 4-speed or 5-speed transmissions are most common. The lower gears allow full engine power to be applied to the rear wheels during acceleration at low speeds.

The clutch driveplate is a thin disc, the center of which is splined to the transmission input shaft. Both sides of the disc are covered with a layer of material which is similar to brake lining and which is capable of allowing slippage without roughness or excessive noise.

The clutch cover is bolted to the engine flywheel and incorporates a diaphragm spring which provides the pressure to engage the clutch. The cover also houses the pressure plate. When the clutch pedal is released, the driven disc is sandwiched between the pressure plate and the smooth surface of the flywheel, thus forcing the disc to turn at the same speed as the engine crankshaft.

The transmission contains a mainshaft which passes all the way through the transmission, from the clutch to the driveshaft. This shaft is separated at one point, so that front and rear portions can turn at different speeds.

Power is transmitted by a countershaft in the lower gears and reverse. The gears of the countershaft mesh with gears on the mainshaft, allowing power to be carried from one to the other. Countershaft gears are often integral with that shaft, while several of the mainshaft gears can either rotate independently of the shaft or be locked to it. Shifting from one gear to the next causes one of the gears to be freed from rotating with the shaft and locks another to it. Gears are locked and unlocked by internal dog clutches which slide between the center of the gear and the shaft. The forward gears usually employ synchronizers; friction

members which smoothly bring gear and shaft to the same speed before the toothed dog clutches are engaged.

ADJUSTMENT

LINKAGE

4-SPEED TRANSMISSION

All terms used in the following procedure match those which are used in the accompanying illustration. No linkage adjustment is possible on the 5-speed transmissions.

1. Disconnect the negative battery cable at the battery.
2. Place the shift control lever (F) in Neutral.
3. Raise the vehicle and support it safely with jackstands.
4. Remove the swivel retainers (P) from the levers (E, H, and J).
5. Remove the swivels (S) from the shifter assembly (G), and loosen the swivel locknuts (R and T).

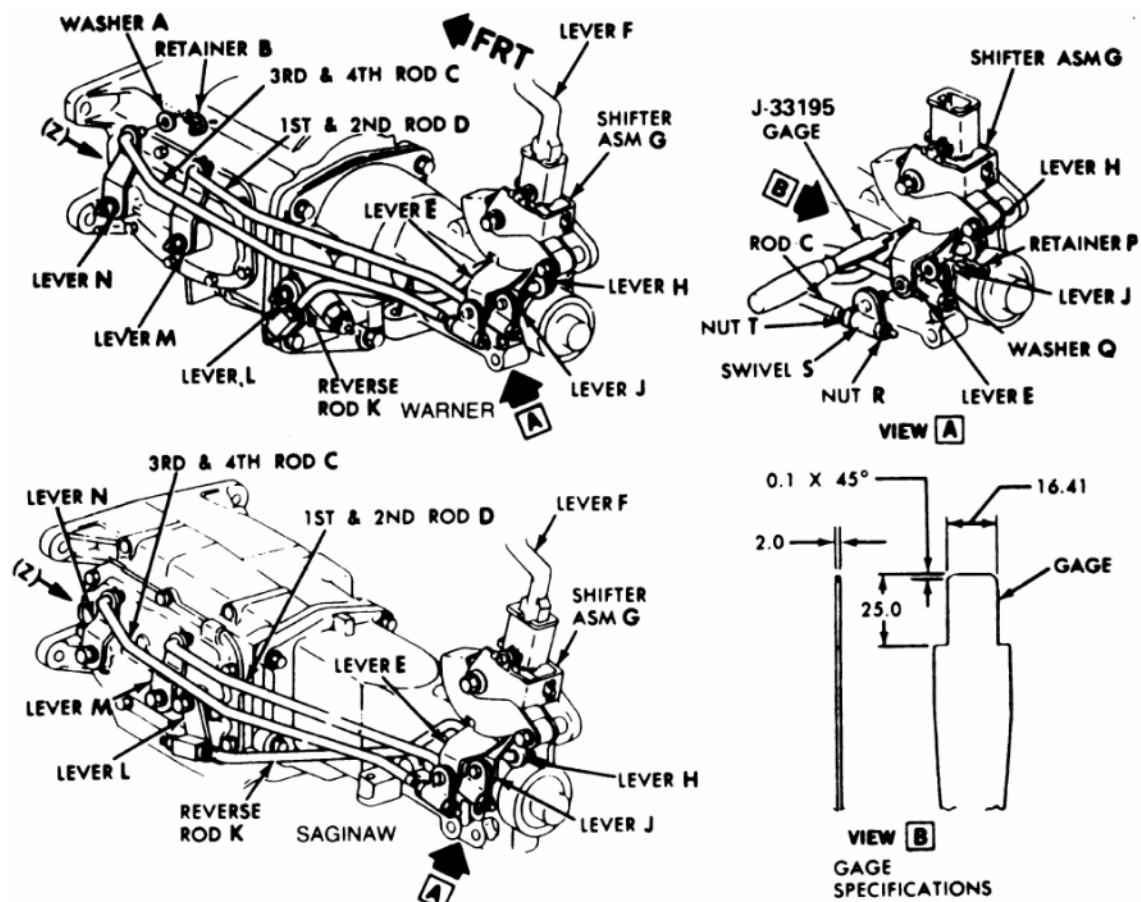


Fig. 1: 4-speed shift linkage adjustments

6. Make sure that levers L, M, and N are in their Neutral positions (center detents).
7. Align the holes of levers E, H, and J with the notch in the shifter assembly (G). Insert an alignment gauge (J-33195) to hold the levers in this position.
8. Insert swivel S into lever E and install washer Q. Secure with retainer P.
9. Apply rearward pressure (Z) to lever N. Tighten locknuts R and T (at the same time) against swivel S to 25 ft. lbs. (34 Nm).
10. Repeat steps 8 and 9 for rod D and levers J and M.
11. Repeat steps 8 and 9 for rod K and levers H and L.
12. Remove the alignment gauge, lower the vehicle, and check the operation of the shifting mechanism.
13. Reconnect the negative battery cable.

CLUTCH SWITCH

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Remove the sound insulator on 1988-89 vehicles or the console trim plate on 1990-92 vehicles.

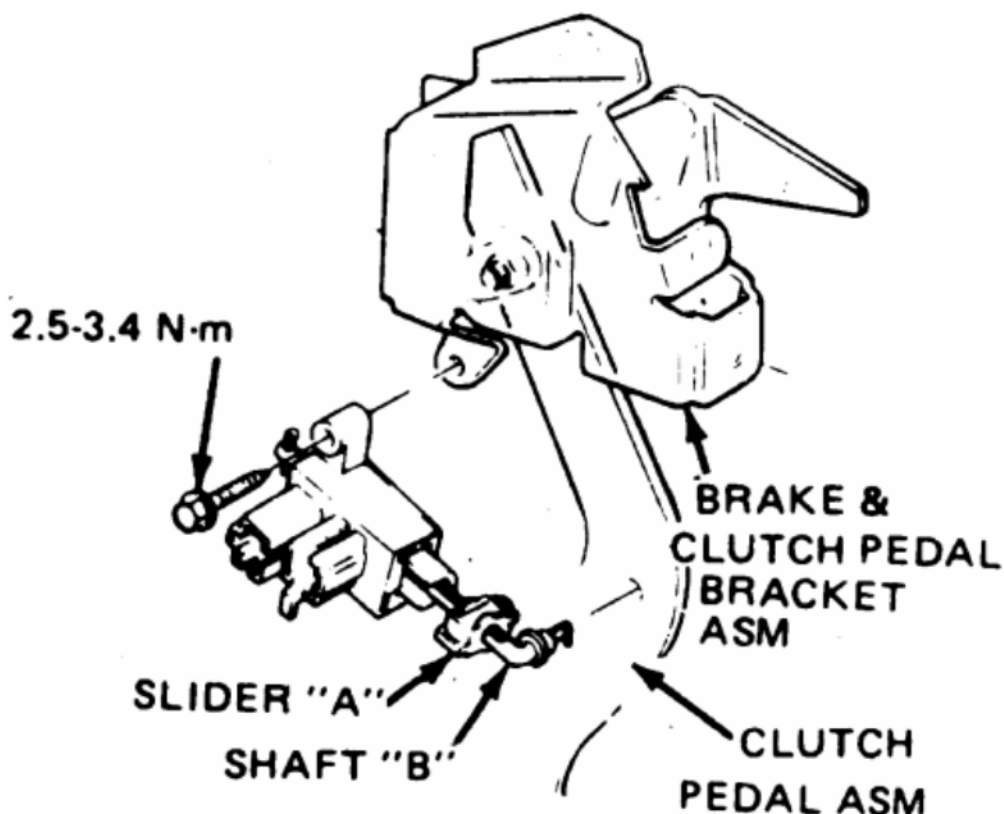


Fig. 1: Exploded view of the clutch switch mounting - on most models, the clutch switch adjusts automatically

3. Unplug the clutch switch connector.

4. Remove the switch attaching bolt and remove the clutch switch.
5. Installation is the reverse of the removal procedure. The switch will automatically adjust when depressed for the first time.

SPEED SENSOR

REMOVAL & INSTALLATION

5-SPEED TRANSMISSION

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector.
3. Remove the attaching bolt and remove the sensor.
4. Installation is the reverse of the removal procedure. The bolt torque is 89 inch lbs. (10 Nm).

SHIFT HANDLE

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Raise and safely support the vehicle.
3. Disconnect the shift rods from the control lever.
4. Lower the vehicle. Remove the shifter knob.
5. Remove the parking lever grip.

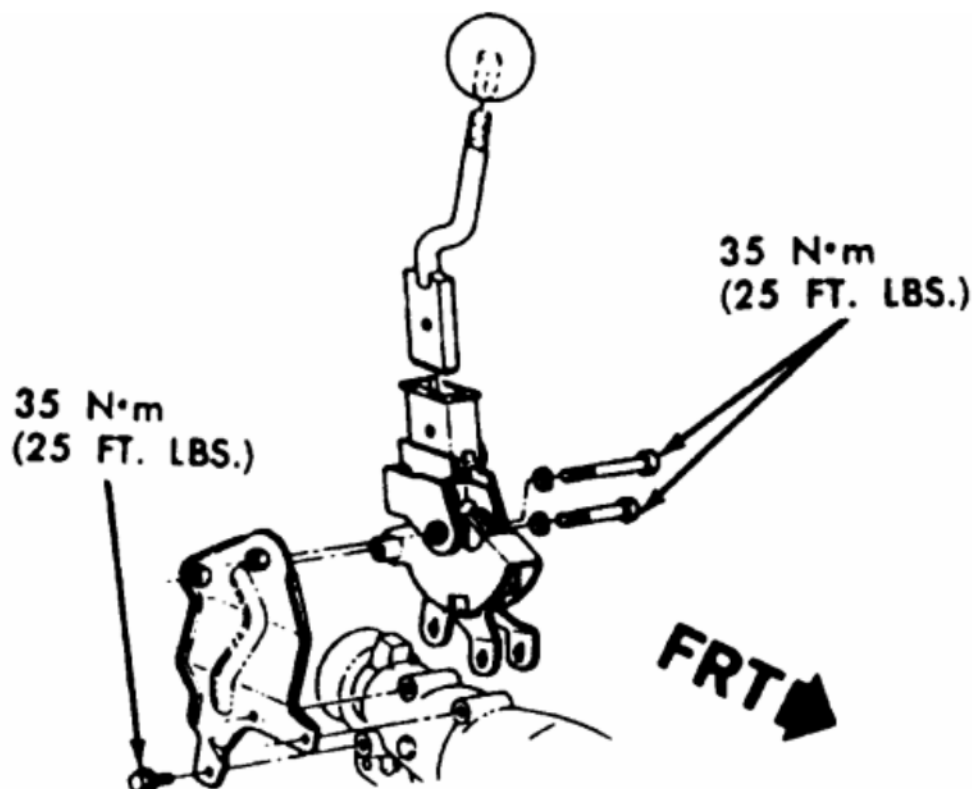


Fig. 1: Exploded view of the typical transmission shifter mounting

6. Remove the console cover.
7. Remove the shifter boot.
8. Remove the shifter mounting bolts and remove the shifter assembly.
9. Installation is the reverse of the removal procedure. Adjust the linkage as detailed earlier.

BACK-UP LIGHT SWITCH

REMOVAL & INSTALLATION

1. Disconnect the negative battery terminal from the battery.
2. At the left-rear of the transmission, the back-up light switch is threaded into the transmission case. The speed sensor is held in with a separate bracket. Disconnect the electrical connector from the back-up light switch.
3. Remove the back-up light switch from the transmission.
4. To install, reverse the removal procedures. Coat the threads with Teflon® tape. Please refer to the torque chart for specifications. Place the gear shift lever in the reverse position and check that the back-up lights work.

EXTENSION HOUSING SEAL

REMOVAL & INSTALLATION

This seal controls transmission oil leakage around the driveshaft. Continued failure of this seal usually indicates a worn output shaft bushing. If so, there will be signs of the same wear on the driveshaft where it contacts the seal and bushing. The seal is available and is fairly simple to install, with the proper tool.

1. Raise and safely support the rear of the vehicle to minimize transmission oil loss when the driveshaft is removed.
2. Unbolt the driveshaft from the differential and center support bearing, if equipped. Wrap tape around the bearing cups to keep them in place on the universal joint and slide the shaft out of the transmission.
3. Use an small pry tool to carefully pry out the old seal. Be careful not to insert the tool too far into the housing or the bushing will be damaged.

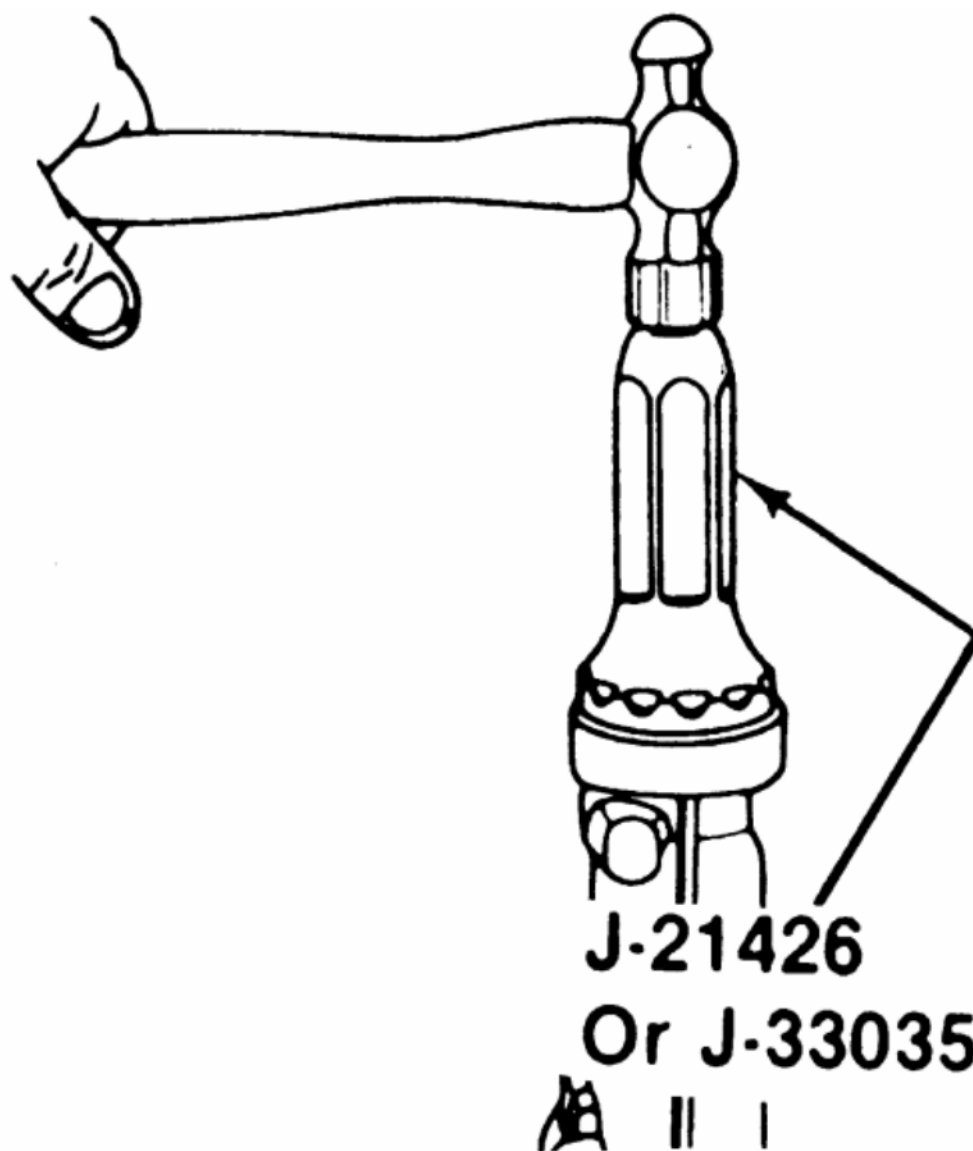


Fig. 1: Installing the extension housing seal

4. Use an oil seal installation tool to evenly drive the new seal into the housing. Make sure the tool only contacts the outer metal portion of the seal.
5. Install the driveshaft. Torque the universal bearing cup retainer bolts to 15 ft. lbs. (20 Nm).

TRANSMISSION

REMOVAL & INSTALLATION

On 5-speed transmissions remove the shift lever boot and the shift lever prior to transmission removal.

1. Disconnect the negative battery cable at the battery.
2. Raise the vehicle and support it safely with jackstands.
3. Drain the lubricant from the transmission.

4. Remove the torque arm from the vehicle as outlined under Rear Suspension in [Suspension & Steering](#) of this repair guide.
5. Mark the driveshaft and the rear axle pinion flange to indicate their relationship. Unbolt the rear universal joint straps. Lower the rear of the driveshaft, being careful to keep the universal joint caps in place. Withdraw the driveshaft from the transmission and remove it from the vehicle.
6. Disconnect the speedometer cable and the electrical connectors from the transmission.
7. Remove the exhaust pipe brace.
8. Remove the transmission shifter support attaching bolts from the transmission.
9. On 4-speed transmissions only, disconnect the shift linkage at the shifter.
10. Raise the transmission slightly with a jack, then remove the crossmember attaching bolts.
11. Remove the transmission mount attaching bolts, then remove the mount and crossmember from the vehicle.
12. Remove the transmission attaching bolts, then with the aid of an assistant, move the transmission rearward and downward out of the vehicle.

To install:

13. Apply a light coating of high temperature grease to the main drive gear bearing retainer and to the splined portion of the main drive gear. This will assure free movement of the clutch and transmission components during assembly.
14. Install the transmission and secure with transmission mounting bolts. Torque transmission-to-clutch housing bolts to 55 ft. lbs. (74 Nm).
15. Install the mount and crossmember into the vehicle, then install the transmission mount attaching bolts. Torque both the mount-to-crossmember bolts and the mount-to-transmission bolts to 35 ft. lbs. (47 Nm).
16. Install the crossmember attaching bolts. Torque the crossmember-to-body bolts to 35 ft. lbs.
17. On 4-speed transmissions only, connect the shift linkage at the shifter and adjust the shift linkage.
18. Install the transmission shifter support attaching bolts to the transmission. Torque shifter bracket-to-extension housing to 25 ft. lbs. (35 Nm).
19. Install the exhaust pipe brace.
20. Connect the speedometer cable and the electrical connectors to the transmission.
21. Install the driveshaft into the transmission. Then, align the marks on the driveshaft and the rear axle pinion flange. Bolt the rear universal joint straps.
22. Install the torque arm into the vehicle.
23. Fill the transmission with lubricant. Then install the filler plug and torque to 15 ft. lbs. (20 Nm).
24. Lower the vehicle.

25. Connect the negative battery cable at the battery.

CLUTCH

UNDERSTANDING THE CLUTCH

The purpose of the clutch is to disconnect and connect engine power at the transmission. A vehicle at rest requires a lot of engine torque to get all that weight moving. An internal combustion engine does not develop a high starting torque (unlike steam engines) so it must be allowed to operate without any load until it builds up enough torque to move the vehicle. To a point, torque increases with engine rpm. The clutch allows the engine to build up torque by physically disconnecting the engine from the transmission, relieving the engine of any load or resistance.

The transfer of engine power to the transmission (the load) must be smooth and gradual; if it weren't, drive line components would wear out or break quickly. This gradual power transfer is made possible by gradually releasing the clutch pedal. The clutch disc and pressure plate are the connecting link between the engine and transmission. When the clutch pedal is released, the disc and plate contact each other (the clutch is engaged) physically joining the engine and transmission. When the pedal is pushed in, the disc and plate separate (the clutch is disengaged) disconnecting the engine from the transmission.

Most clutch assemblies consists of the flywheel, the clutch disc, the clutch pressure plate, the throw out bearing and fork, the actuating linkage and the pedal. The flywheel and clutch pressure plate (driving members) are connected to the engine crankshaft and rotate with it. The clutch disc is located between the flywheel and pressure plate, and is splined to the transmission shaft. A driving member is one that is attached to the engine and transfers engine power to a driven member (clutch disc) on the transmission shaft. A driving member (pressure plate) rotates (drives) a driven member (clutch disc) on contact and, in so doing, turns the transmission shaft.

There is a circular diaphragm spring within the pressure plate cover (transmission side). In a relaxed state (when the clutch pedal is fully released) this spring is convex; that is, it is dished outward toward the transmission. Pushing in the clutch pedal actuates the attached linkage. Connected to the other end of this is the throw out fork, which hold the throw out bearing. When the clutch pedal is depressed, the clutch linkage pushes the fork and bearing forward to contact the diaphragm spring of the pressure plate. The outer edges of the spring are secured to the pressure plate and are pivoted on rings so that when the center of the spring is compressed by the throw out bearing, the outer edges bow outward and, by so doing, pull the pressure plate in the same direction - away from the clutch disc. This action separates the disc from the plate, disengaging the clutch and allowing the transmission to be shifted into another gear. A coil type clutch return spring attached to the clutch pedal arm permits full release of the pedal. Releasing the pedal pulls the throw out bearing away from the diaphragm spring resulting in a reversal of spring position. As bearing pressure is gradually released from the spring center, the outer edges

of the spring bow outward, pushing the pressure plate into closer contact with the clutch disc. As the disc and plate move closer together, friction between the two increases and slippage is reduced until, when full spring pressure is applied (by fully releasing the pedal) the speed of the disc and plate are the same. This stops all slipping, creating a direct connection between the plate and disc which results in the transfer of power from the engine to the transmission. The clutch disc is now rotating with the pressure plate at engine speed and, because it is splined to the transmission shaft, the shaft now turns at the same engine speed.

The clutch is operating properly if:

1. It will stall the engine when released with the vehicle held stationary.
2. The shift lever can be moved freely between 1st and reverse gears when the vehicle is stationary and the clutch disengaged.

APPLICATION

All 1982-83 vehicles use a mechanical (non-hydraulic) clutch; 1984-92 models use a hydraulic clutch. With the hydraulic clutch, no adjustment of the clutch pedal or the linkage is required. On the mechanical type, the only required adjustment is to maintain the proper clutch pedal freeplay. The freeplay adjustment is very important, for it determines the engaging and disengaging characteristics of the clutch assembly.

The clutch assembly consists of: a flywheel, a pressure plate, a throwout bearing and fork, a clutch pedal, and an actuating lever (non-hydraulic) or a master cylinder/slave cylinder (hydraulic).

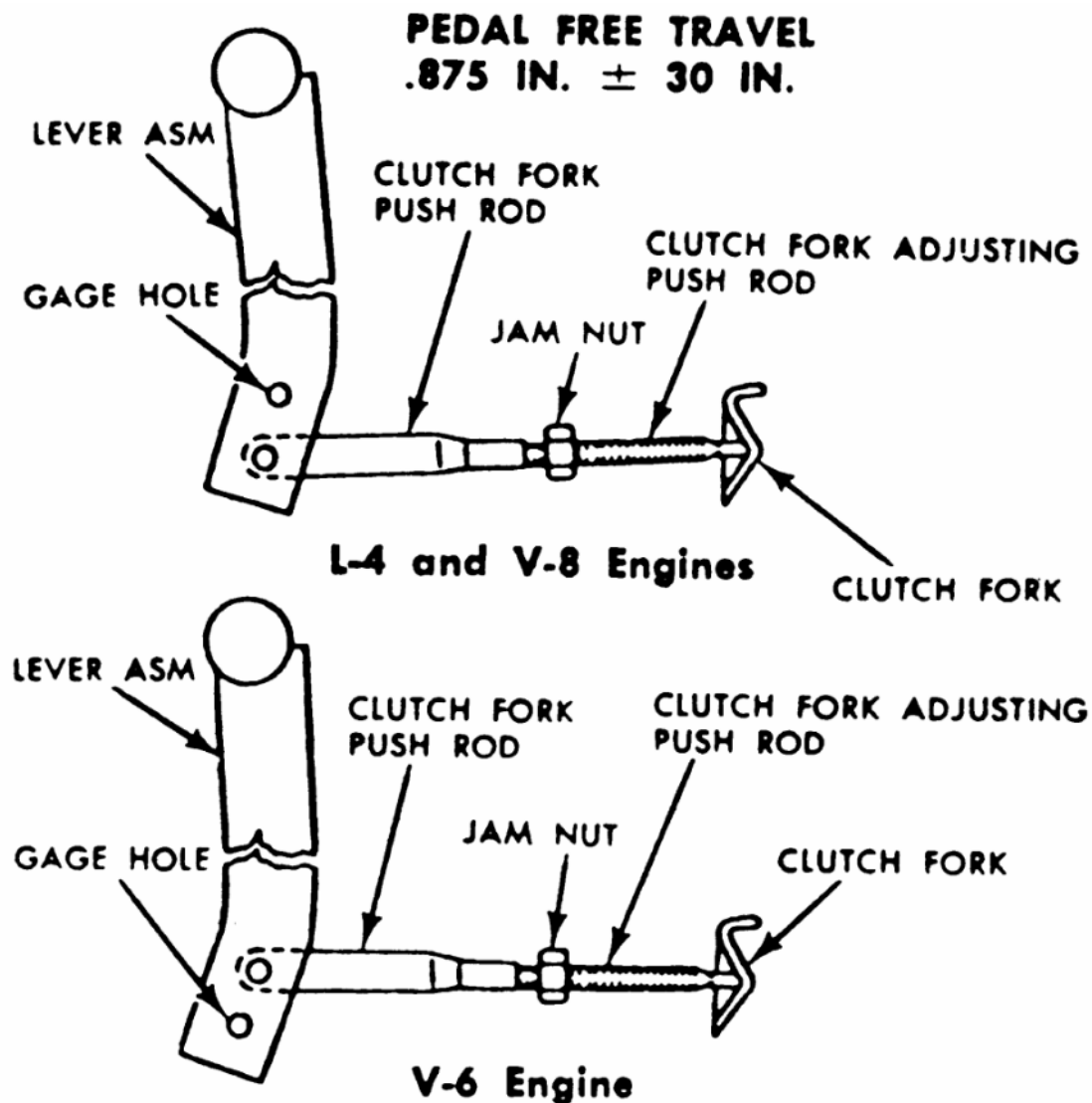
The hydraulic system utilizes a remote reservoir which is mounted to the power brake booster, a master cylinder mounted to the cowl panel and a slave cylinder that is mounted to the bell housing. The system is operated directly by the clutch pedal. When adding fluid to the reservoir, always use a type which meets DOT 3 specifications.

CAUTION - The clutch driven disc contains asbestos, which has been determined to be a cancer causing agent. Never clean clutch surfaces with compressed air! Avoid inhaling any dust from any clutch surface! When cleaning clutch surfaces, use a commercially available brake cleaning fluid.

FREE-PLAY ADJUSTMENT

MECHANICAL LINKAGE

1. Disconnect the return spring at the clutch fork.
2. Hold the pedal against the rubber bumper on the dash brace.
3. Push the clutch fork so that the throwout bearing lightly contacts the pressure plate fingers.



Clutch pedal free travel

Fig. 1: Free-play adjustment

4. Loosen the locknut and adjust the length of the rod so that the swivel or rod can slip freely into the gauge hole in the lever. Increase the length of the rod until all free-play is removed.
5. Remove the rod or swivel from the gauge hole and insert it in the other (original) hole on the lever. Install the retainer and tighten the locknut.
6. Install the return spring and check freeplay measurement at the pedal pad.

CLUTCH PEDAL

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Disconnect the clutch return spring.
3. Remove the hush panel under the dash.
4. If equipped, remove the cruise control switch at the pedal.

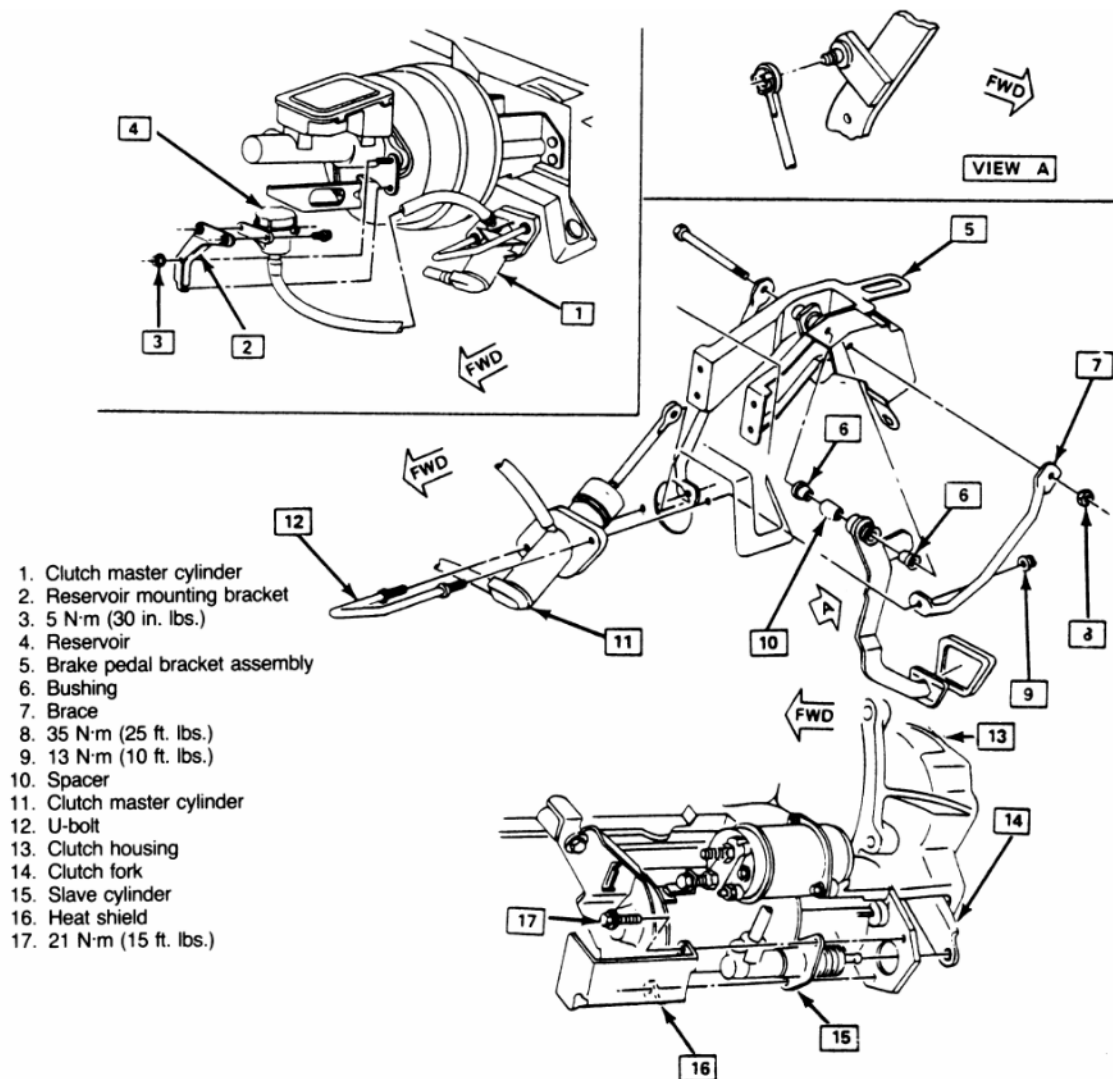


Fig. 1: Clutch pedal with hydraulic linkage

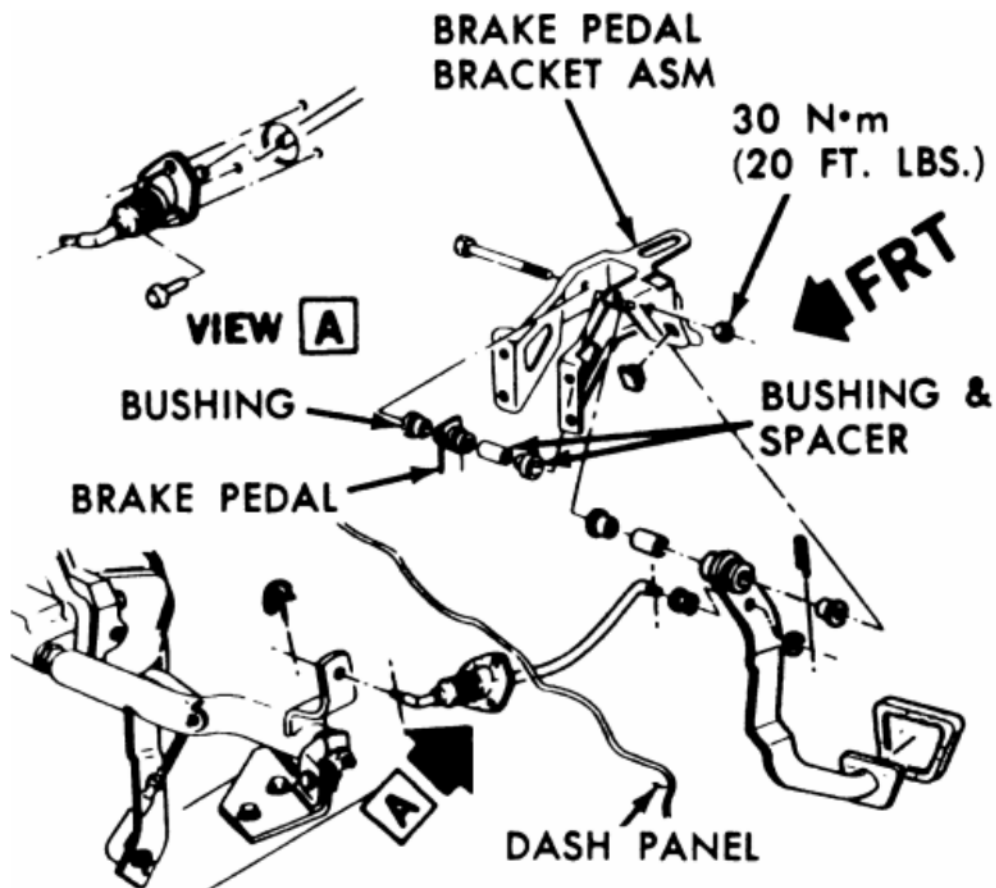


Fig. 2: Clutch pedal with mechanical linkage

5. Disconnect and remove the neutral start switch at the pedal.
6. Remove the turn signal and hazard warning flasher mounting bracket.
7. Disconnect the clutch pedal rod from the pedal.
8. Remove the clutch pedal pivot bolt far enough to permit removal of pedal assembly.
9. Clean all parts and relubricate. Install in reverse of removal.

CLUTCH LINKAGE

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Disconnect the return spring and rods from the pedal and fork assembly.

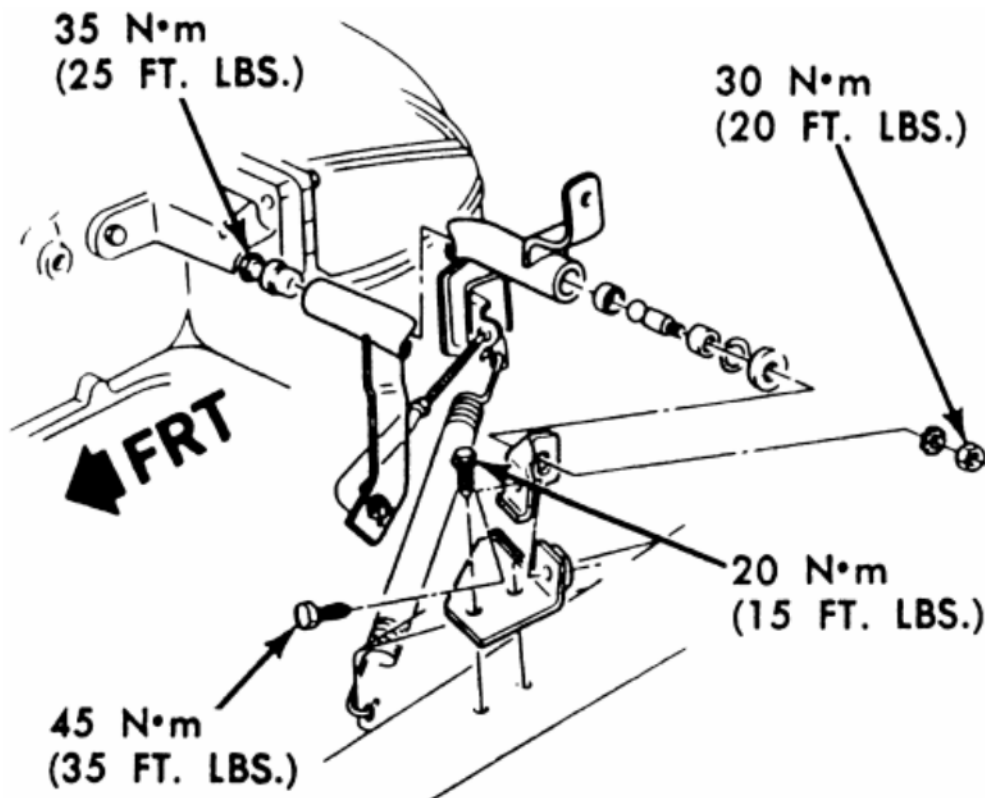


Fig. 1: Mechanical clutch linkage

3. Loosen the outboard ball stud nut and slide stud out of the bracket slot.
4. Move the cross shaft outboard, as required to clear inboard ball stud, then lift out from the vehicle.
5. Inspect the nylon bushing and anti-rattle O-ring for wear and replace as required.
6. Installation is the reverse of the removal procedure. Adjust linkage as previously outlined.

DRIVEN DISC AND PRESURE PLATE

REMOVAL & INSTALLATION

1. Support engine and remove the transmission (as outlined in this section).
2. Disconnect the clutch fork push rod and spring.
3. Remove the flywheel housing.
4. Slide the clutch fork from the ball stud and remove the fork from the dust boot. The ball stud is threaded into the clutch housing and may be replaced, if necessary.

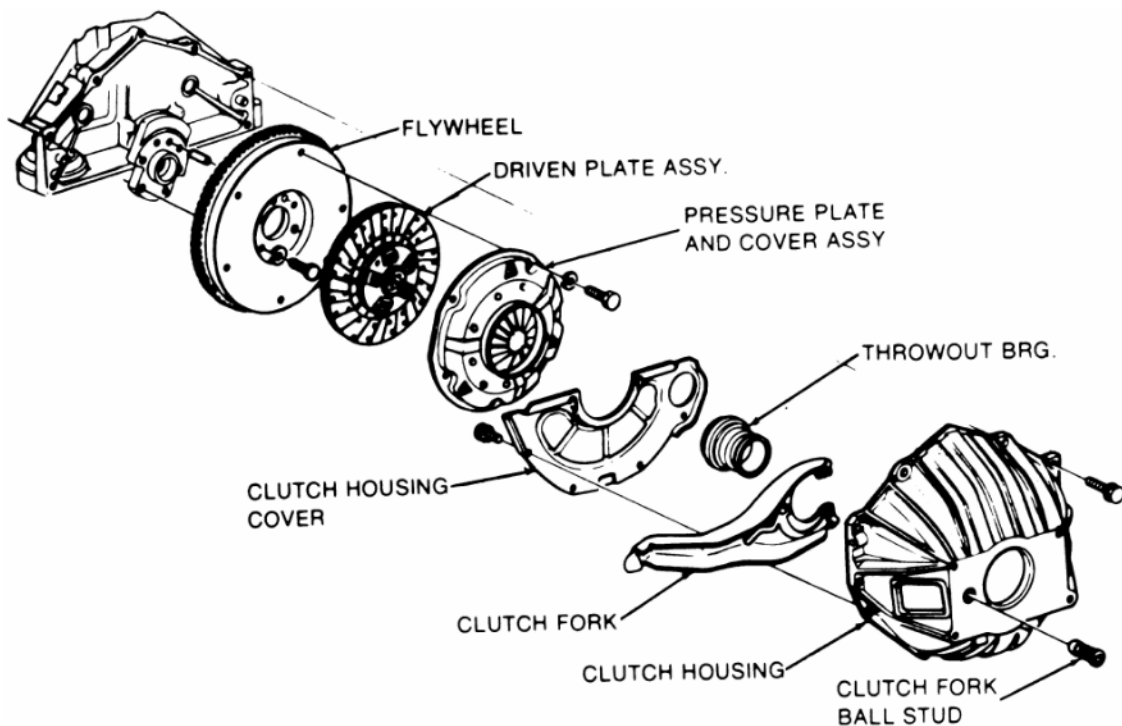


Fig. 1: Clutch assembly

5. Install an alignment tool to support the clutch assembly during removal. Mark the flywheel and clutch cover for reinstallation, if they do not already have X marks.
6. Loosen the clutch-to-flywheel attaching bolts evenly, one turn at a time, until spring pressure is released. Remove the bolts and clutch assembly.

To install:

7. Clean the pressure plate and flywheel face.
8. Support the clutch disc and pressure plate with an alignment tool. The driven disc is installed with the damper springs on the transmission side.
9. Turn the clutch assembly until the mark on the cover lines up with the mark on the flywheel, then install the bolts. Tighten down evenly and gradually to avoid distortion.
10. Remove the alignment tool.
11. Lubricate the ball socket and fork fingers at the release bearing end with high melting point grease. Lubricate the recess on the inside of the throwout bearing and throwout fork groove with a light coat of graphite grease.
12. Install the clutch fork and dust boot into the housing. Install the throwout bearing to the throwout fork. Install the flywheel housing. Install the transmission.
13. Connect the fork push rod and spring. Lubricate the spring and pushrod ends.
14. Adjust the shift linkage and clutch pedal free-play.

MASTER CYLINDER

Before removing the hydraulic components for repair, remove the clutch housing dust cover to verify the malfunction. Measure the movement of the slave cylinder push rod by pushing the clutch pedal to the floor; the minimum movement should be 14mm. Do not replace the cylinder if its movement exceeds the minimum.

REMOVAL & INSTALLATION

The clutch master cylinder is located in the engine compartment, on the left side of the firewall, above the steering column.

1. Disconnect negative battery terminal from the battery.
2. Remove hush panel from under the dash.
3. Disconnect push rod from clutch pedal.
4. Disconnect hydraulic line from the clutch master cylinder.

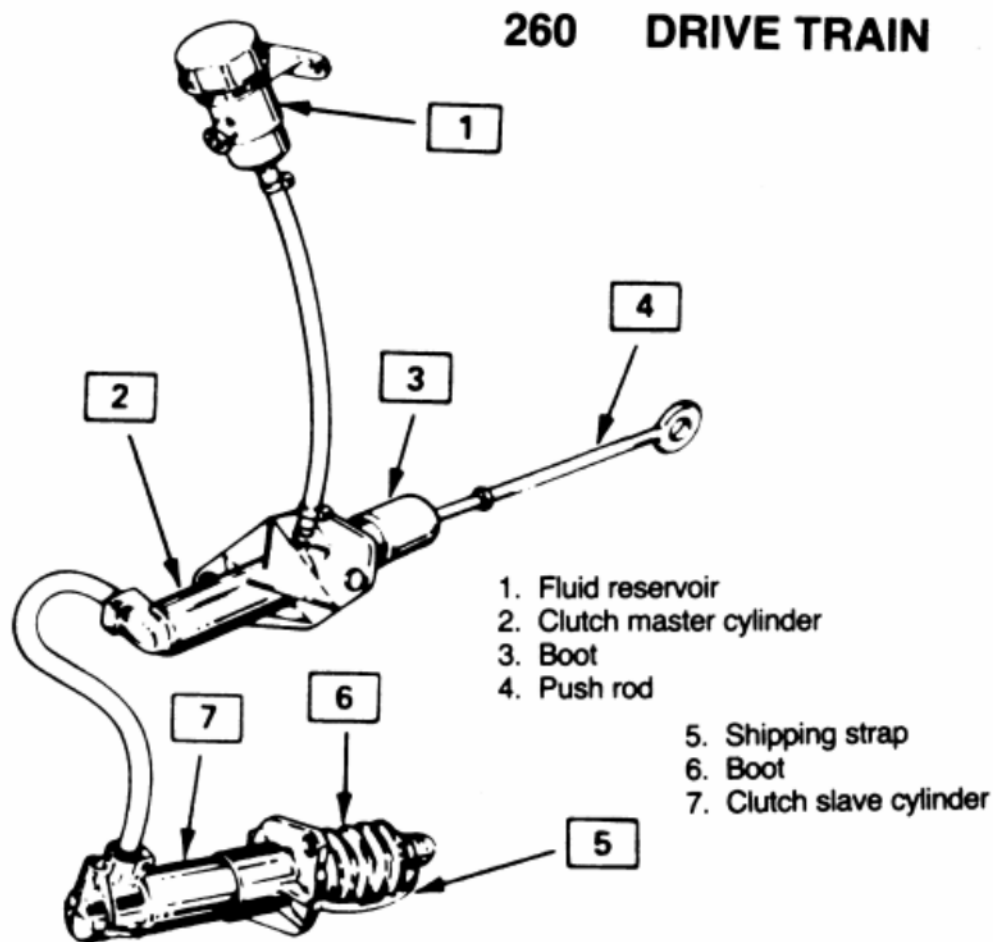


Fig. 1: Hydraulic clutch system

5. Remove the master cylinder-to-cowl brace nuts. Remove master cylinder and overhaul (if necessary).
6. Using a putty knife, clean the master cylinder and cowl mounting surfaces.

7. To install, reverse the removal procedures. Torque the master cylinder-to-cowl brace nuts to 10-15 ft. lbs. (14-20 Nm). Fill master cylinder with new hydraulic fluid conforming to DOT 3 specifications. Bleed and check the hydraulic clutch system for leaks.

OVERHAUL

1. Remove the filler cap and drain fluid from the master cylinder.
2. Remove the reservoir and seal from the master cylinder. Pull back the dust cover and remove the snapping.
3. Remove the push rod assembly. Using a block of wood, tap the master cylinder on it to eject the plunger assembly from the cylinder bore.
4. Remove the seal (carefully) from the front of the plunger assembly, ensuring no damage occurs to the plunger surfaces.
5. From the rear of the plunger assembly, remove the spring, the support, the seal and the shim.
6. Using clean brake fluid, clean all of the parts.
7. Inspect the cylinder bore and the plunger for ridges, pitting and/or scratches, the dust cover for wear and cracking; replace the parts if any of the conditions exist.

To assemble:

8. Use new seals, lubricate all of the parts in clean brake fluid, fit the plunger seal to the plunger and reverse the disassembly procedures.
9. Insert the plunger assembly, valve end leading into the cylinder bore (easing the entrance of the plunger seal).
10. Position the push rod assembly into the cylinder bore, then install a new snapping to retain the push rod. Install dust cover onto the master cylinder. Lubricate the inside of the dust cover with Girling® Rubber Grease or equivalent.

Be careful not to use any lubricant that will deteriorate rubber dust covers or seals.

SLAVE CYLINDER

On vehicles equipped with a hydraulic clutch release mechanism, the slave cylinder is located on the left side of the bellhousing and controls the clutch release fork operation.

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable.
2. Raise and safely support the front of the vehicle on jackstands.
3. Disconnect the hydraulic line from clutch master cylinder. Remove the line-to-chassis screw and the clip from the chassis.

Be sure to plug the line opening to keep dirt and moisture out of the system.

4. Remove the slave cylinder-to-bellhousing nuts.
5. Remove the push rod and the slave cylinder from the vehicle, then overhaul it (if necessary).
6. To install, reverse the removal procedures. Lubricate leading end of the slave cylinder with Girling® Rubber Lube or equivalent. Torque the slave cylinder-to-bellhousing nuts to 10-15 ft. lbs. (14-20 Nm). Fill the master cylinder with new brake fluid conforming to DOT 3 specifications. Bleed the hydraulic system.

OVERHAUL

1. Remove the shield, the pushrod and the dust cover from the slave cylinder, then inspect the cover for damage or deterioration.
2. Remove the snapping from the end of the cylinder bore.
3. Using a block of wood, tap the slave cylinder on it to eject the plunger, then remove the seal and the spring.
4. Using clean brake fluid, clean all of the parts.
5. Inspect the cylinder bore and the plunger for ridges, pitting and/or scratches, the dust cover for wear and cracking; replace the parts if any of the conditions exist.

To assemble:

6. Use new seals and lubricate all of the parts in clean brake fluid. Install the spring, the plunger seal and the plunger into the cylinder bore, then install anew snapping.
7. Lubricate the inside of the dust cover with Girling® Rubber Grease or equivalent, then install it into the slave cylinder.

Be careful not to use any lubricant that will deteriorate rubber dust covers or seals.

BLEEDING THE HYDRAULIC CLUTCH

Bleeding air from the hydraulic clutch system is necessary whenever any part of the system has been disconnected or the fluid level (in the reservoir) has been allowed to fall so low that air has been drawn into the master cylinder.

1. Fill master cylinder reservoir with new brake fluid conforming to DOT 3 specifications.
2. Raise and safely support the front of the vehicle on jackstands.
3. Remove the slave cylinder attaching bolts.
4. Hold slave cylinder at approximately 45 degrees with the bleeder at highest point. Fully depress clutch pedal and open the bleeder screw.
5. Close the bleeder screw and release clutch pedal.
6. Repeat the procedure until all of the air is evacuated from the system. Check and refill master cylinder reservoir as required to prevent air from being drawn through the master cylinder.

Never release a depressed clutch pedal with the bleeder screw open or air will be drawn into the system.

AUTOMATIC TRANSMISSION

UNDERSTANDING AUTOMATIC TRANSMISSIONS

The automatic transmission allows engine torque and power to be transmitted to the rear wheels within a narrow range of engine operating speeds. It will allow the engine to turn fast enough to produce plenty of power and torque at very low speeds, while keeping it at a sensible rpm at high vehicle speeds (and it does this job without driver assistance). The transmission uses a light fluid as the medium for the transmission of power. This fluid also works in the operation of various hydraulic control circuits and as a lubricant. Because the transmission fluid performs all of these functions, trouble within the unit can easily travel from one part to another. For this reason, and because of the complexity and unusual operating principles of the transmission, a very sound understanding of the basic principles of operation will simplify troubleshooting.

TORQUE CONVERTER

The torque converter replaces the conventional clutch. It has three functions:

1. It allows the engine to idle with the vehicle at a standstill, even with the transmission in gear.
2. It allows the transmission to shift from range-to-range smoothly, without requiring that the driver close the throttle during the shift.
3. It multiplies engine torque to an increasing extent as vehicle speed drops and throttle opening is increased. This has the effect of making the transmission more responsive and reduces the amount of shifting required.

The torque converter is a metal case which is shaped like a sphere that has been flattened on opposite sides. It is bolted to the rear end of the engine's crankshaft. Generally, the entire metal case rotates at engine speed and serves as the engine's flywheel.

The case contains three sets of blades. One set is attached directly to the case. This set forms the torus or pump. Another set is directly connected to the output shaft, and forms the turbine. The third set is mounted on a hub which, in turn, is mounted on a stationary shaft through a one-way clutch. This third set is known as the stator.

A pump, which is driven by the converter hub at engine speed, keeps the torque converter full of transmission fluid at all times. Fluid flows continuously through the unit to provide cooling.

Under low speed acceleration, the torque converter functions as follows:

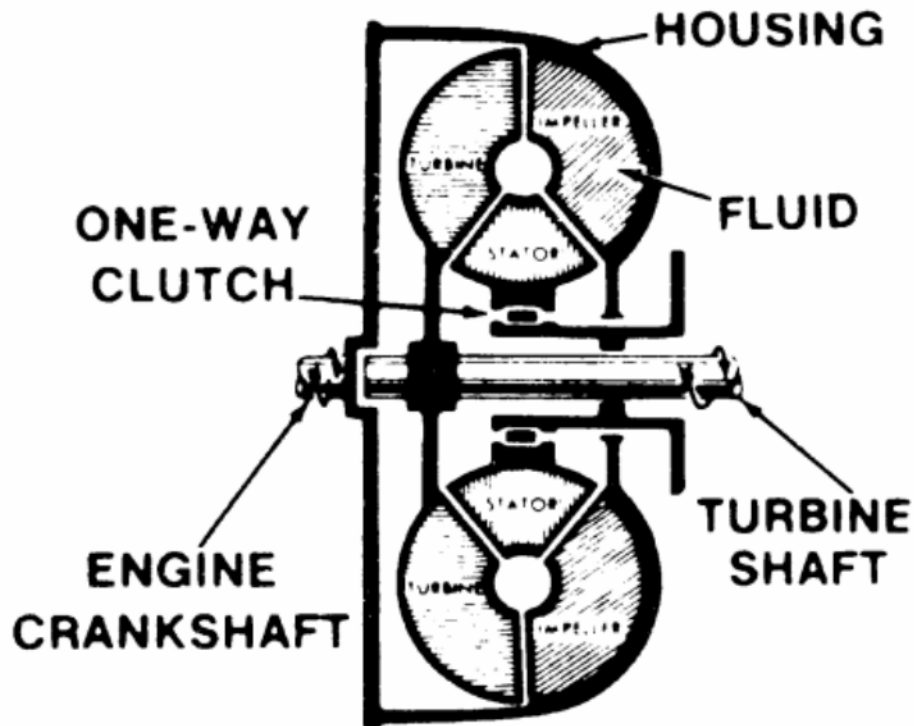


Fig. 1: The torque converter housing is rotated by the engine's crankshaft, and turns the impeller - The impeller then spins the turbine, which gives motion to the turbine shaft, driving the gears

The torus is turning faster than the turbine. It picks up fluid at the center of the converter and, through centrifugal force, slings it outward. Since the outer edge of the converter moves faster than the portions at the center, the fluid picks up speed.

The fluid then enters the outer edge of the turbine blades. It then travels back toward the center of the converter case along the turbine blades. In impinging upon the turbine blades, the fluid loses the energy picked up in the torus.

If the fluid was now returned directly into the torus, both halves of the converter would have to turn at approximately the same speed at all times, and torque input and output would both be the same.

In flowing through the torus and turbine, the fluid picks up two types of flow, or flow in two separate directions. It flows through the turbine blades, and it spins with the engine. The stator, whose blades are stationary when the vehicle is being accelerated at low speeds, converts one type of flow into another. Instead of allowing the fluid to flow straight back into the torus, the stator's curved blades turn the fluid almost 90° toward the direction of rotation of the engine. Thus the fluid does not flow as fast toward the torus, but is already spinning when the torus picks it up. This has the effect of allowing the torus to turn much faster than the turbine. This difference in speed may be compared to the difference in speed between the smaller and larger gears in any gear train. The result is that engine power output is higher, and engine torque is multiplied.

As the speed of the turbine increases, the fluid spins faster and faster in the direction of engine rotation. As a result, the ability of the stator to redirect the fluid flow is reduced. Under cruising conditions, the stator is eventually forced to rotate on its one-way clutch in the direction of engine rotation. Under these conditions, the torque converter begins to behave almost like a solid shaft, with the torus and turbine speeds being almost equal.

PLANETARY GEARBOX

The ability of the torque converter to multiply engine torque is limited. Also, the unit tends to be more efficient when the turbine is rotating at relatively high speeds. Therefore, a planetary gearbox is used to carry the power output of the turbine to the driveshaft.

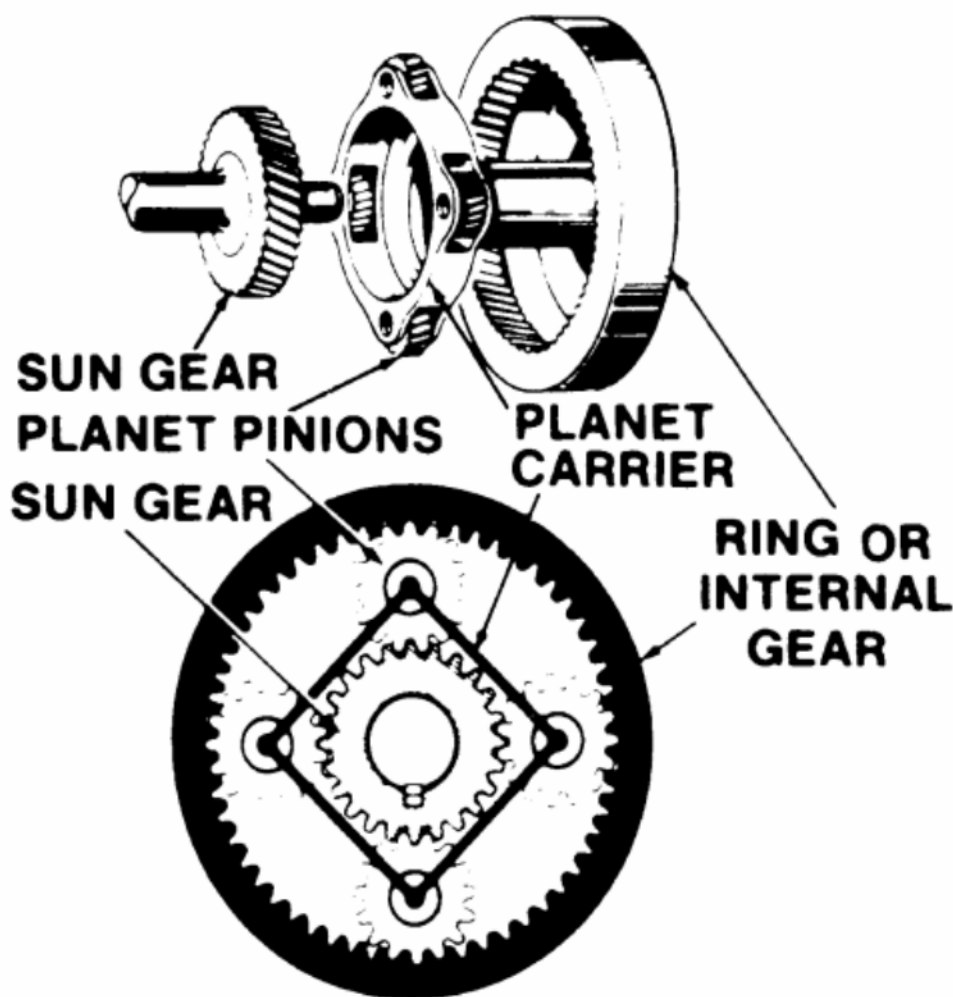


Fig. 2: Planetary gears work in a similar fashion to manual transmission gears, but are composed of three parts

Planetary gears function very similarly to conventional transmission gears. However, their construction is different in that three elements make up one gear system, and, in that all three elements are different from one another. The three elements are: an outer gear that is shaped like a hoop, with teeth cut into the inner surface; a sun gear, mounted on a shaft and located at the very center of

the outer gear; and a set of three planet gears, held by pins in a ring-like planet carrier, meshing with both the sun gear and the outer gear. Either the outer gear or the sun gear may be held stationary, providing more than one possible torque multiplication factor for each set of gears. Also, if all three gears are forced to rotate at the same speed, the gearset forms, in effect, a solid shaft.

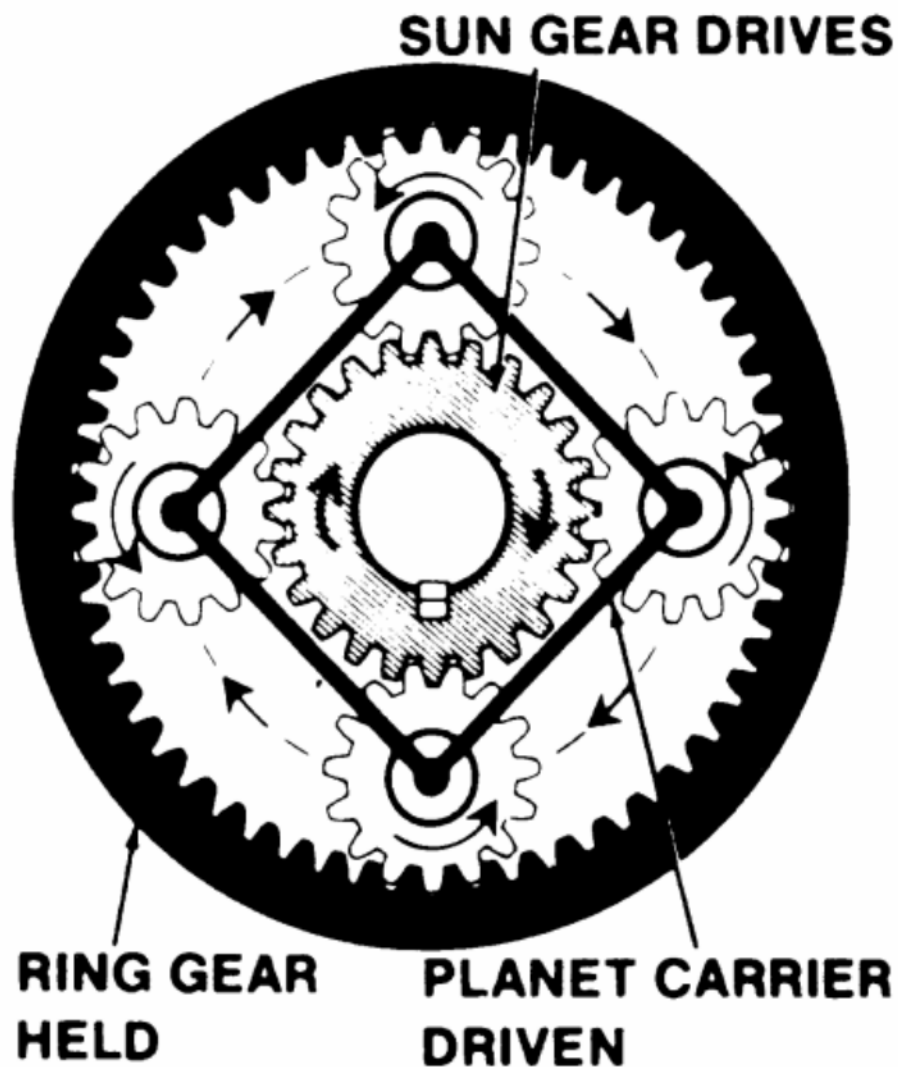


Fig. 3: Planetary gears in the maximum reduction (low) range. The ring gear is held and a lower gear ratio is obtained

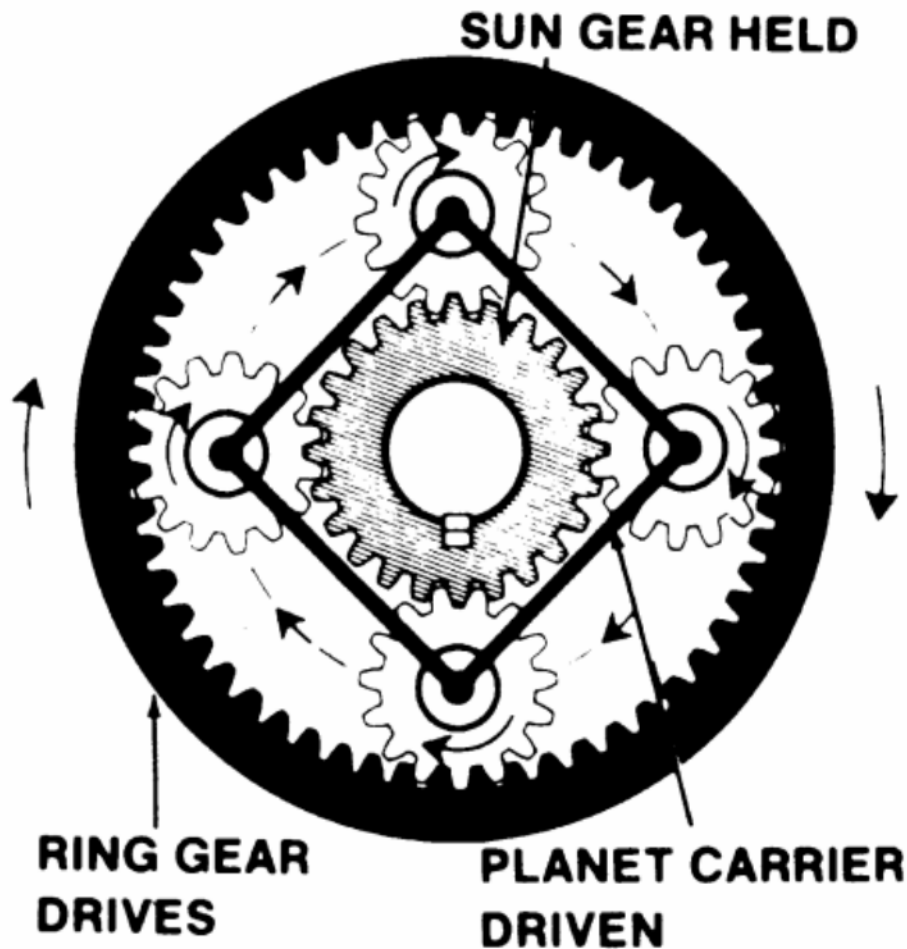


Fig. 4: Planetary gears in the minimum reduction (drive) range. The ring gear is allowed to revolve, providing a higher gear ratio

Most automatics use the planetary gears to provide various reductions ratios. Bands and clutches are used to hold various portions of the gearsets to the transmission case or to the shaft on which they are mounted. Shifting is accomplished, then, by changing the portion of each planetary gearset which is held to the transmission case or to the shaft.

SERVOES AND ACCUMULATORS

The servos are hydraulic pistons and cylinders. They resemble the hydraulic actuators used on many other machines, such as bulldozers. Hydraulic fluid enters the cylinder, under pressure, and forces the piston to move to engage the band or clutches.

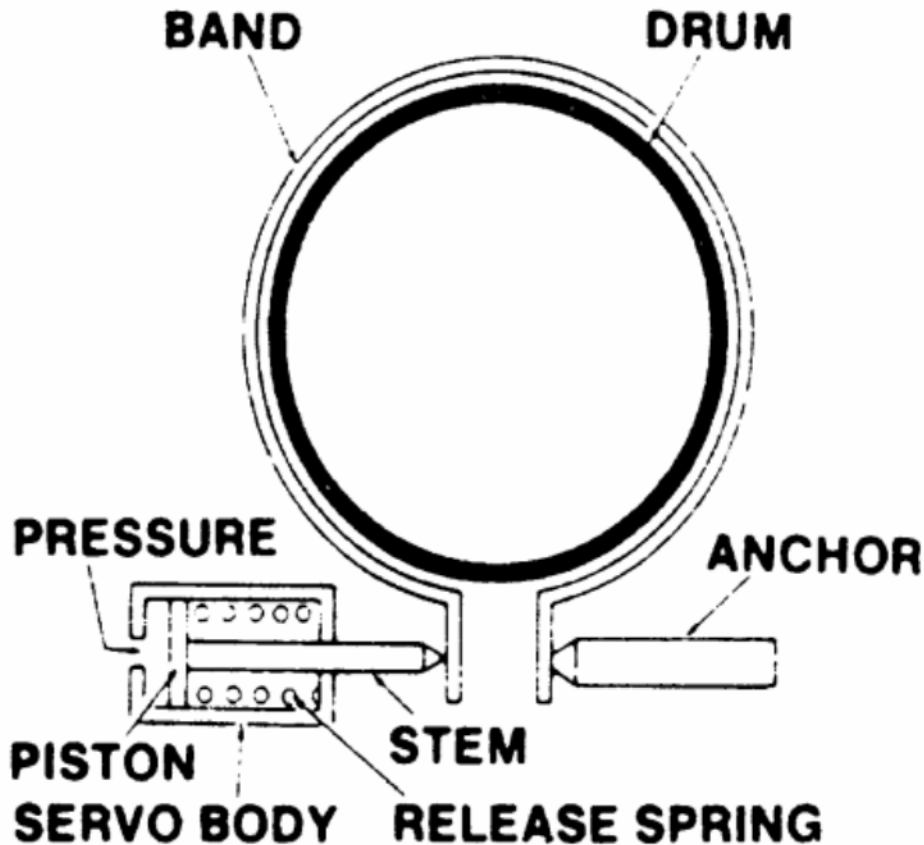


Fig. 5: Servos, operated by pressure, are used to apply or release the bands, to either hold the ring gear or allow it to rotate

The accumulators are used to cushion the engagement of the servos. The transmission fluid must pass through the accumulator on the way to the servo. The accumulator housing contains a thin piston which is sprung away from the discharge passage of the accumulator. When fluid passes through the accumulator on the way to the servo, it must move the piston against spring pressure, and this action smooths out the action of the servo.

HYDRAULIC CONTROL SYSTEM

The hydraulic pressure used to operate the servos comes from the main transmission oil pump. This fluid is channeled to the various servos through the shift valves. There is generally a manual shift valve which is operated by the transmission selector lever and an automatic shift valve for each automatic upshift the transmission provides.

Many new transmissions are electronically controlled. On these models, electrical solenoids are used to better control the hydraulic fluid. Usually, the solenoids are regulated by an electronic control module.

There are two pressures which affect the operation of these valves. One is the governor pressure which is effected by vehicle speed. The other is the modulator pressure which is effected by intake manifold vacuum or throttle position. Governor pressure rises with an increase in vehicle speed, and

modulator pressure rises as the throttle is opened wider. By responding to these two pressures, the shift valves cause the upshift points to be delayed with increased throttle opening to make the best use of the engine's power output.

Most transmissions also make use of an auxiliary circuit for downshifting. This circuit may be actuated by the throttle linkage the vacuum line which actuates the modulator, by a cable or by a solenoid. It applies pressure to a special downshift surface on the shift valve or valves.

The transmission modulator also governs the line pressure, used to actuate the servos. In this way, the clutches and bands will be actuated with a force matching the torque output of the engine.

IDENTIFICATION

Two types of transmissions are used on the vehicles; Turbo Hydra-Matic 200C 3-speed and Turbo Hydra-Matic 700-R4 4-speed. Beginning in 1991, the 700-R4 was redesignated the 4L60.

FLUID PAN

REMOVAL, FLUID/FILTER CHANGE, & INSTALLATION

Refer to General Information & Maintenance for fluid pan procedures.

ADJUSTMENTS

BANDS

There are no band adjustments possible or required.

SHIFT CONTROL CABLE

1. Place the control lever in *N*.
2. Raise the car and support it with jackstands.

DRIVE TRAIN 265

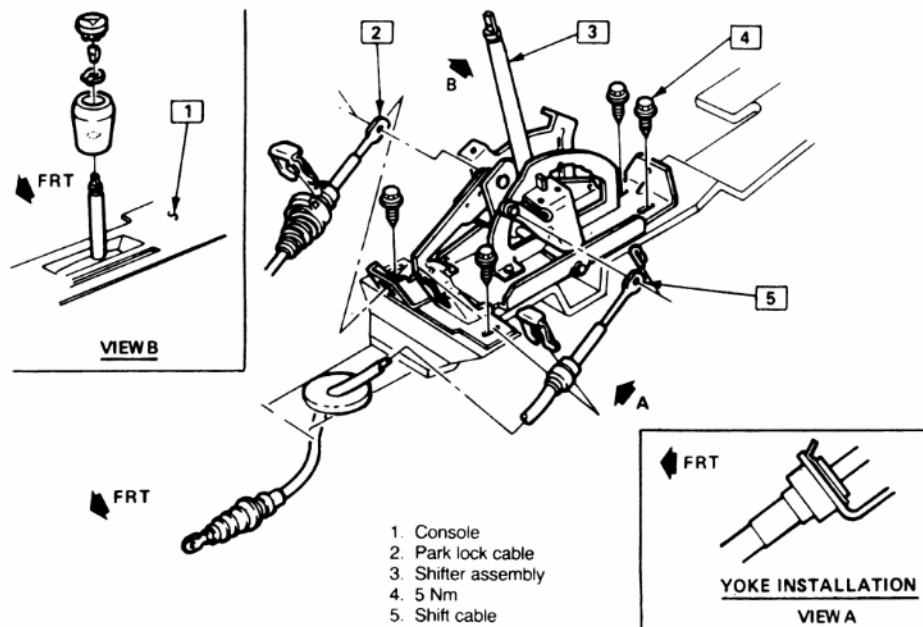


Fig. 1: Shift cable at the console

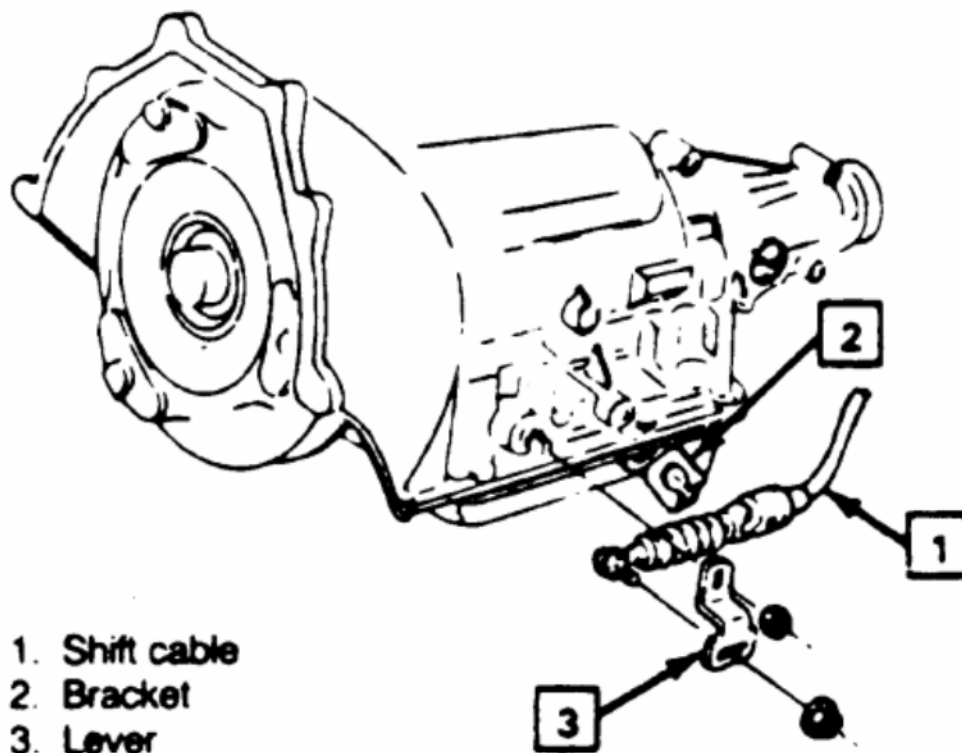


Fig. 2: Shift cable at the transmission

3. Loosen the cable attachment at the shift lever.

4. Rotate the shift lever clockwise to the park detent and then back to neutral.
5. Tighten cable attachment to 11 ft. lbs. (15 Nm).

The lever must be held out of P when tightening the nut.

SHIFT LINKAGE

1. Place the manual shaft of the transmission in *N*. Place the console shift lever in *N*.
2. Install the cable in the slot of the shift lever. Adjust the cable so that the pin has free movement.
3. Install and tighten the nut to the pin.

THROTTLE VALVE CABLE

1. After installation of the cable to the transmission, engine bracket, and the cable actuating lever, check to assure that the cable slider is in the zero or fully re-adjusted position.
2. If cable slider is not in zero or fully re-adjusted, depress and hold the metal re-adjust tab. Move the slider back through the fitting in the direction away from the cable actuating lever until the slider stops against the fitting. Release the metal re-adjust tab.

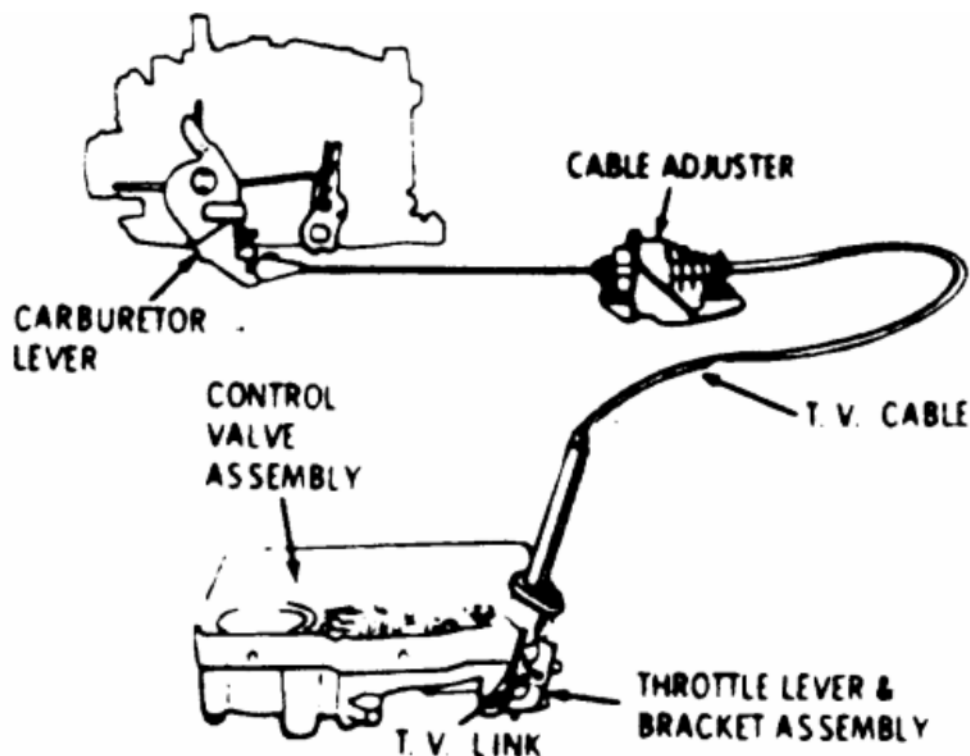


Fig. 3: TV cable and linkage

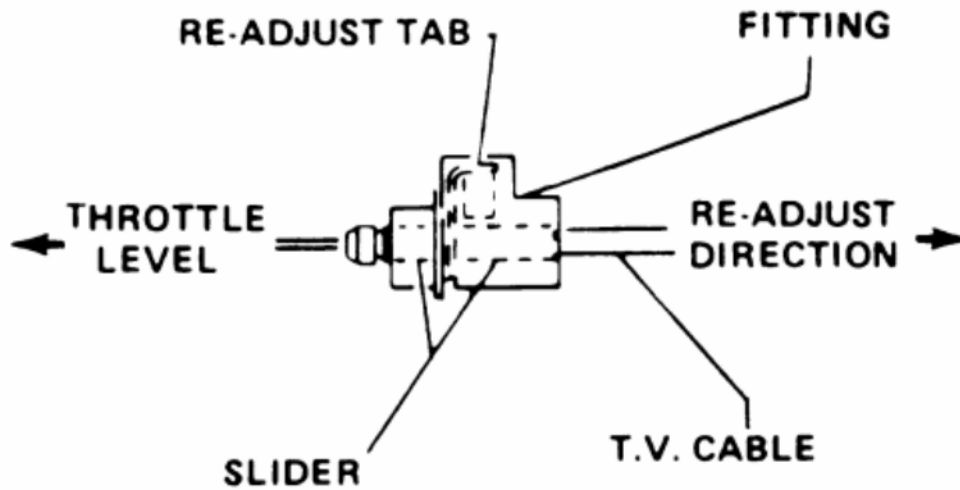


Fig. 4: TV cable adjustment

3. Rotate the cable actuating lever to its full travel position.
4. The slider must move (ratchet) forward when the lever is rotated to the full travel position.
5. Release the lever.

NEUTRAL START/BACK-UP LIGHT SWITCH

REPLACEMENT & ADJUSTMENT

1. Remove the console trim from the console.
2. Disconnect the electrical connector from the switch.
3. Remove the 2 attaching screws from the switch and remove the switch.

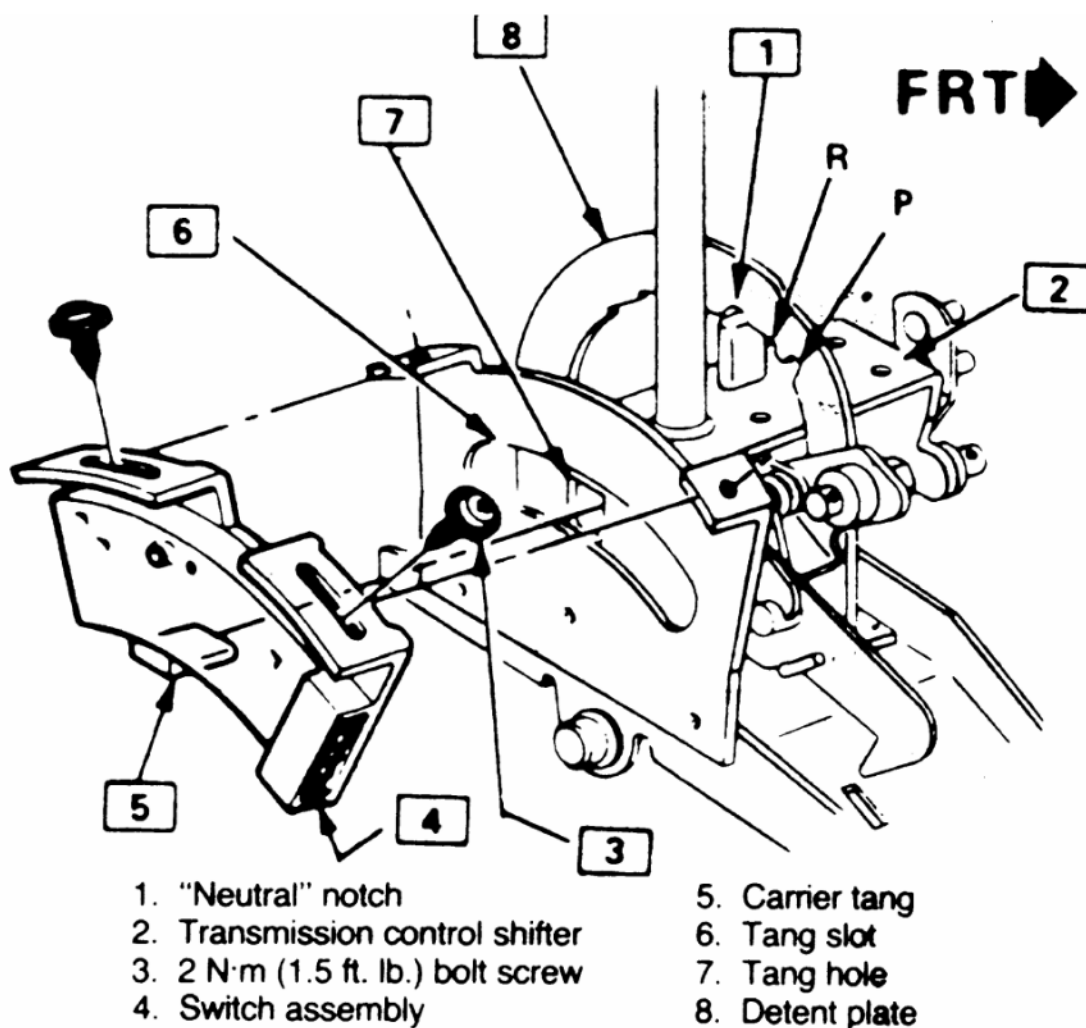


Fig. 1: Neutral start/back-up light switch

4. To install a new switch:
 - a. Place the switch onto the transmission control shifter and loosely install the attaching screws. Position the transmission control shifter assembly in the *N* notch in the detent plate.
 - b. Assemble the switch to the transmission control shifter assembly by inserting the carrier tang into the hole in the shifter lever.
 - c. Install the attaching screws and tighten.
 - d. Move the transmission control shifter assembly out of *N* position. This will shear the switch internal plastic pin.
5. To install the original switch:
 - a. Place the switch onto the transmission control shifter and loosely install the attaching screws. Position the transmission control shifter assembly in the *N* notch in the detent plate.
 - b. Rotate the switch on the shifter assembly to align the service adjustment hole with the carrier tang hole. Insert a $\frac{3}{32}$ in. (2.38mm) diameter gauge pin to a depth of $\frac{9}{16}$ in. (15mm) and tighten attaching screws.
 - c. Remove the gauge pin.
6. Connect the electrical connector to the switch.

7. Install the console trim to the console.

PARK LOCK CABLE

REMOVAL & INSTALLATION

1982-83 MODELS

1. Remove the console and steering column covers. Remove cable retaining screw from the steering column slider and disconnect the cable.
2. At the shifter bracket, pull out the lock button on the cable housing and remove the yoke.

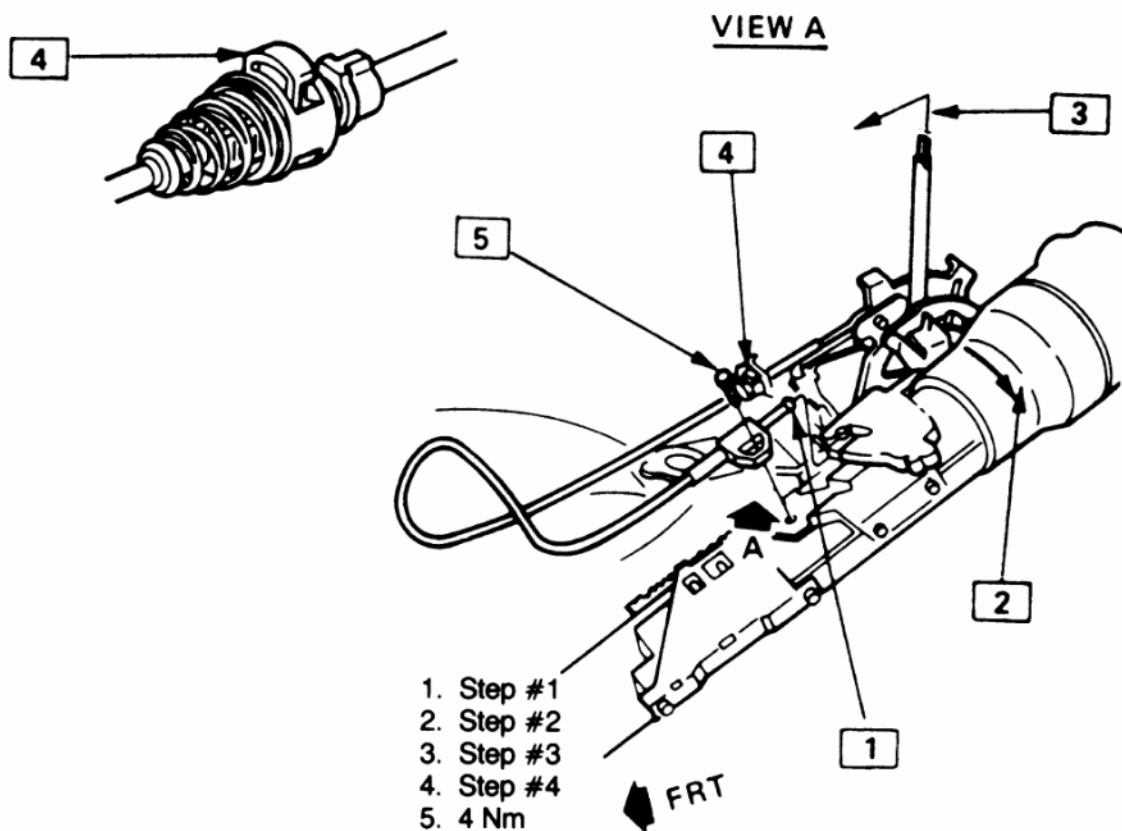


Fig. 1: Park/lock cable adjustment - 1982-83 models

3. Disconnect the cable from the shifter.

To install:

4. Place the shifter lever in *P*. Rotate the steering column shift bowl to the *P* position and lock the column.
5. Connect the cable to the shifter.
6. Install the yoke and push in the lock button on the cable bracket.
7. Connect the cable and install cable retaining screw to the steering column slider.
8. Install the console and steering column covers.

1984-89 MODELS

1. Place the shifter lever in the *P* position. Remove the negative battery cable.
2. Turn the key to *RUN*. Release the cable from the inhibitor switch by inserting a screwdriver into the switch slot.

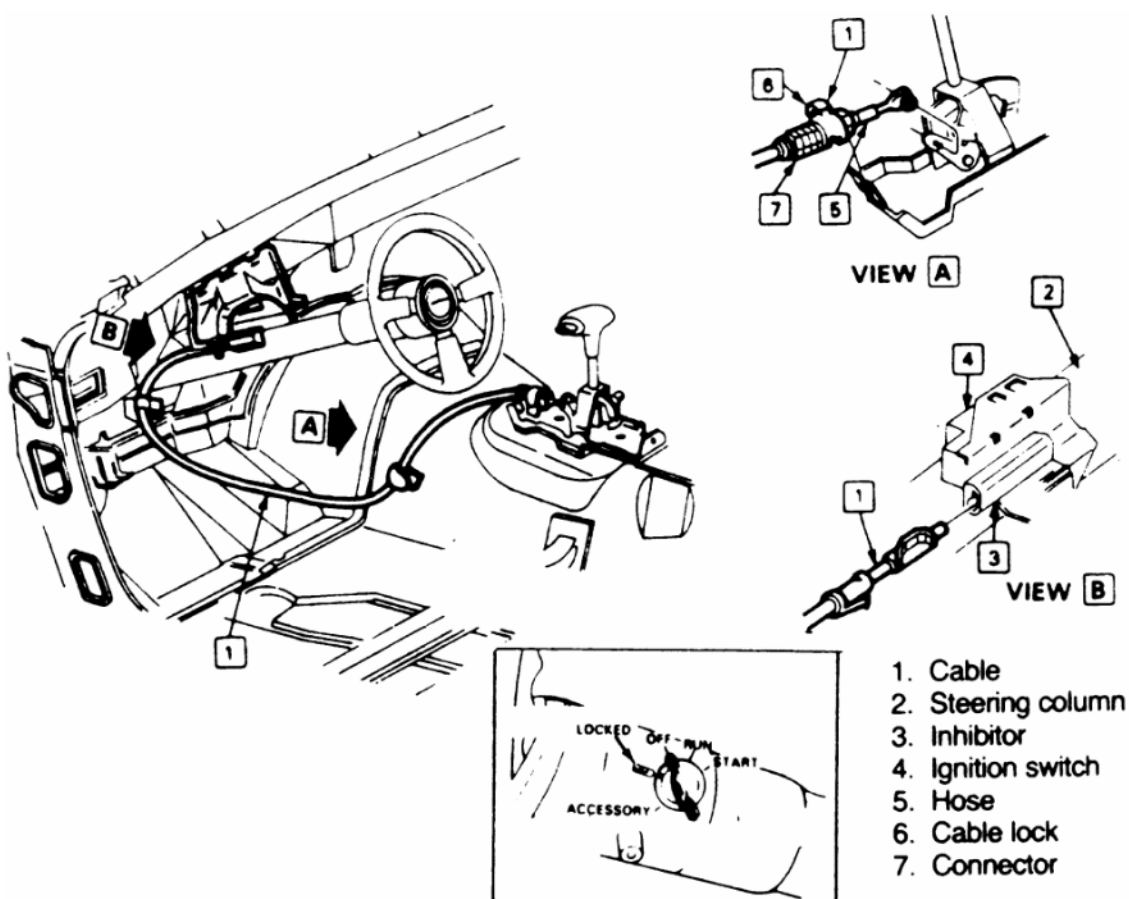


Fig. 2: Park/lock cable adjustment - 1984-89 models

3. Push the cable lock button to the *UP* position and remove the cable from the park lever lock pin.
4. Depress the 2 cable connector latches at the shifter base and remove the cable. Remove the cable clips.

To install:

5. Place the shifter lever into the *P* position and the ignition key to the *RUN* position.
6. After installing the cable ends, push the cable connector nose toward the connector as far as possible and push down the lock button.
7. Complete the installation by reversing the removal procedure.

1990-92 MODELS

1. Place the shifter lever in the *P* position. Remove the negative battery cable.
2. Turn the key to *RUN*.
3. Remove the left side instrument panel sound insulator and kick panels.
4. Remove the floor console.
5. Remove the cable nut and clip. Remove the cable from the bracket, move the button to the *UP* position and unsnap the cable end from the lever lock pin.
6. Lower the steering column. Remove the cable clips.

To install:

7. Place the shifter lever into the *P* position and the ignition key to the *RUN* position.
8. After installing the cable ends, push the cable connector nose toward the connector as far as possible and push down the lock button.
9. Complete the installation by reversing the removal procedure.

EXTENSION HOUSING SEAL (IN VEHICLE)

REMOVAL & INSTALLATION

This seal controls transmission oil leakage around the driveshaft. Continued failure of this seal usually indicates a worn output shaft bushing. If so, there will be signs of the same wear on the driveshaft where it contacts the seal and bushing. The seal is available and is fairly simple to install, with the proper tool.

1. Raise and safely support rear of the vehicle to minimize transmission oil loss when the driveshaft is removed.
2. Unbolt the driveshaft from the differential and center support bearing, if equipped. Wrap tape around the bearing cups to keep them in place on the universal joint and slide the shaft out of the transmission.
3. Use a small pry tool to carefully pry out the old seal. Be careful not to insert the tool too far into the housing or the bushing will be damaged.
4. Use an oil seal installation tool to evenly drive the new seal into the housing. Make sure the tool only contacts the outer metal portion of the seal.
5. Install the driveshaft. Torque the universal bearing cup retainer bolts to 15 ft. lbs. (20 Nm). Recheck fluid level.

TRANSMISSION

REMOVAL & INSTALLATION

1. Disconnect the negative battery cable at the battery.
2. Remove the air cleaner assembly.
3. Disconnect the throttle valve (TV) control cable at the carburetor.

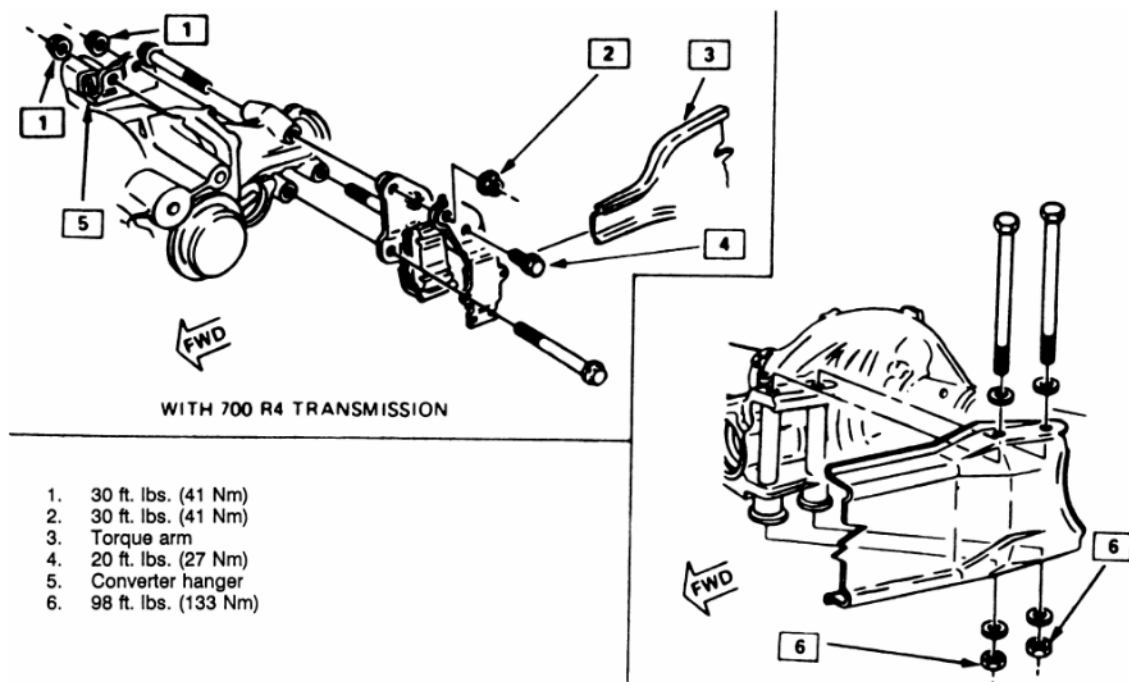


Fig. 1: Torque arm removal

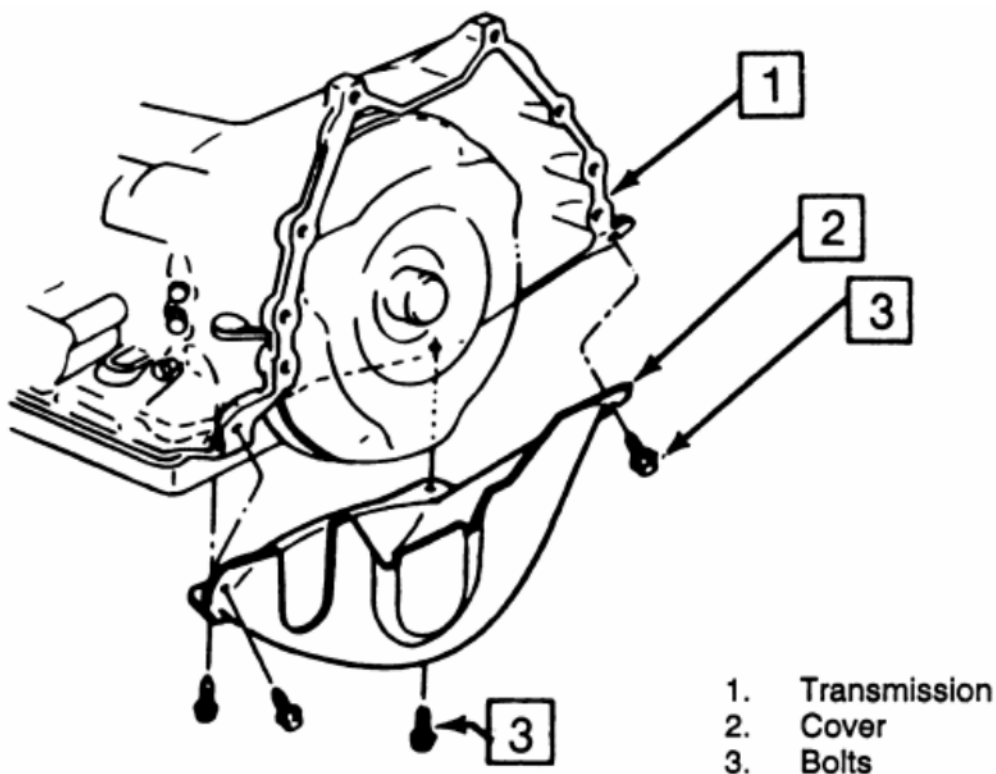


Fig. 2: Flywheel cover removal

4. Remove the transmission oil dipstick. Unbolt and remove the dipstick tube.
5. Raise the vehicle and support it safely with jackstands.

In order to provide adequate clearance for transmission removal, it may be necessary to raise both the front and the rear of the vehicle.

6. Mark the relationship between the driveshaft and the rear pinion flange so that the driveshaft may be reinstalled in its original position.

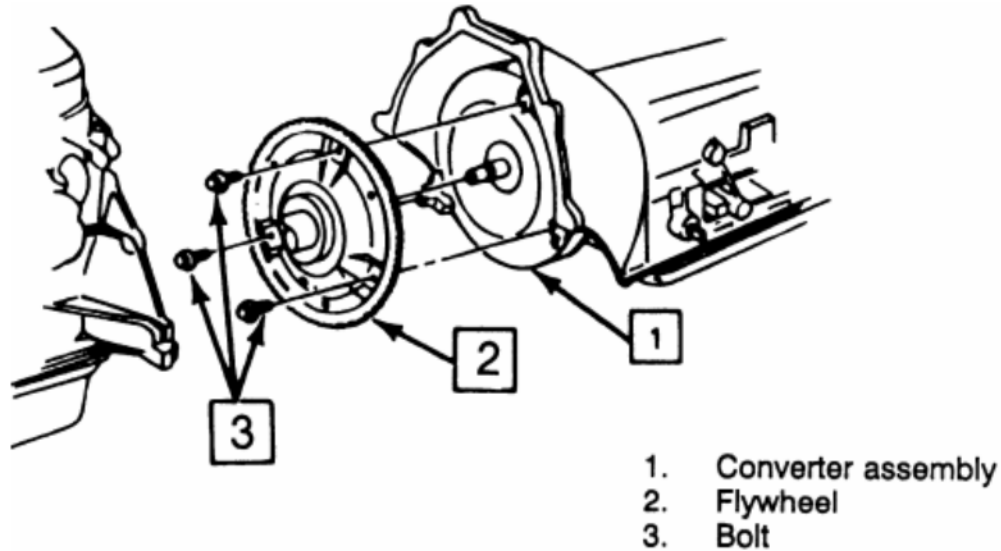


Fig. 3: Converter-to-flywheel bolts

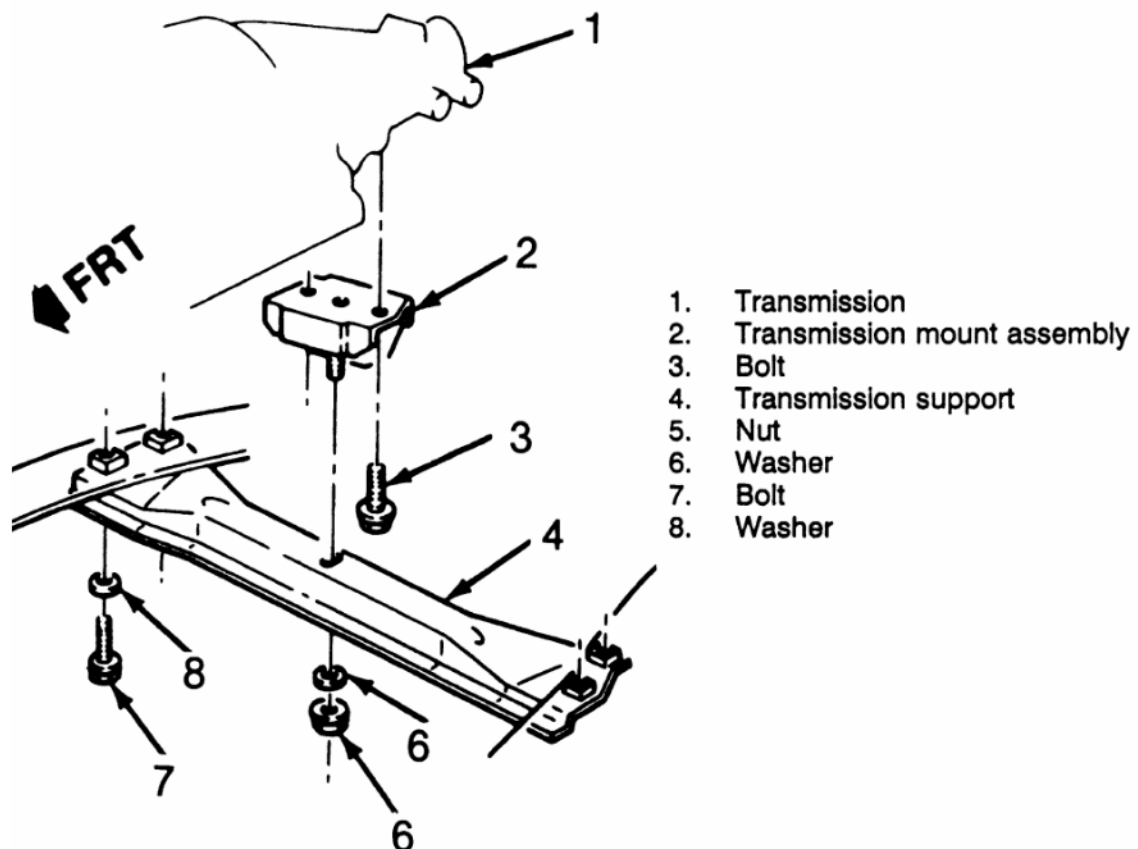
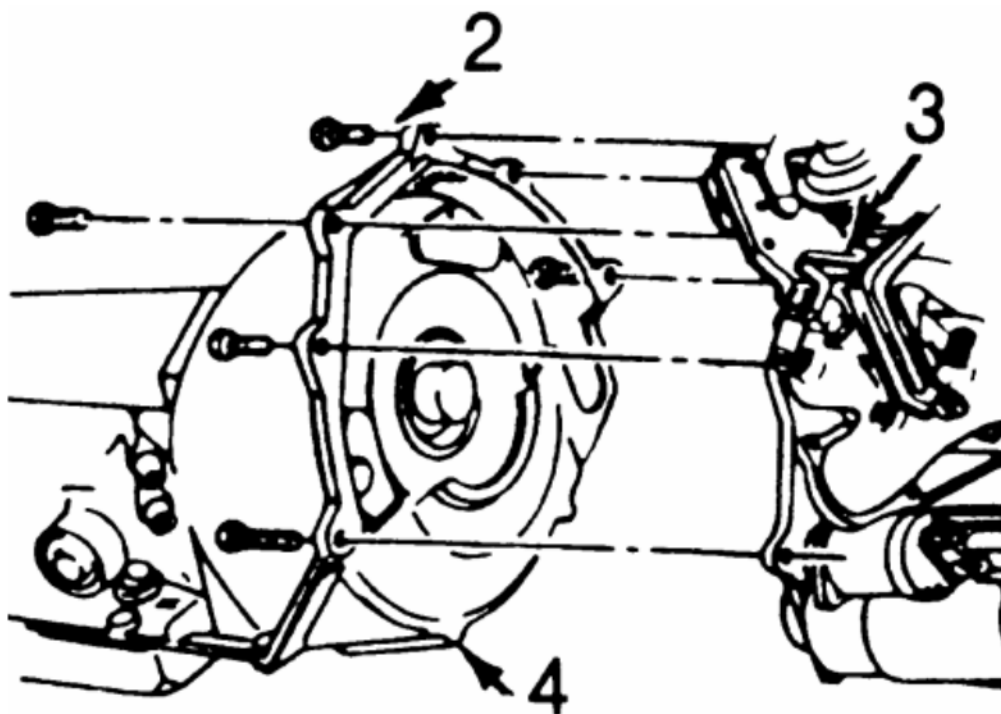


Fig. 4: Transmission mounts - 5.0L & 5.7L engine vehicles

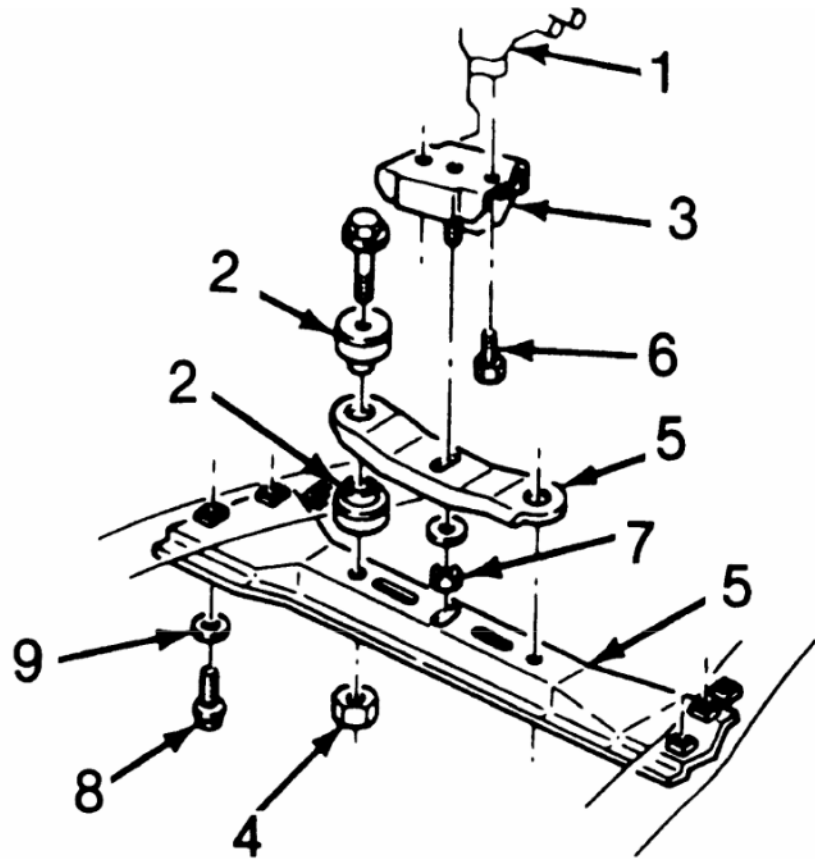
7. Unbolt the universal joint straps from the pinion flange (use care to keep the universal joint caps in place), lower and remove the driveshaft from the vehicle. Place a transmission tailshaft plug or rag in place of the driveshaft to keep the transmission fluid from draining out.
8. Disconnect the catalytic converter support bracket at the transmission.
9. Disconnect the speedometer cable, electrical connectors and the shift control cable from the transmission.

CAUTION - During the next step, rear spring force will cause the torque arm to move toward the floor pan. When disconnecting the arm from the transmission, carefully place a piece of wood between the floor pan and the torque arm. This will prevent possible personal injury and/or floor pan damage



1. Transmission
2. Bolts
3. Engine

Fig. 5: Transmission-to-engine bolts



1. Transmission
2. Insulator
3. Transmission mount assembly
4. Nut
5. transmission support
6. Bolt
7. Nut
8. Bolt
9. Washer

Fig. 6: Transmission mounts for vehicles equipped with the 3.1L engine

10. Remove the torque arm-to-transmission bolts.
11. Remove the flywheel cover, then mark the relationship between the torque converter and the flywheel so that these parts may be reassembled in the same relationship.
12. Remove the torque converter-to-flywheel attaching bolts.
13. Support the transmission with a jack, then remove the transmission mount bolt.
14. Unbolt and remove the transmission crossmember.
15. Lower the transmission slightly. Disconnect the throttle valve cable and oil cooler lines from the transmission.
16. Support the engine using GM special tool BT-6424 or its equivalent. Remove the transmission-to-engine mounting bolts.

CAUTION - The transmission must be secured to the transmission jack

17. Remove the transmission from the vehicle. Be careful not to damage the oil cooler lines, throttle valve cable, or the shift control cable. Also, keep the rear of the transmission lower than the front to avoid the possibility of the torque converter disengaging from the transmission.

To install:

18. Position the transmission and converter into place.
19. Install the transmission-to-engine mounting bolts.
20. Connect the throttle valve cable and oil cooler lines to the transmission.
21. Install the transmission crossmember and secure with bolts.
22. Install the transmission mount bolt.
23. Matchmark the torque converter-to-flywheel. Install the torque converter-to-flywheel attaching bolts.

Before installing the converter-to-flywheel bolts, be sure that the weld nuts on the converter are flush with the flywheel, and that the converter rotates freely by hand in this position.

24. Install the flywheel cover.
25. Install the torque arm-to-transmission bolts.
26. Connect the speedometer cable, electrical connectors and the shift control cable from the transmission.
27. Connect the catalytic converter support bracket at the transmission.
28. Align the matchmark made earlier, then install the driveshaft to the axle pinion. Bolt the universal joint straps to the pinion flange.
29. Lower the vehicle.
30. Install the dipstick tube using a new dipstick tube O-ring and secure with the bolt. Install the transmission oil dipstick.
31. Connect the throttle valve (TV) control cable at the carburetor.
32. Install the air cleaner assembly.
33. Connect the negative battery cable at the battery.

DRIVELINE

DRIVESHAFT AND U-JOINTS

The U-joint is secured to the yoke in one of two ways. Dana and Cleveland shafts use a conventional snapping to hold each bearing cup in the yoke. The snapping fits into a groove located in each yoke end just on top of each bearing cup. The Saginaw design shaft secures its U-joints in another way. Nylon material is injected through a small hole in the yoke and flows along a circular groove between the U-joint and the yoke, creating a synthetic snapping. Disassembly of the Saginaw U-joint requires the joint to be pressed from the yoke. This results in damage to the bearing cups and destruction of the nylon rings.

Replacement kits include new bearing cups and conventional snaprings to replace the original nylon rings. These replacement rings must go inboard of the yoke in contrast to outboard mounting of the Dana and Cleveland designs. Previous service to the Saginaw U-joints can be recognized by the presence of snaprings inboard of the yoke.

Bad U-joints, requiring replacement, will produce a clunking sound when the car is put into gear. This is due to worn needle bearings or a scored trunnion end possibly caused by improper lubrication during assembly. Camaro U-joints require no periodic maintenance and therefore have no lubrication fittings.

DRIVESHAFT

REMOVAL & INSTALLATION

1. Raise the vehicle and safely support it on jackstands. Paint a reference line from the rear end of the driveshaft to the companion flange so that they can be reassembled in the same position.
2. Disconnect the rear universal joint by removing the U-bolts, retaining straps, or the flange bolts.
3. To prevent loss of the needle bearings, tape the bearing caps to the trunnion.

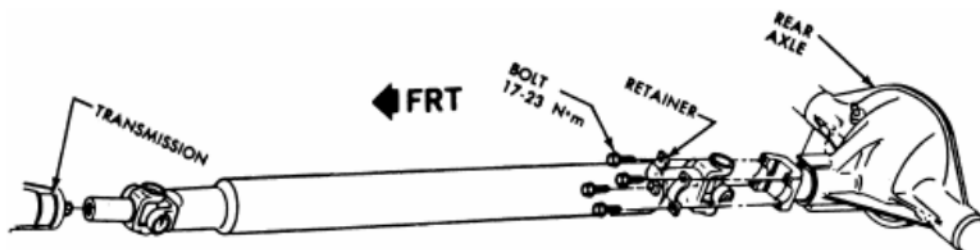


Fig. 1: Driveshaft

4. Remove the driveshaft from the transmission by sliding it rearward.

Do not be alarmed by oil leakage at the transmission output shaft. This oil is there to lubricate the splines of the front yoke.

To install:

5. Check the yoke seal in the transmission case extension and replace it if necessary. See the transmission section for replacement procedures.
6. Position the driveshaft and insert the front yoke into the transmission so the splines mesh with the transmission shaft splines.
7. Using reference marks made during removal, align the driveshaft with the companion flange and secure it with U-bolts or retaining straps.

U-JOINT REPLACEMENT

1. Support the driveshaft horizontally in line with the base plate of a press.

2. Place the U-joint so the lower ear of the shaft yoke is supported on a 1 $\frac{1}{8}$ in. (29mm) socket.
3. Remove the lower bearing cap out of the yoke ear by placing tool J-9522-3 or equivalent, on the open horizontal bearing caps and pressing the lower bearing cap out of the yoke ear.

This will shear the nylon injector ring, if the original U-joint is being removed. There are no bearing retaining grooves in the production bearing caps, therefore they cannot be reused. If a replacement U-joint is being removed, be sure to remove the retaining clips from the U-joint.

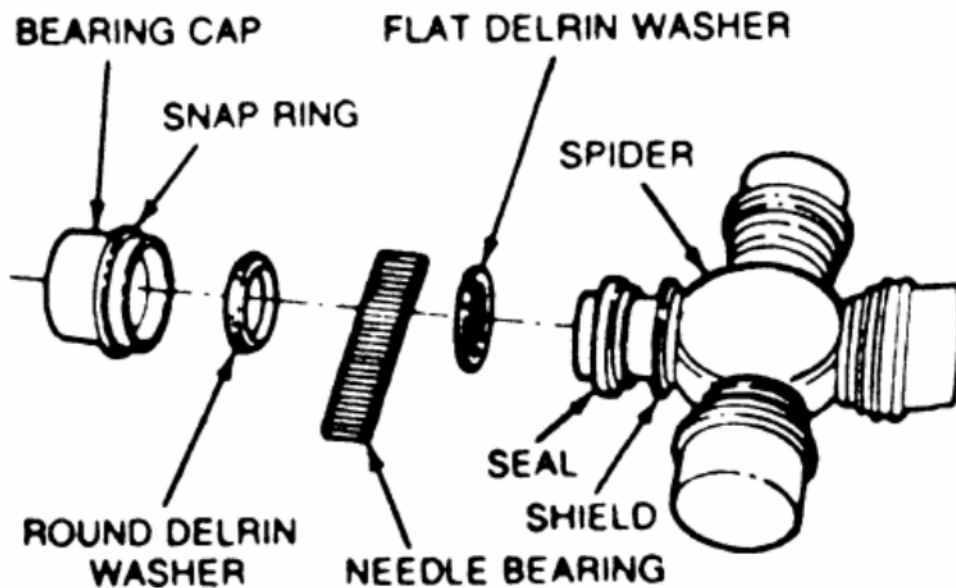


Fig. 2: Internal snapping type

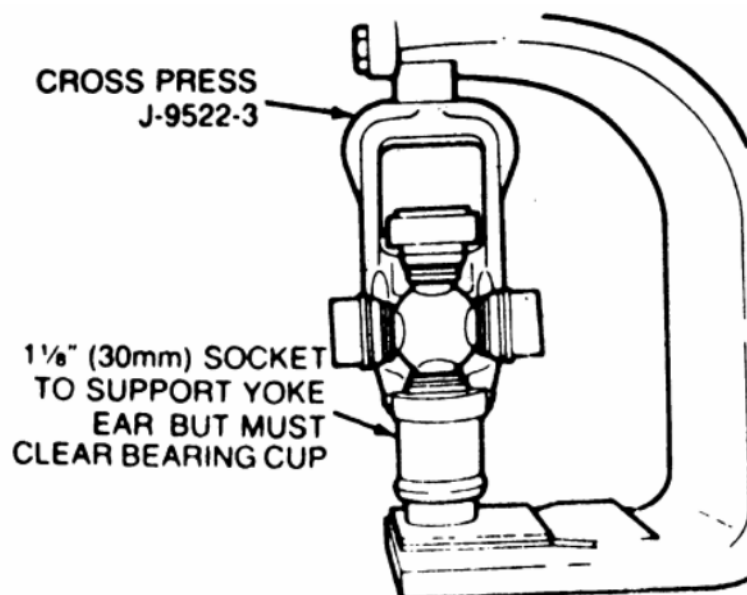


Fig. 3: Pressing out the U-joint

**Pressing out the old
U-joint**

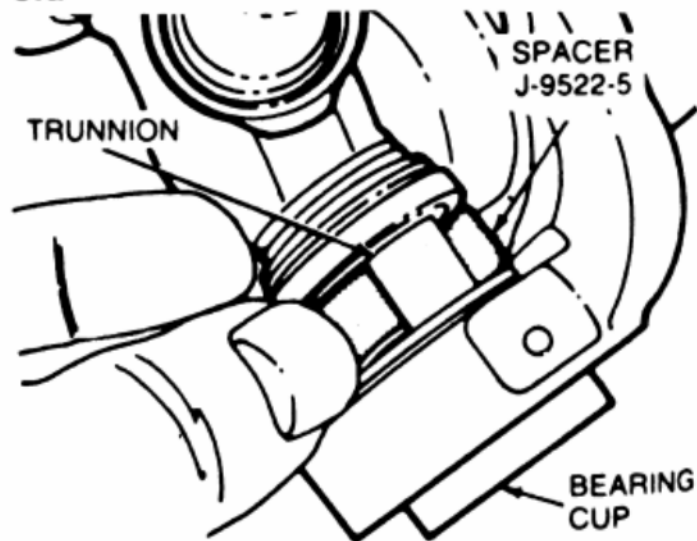


Fig. 4: Insert a spacer to push the joint all the way out

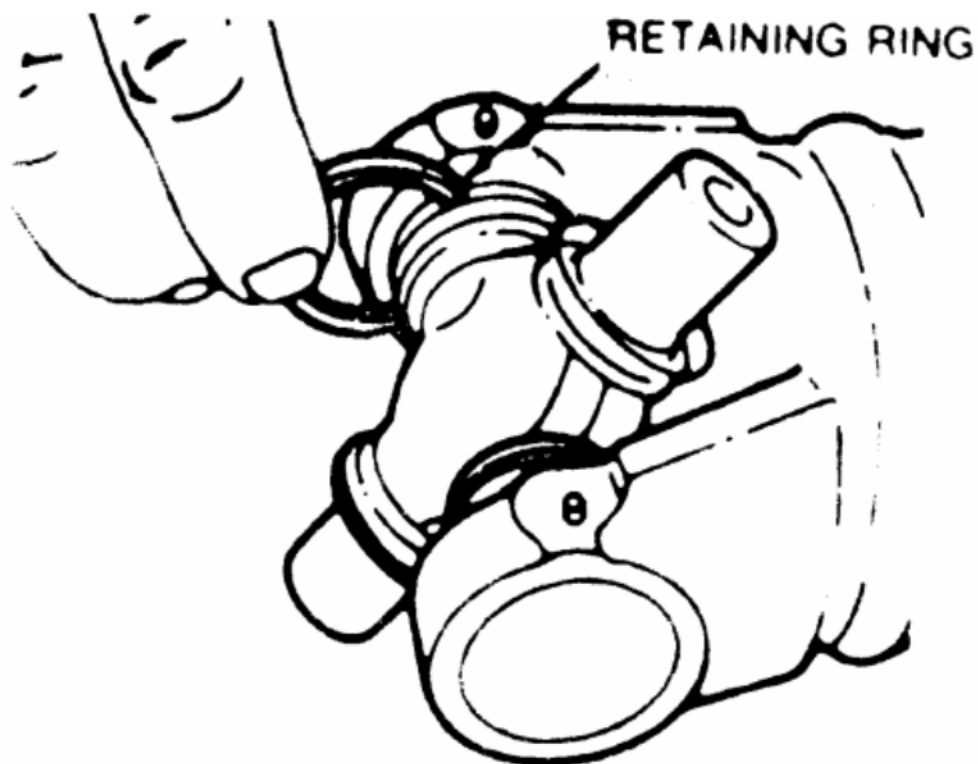


Fig. 5: Installing the snapping

STRIKE TUBE YOKE
EAR IN THIS AREA

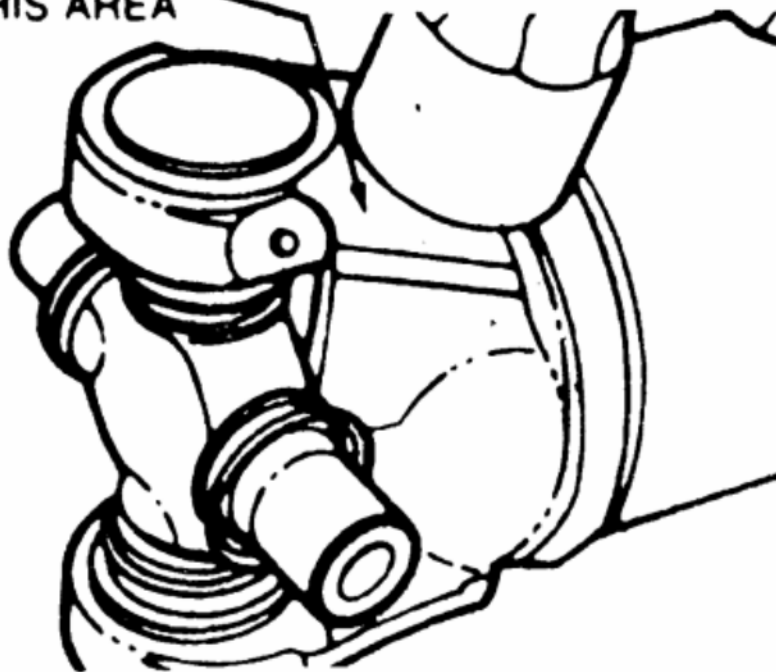


Fig. 6: Seating the snapping

4. If the bearing cap is not completely removed, lift tool J-9522-3 and insert tool J-9522-5 or equivalent between the bearing cap and seal, then continue pressing the U-joint out of the yoke.
5. Repeat the procedure for the opposite side.
6. Remove the spider from the yoke.

To install:

7. Install 1 bearing cap part way into 1 side of the yoke. Turn this yoke ear to the bottom.
8. Using tool J-9522-3 or equivalent, seat the trunnion into the bearing cap.
9. Install the opposite bearing cap partially onto the trunnion.
10. Ensure both trunnions are straight and true in the bearing caps.
11. Press the spider against the opposite bearing cap, while working the spider back and forth to ensure free movement of the trunnions in the bearing caps.
12. If trunnion is binding, the needle bearings have tipped over under the end of the cap.
13. Stop pressing when 1 bearing cap clears the retainer groove inside the yoke.
14. Install a retaining ring.
15. Repeat the procedure for the remaining bearing caps and U-joints.
16. Installation of the driveshaft is the reverse of the removal procedure. Tighten the strap bolts to 16 ft. lbs. (22 Nm).

The Saginaw shaft uses two different sizes of bearing cups at the differential end. The larger cups (the ones with the groove) fit into the driveshaft yoke.

REAR AXLE

IDENTIFICATION

The rear axle code and the manufacturers code, plus the date built, is stamped on the forward side of the right axle tube. Any reports made on the rear axle assemblies must include the full code letters and the date built numbers. The Limited-slip differentials are identified by a tag attached to the lower right section of the axle.

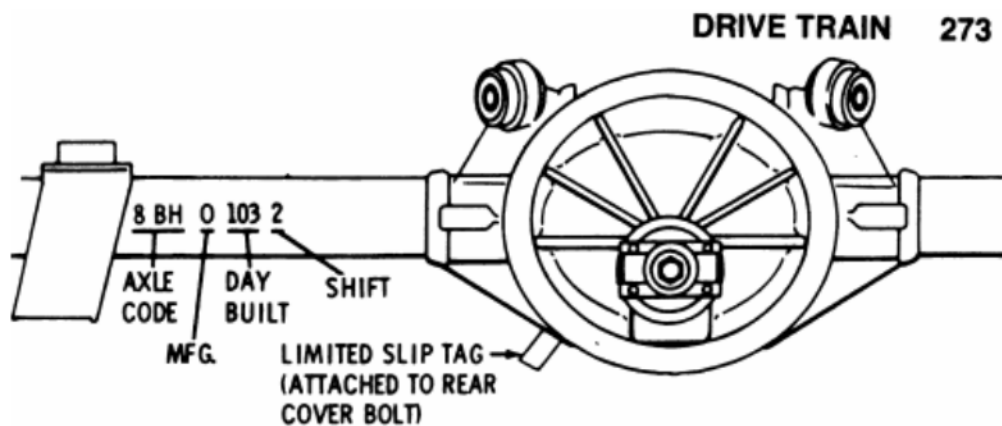


Fig. 1: Rear axle ID code

DETERMINING AXLE RATIO

An axle ratio is obtained by dividing the number of teeth on the drive pinion gear into the number of teeth on the ring gear. For instance, on a 4.11 ratio, the driveshaft will turn 4.11 times for every turn of the rear wheel.

The most accurate way to determine the axle ratio is to drain the differential, remove the cover, and count the number of teeth on the ring and pinion.

An easier method is to jack and support the car so that both rear wheels are off the ground. Make a chalk mark on the rear wheel and the driveshaft. Block the front wheels and put the transmission in Neutral. Turn the rear wheel one complete revolution and count the number of turns made by the driveshaft. The number of driveshaft rotations is the axle ratio. More accuracy can be obtained by going more than one tire revolution and dividing the result by the number of tire rotations.

The axle ratio is also identified by the axle serial number prefix on the axle; the axle ratios are listed in dealer's parts books according to prefix number. Some axles have a tag on the cover.

AXLE SHAFT, BEARING AND SEAL

Axle shafts are the last link in the chain of components working to transmit engine power to the rear wheels. The splined end of each shaft meshes with the

internal splines of each differential side gear. As the side gears turn, so do the axle shafts, and, since they are also connected, so do the wheels.

Each shaft passes through the side gear and is locked into place by either a C-lock or flange plate bolted to the end of the axle housing with pressed on bearings. As the name implies, the C-lock is a flat, C-shaped piece of metal that fits into a groove at the end of the shaft. A round pinion shaft is wedged in between the end of the shafts. This pinion shaft prevents the shafts from sliding inward and makes the C-locks functional by pushing them tightly against each side gear. Removing this pinion shaft allows the shafts to slide inward making the C-locks accessible for removal. Once the C-locks are removed, the axle shafts can be pulled from the car.

The wheel end of each shaft is flanged and pressed into it are five wheel lug bolts serving to hold on the wheel. Each axle shaft is supported by an axle bearing (wheel bearing) and oil seal located within the axle shaft housing just to the outside of the brake backing plate.

REMOVAL & INSTALLATION

EXCEPT BORG-WARNER REAR ASSEMBLY

1. Raise and support the vehicle safely. Remove the rear wheels and drums or rotors.
2. Remove the carrier cover and drain the gear oil into a suitable container.

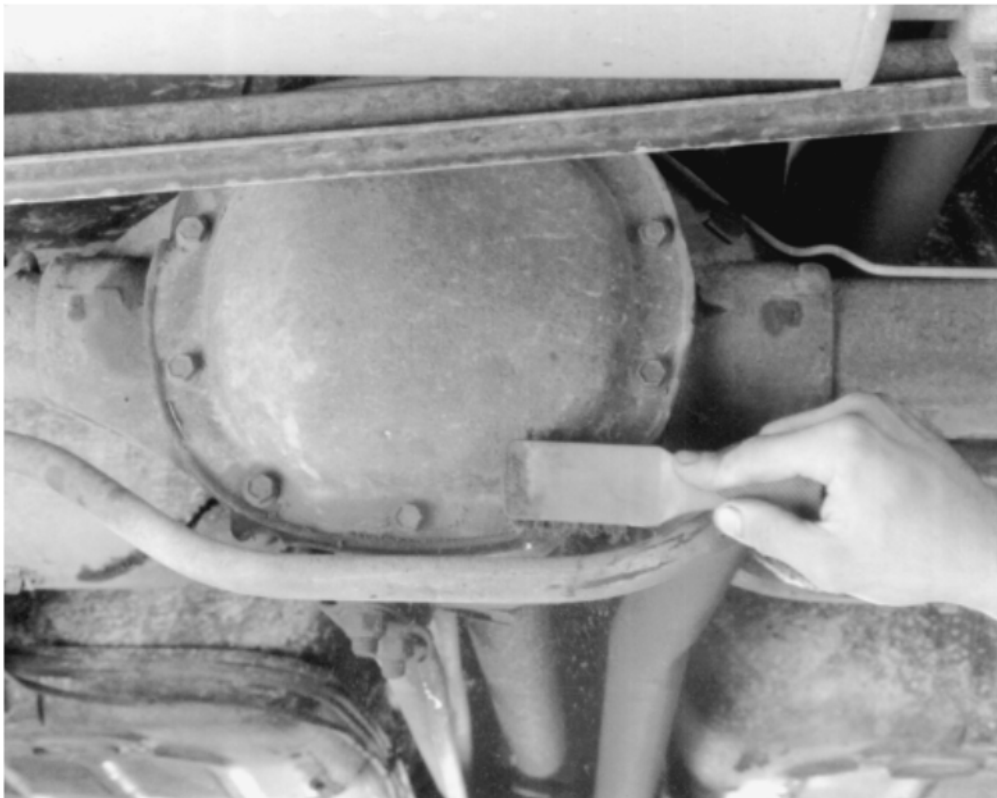


Fig. 1: Clean the area around the bolts

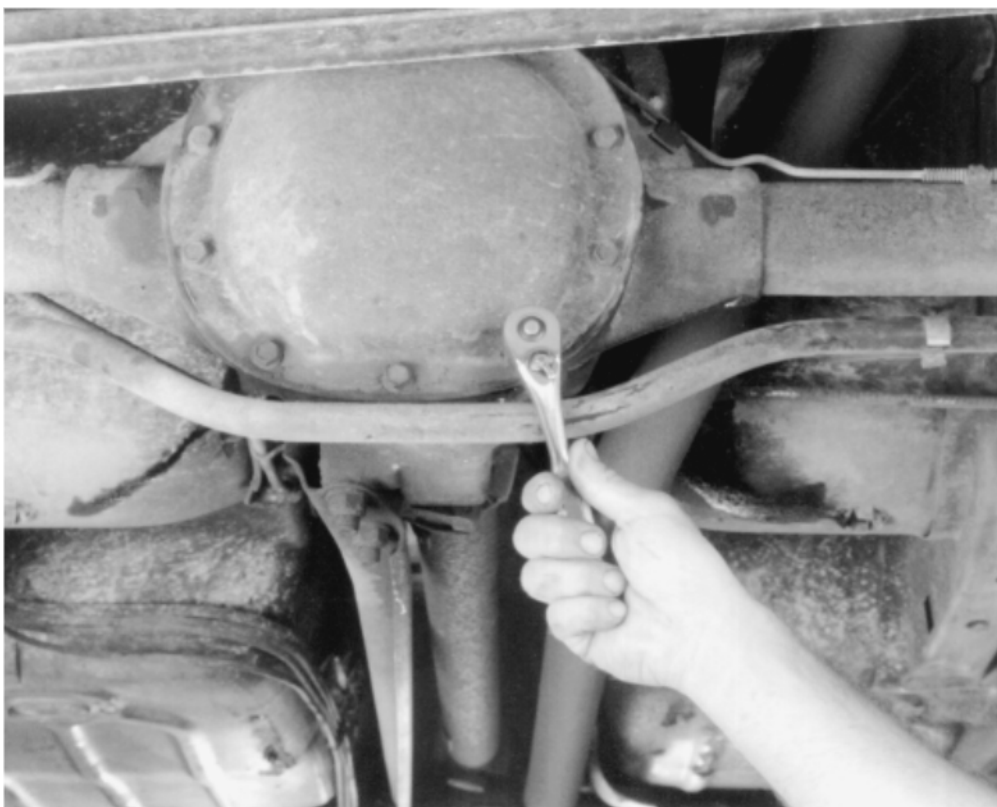


Fig. 2: Bolt removal

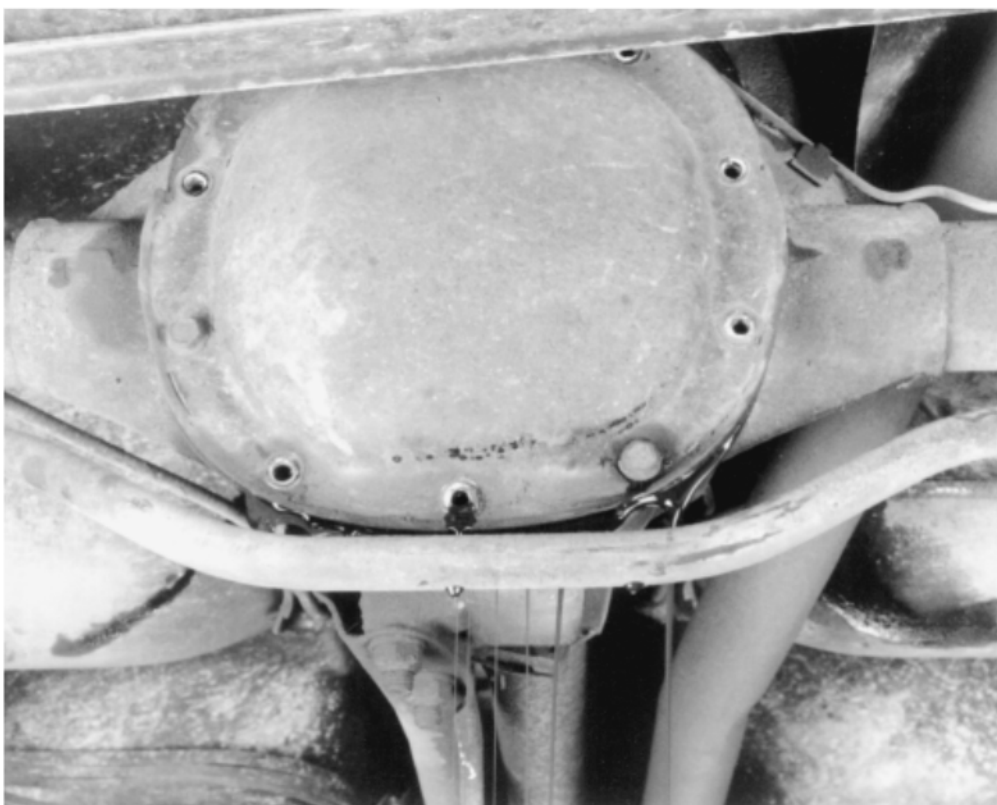


Fig. 3: The fluid will begin to seep out

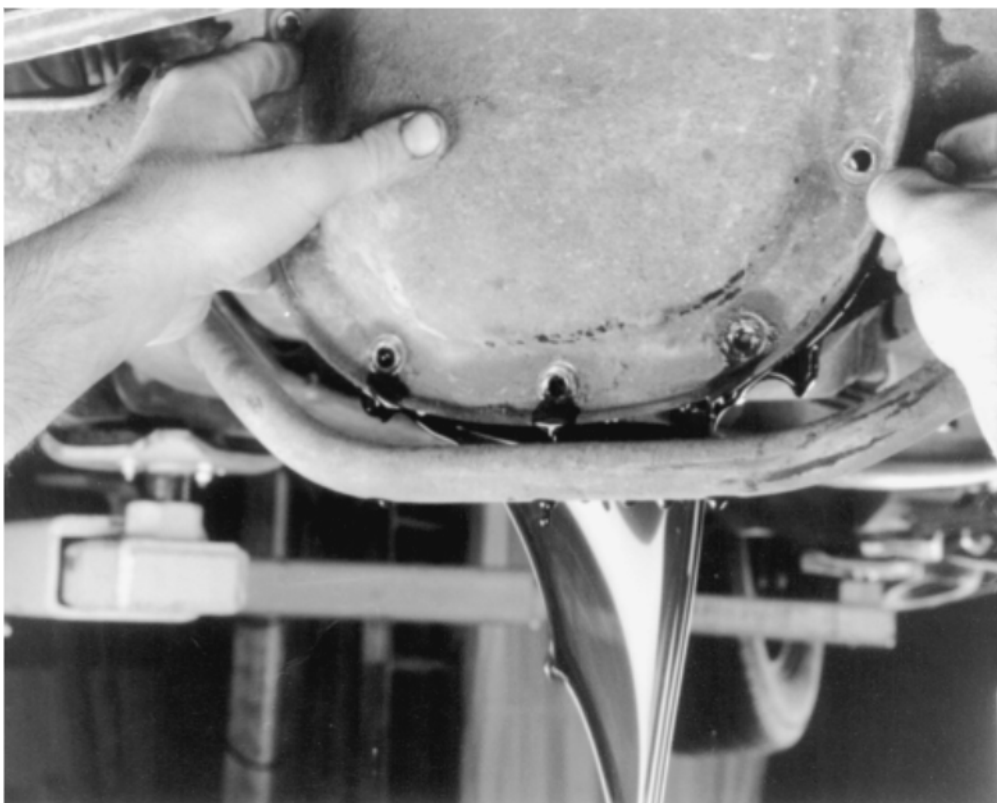


Fig. 4: Pry the cover away

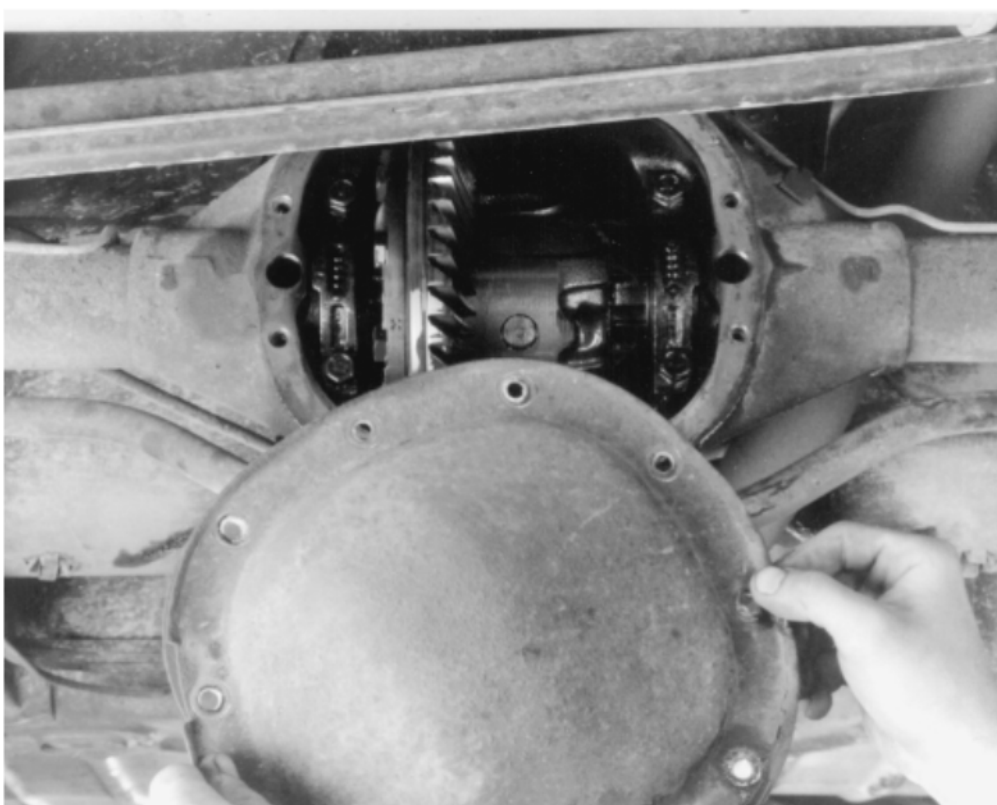


Fig. 5: Cover removal

3. Remove the rear axle pinion shaft lock screw. Remove the rear axle pinion shaft.
4. Push the flanged end of the axle shaft into the axle housing and remove the C-clip from the opposite end of the shaft.
5. Remove the axle shaft from the axle housing.
6. Using a suitable tool, remove the oil seal from the axle housing. Be careful not to damage the housing.

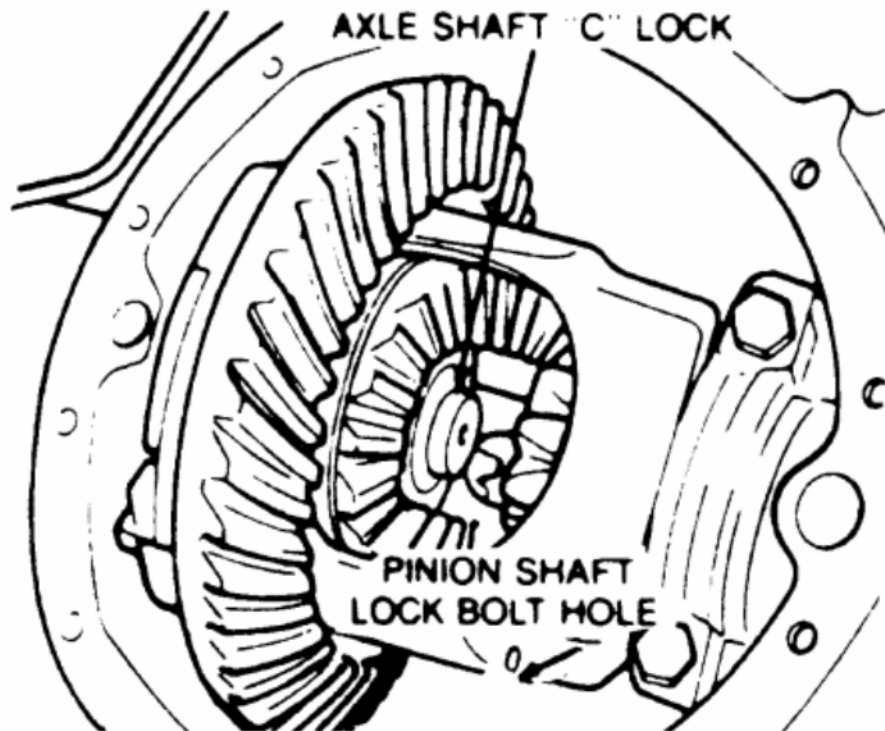


Fig. 6: C-lock removal

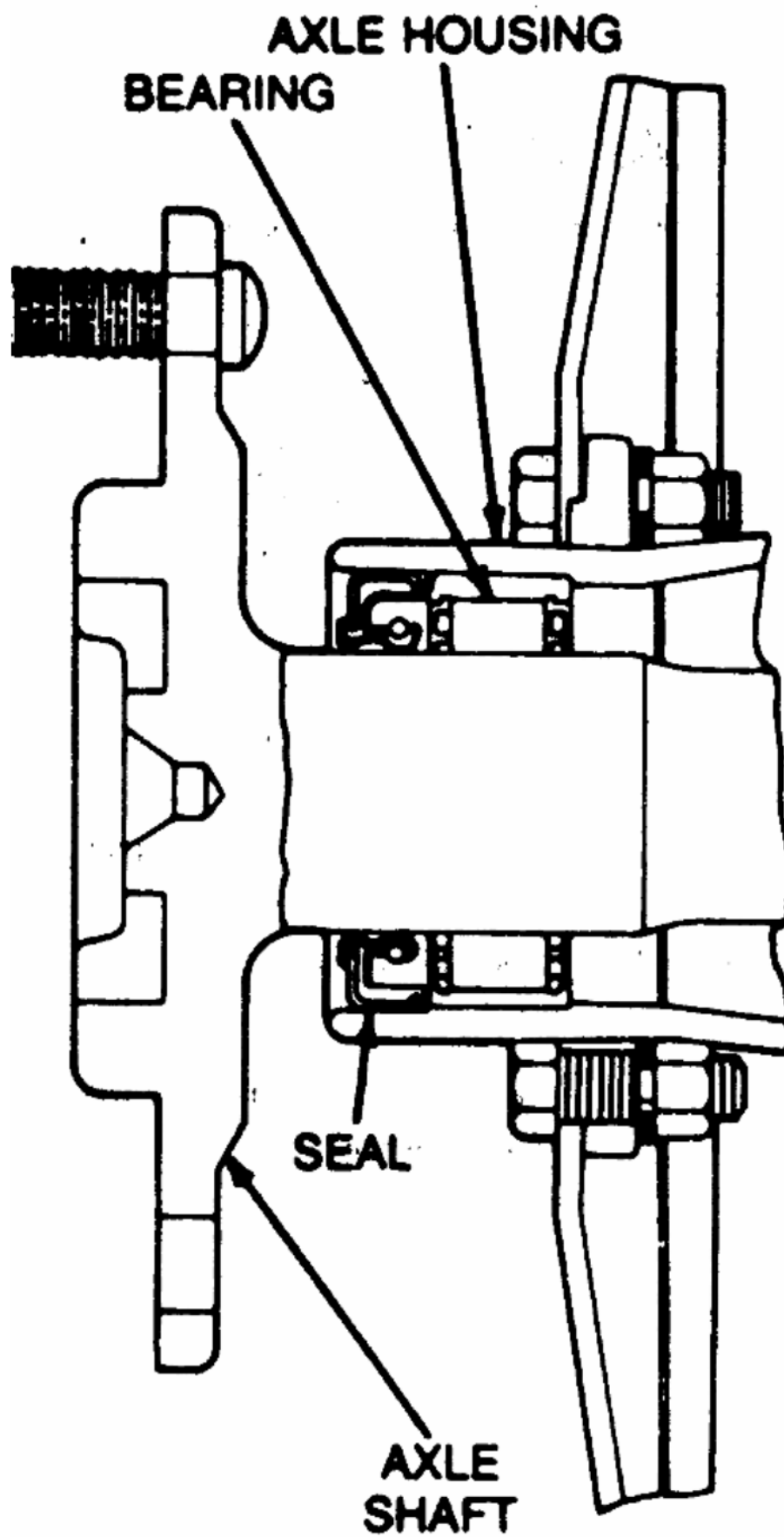


Fig. 7: Bearing and seal side view

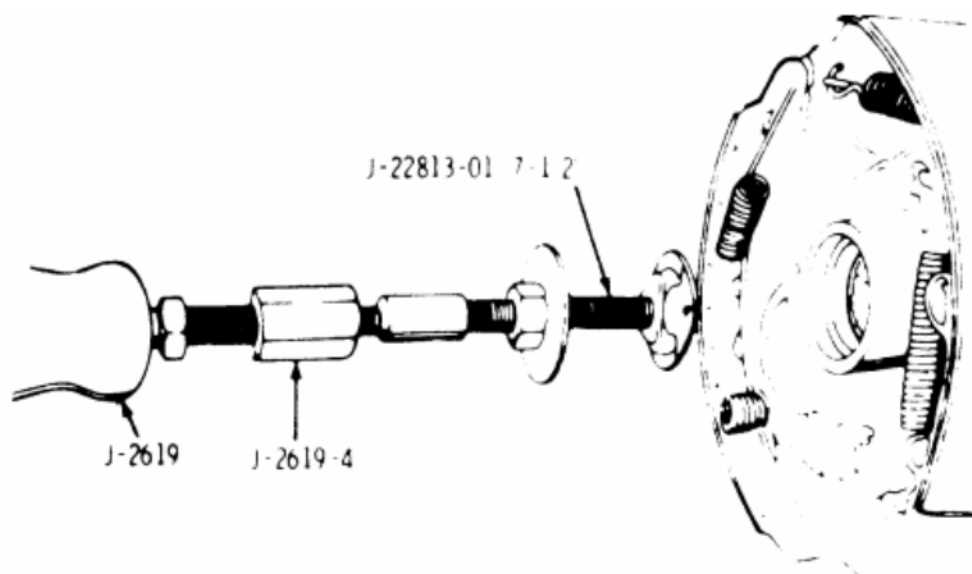


Fig. 8: Bearing removal

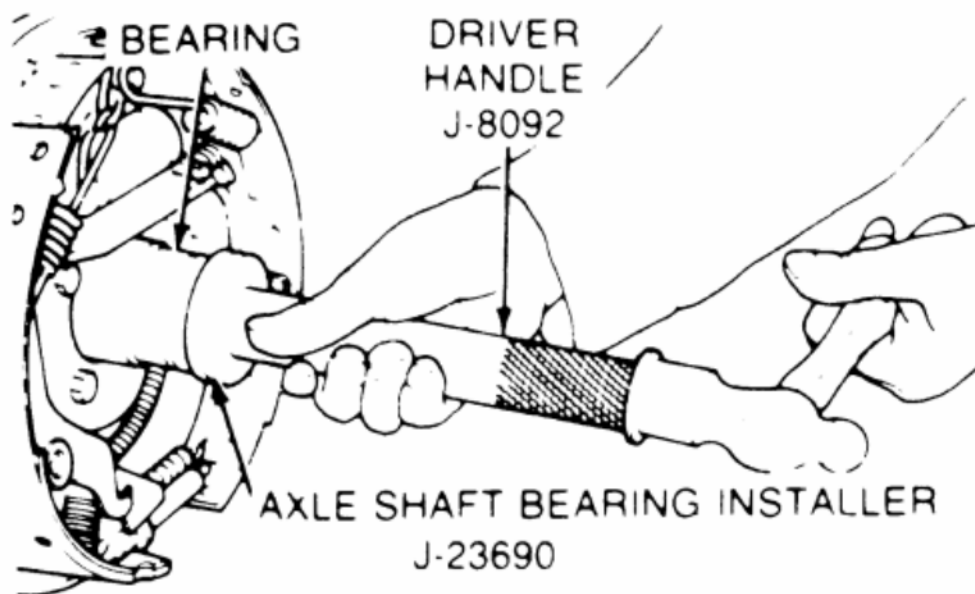


Fig. 9: Bearing installation

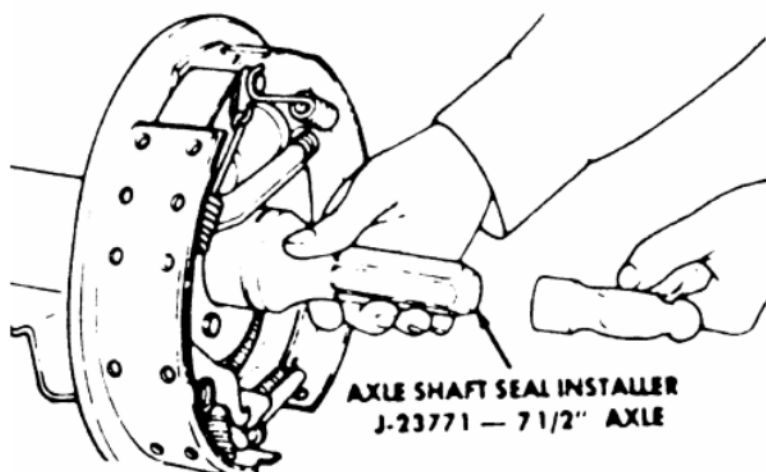


Fig. 10: Seal installation

7. Install tool J-22813-01 or equivalent, into the bore of the axle housing and position it behind the bearing, ensure the tangs of the tool engage the outer race. Remove the bearing using a slide hammer.
8. Installation is the reverse of the removal procedure. Lubricate the new bearing and sealing lips with gear lube before installing. Tighten the pinion gear shaft lock screw to 27 ft. lbs. (36 Nm). Tighten the carrier cover bolts to 22 ft. lbs. (30 Nm).

BORG-WARNER REAR ASSEMBLY

The Borg-Warner axle assembly can be quickly identified by checking the axle code. The Borg-Warner axle numbers are 4EW, 4EU and 4ET on 1988 vehicles, BET, BEU and BEW on 1989 vehicles and 9EQ and 9ER on 1990 vehicles.

1. Raise the vehicle and support is safely.
2. Remove the rear wheels and drums or rotors. Remove the brake components as required.

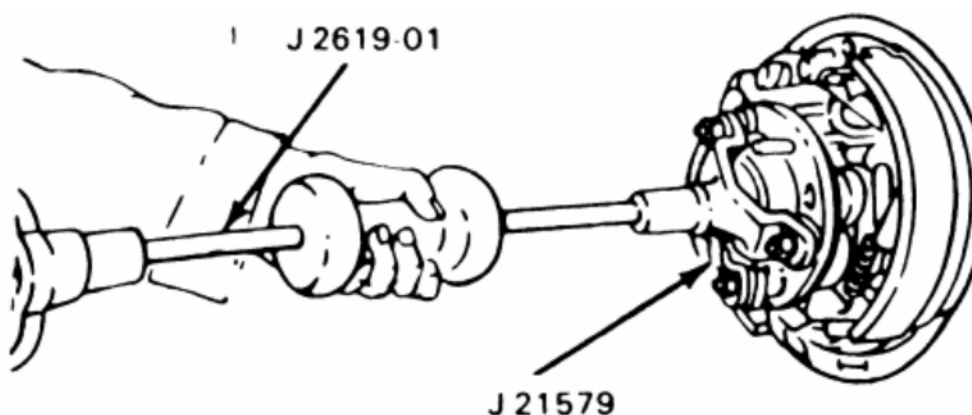


Fig. 11: Borg-Warner axle shaft removal

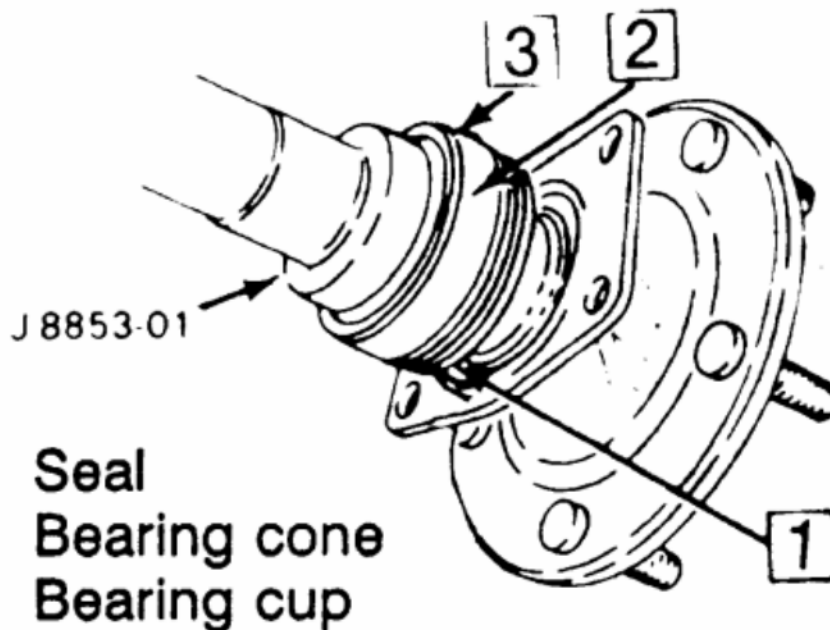


Fig. 12: Bearing & seal installed

3. Remove the 4 nuts attaching the brake anchor plate and outer bearing retainer to the axle housing.
4. Remove the axle shaft and wheel bearing assembly using axle shaft removal tool J-21595 and slide hammer J-2619 or equivalent.
5. To remove the inner bearing retainer and the bearing from the axle shaft, split the retainer with a chisel, then remove it from the shaft. Using tool J-22912-01, press the bearing off the shaft.
6. Installation is the reverse of the removal procedure. Make sure the axle seal is installed with the spring side facing the center of the axle. Tighten the backing plate bolts to 36 ft. lbs. (49 Nm).

There are right (black banded) and left (gold banded) axle seals and they cannot be interchanged.

PINION SEAL

REMOVAL & INSTALLATION

EXCEPT BORG-WARNER REAR AXLE

1. Raise and safely support the vehicle.
2. Remove both rear wheel and tire assemblies.
3. Matchmark the driveshaft and pinion yoke so they may be reassembled in the same position. Remove the driveshaft.
4. Using a suitable punch, mark the position of the pinion yoke, pinion shaft and nut so proper reinstallation preload can be maintained.

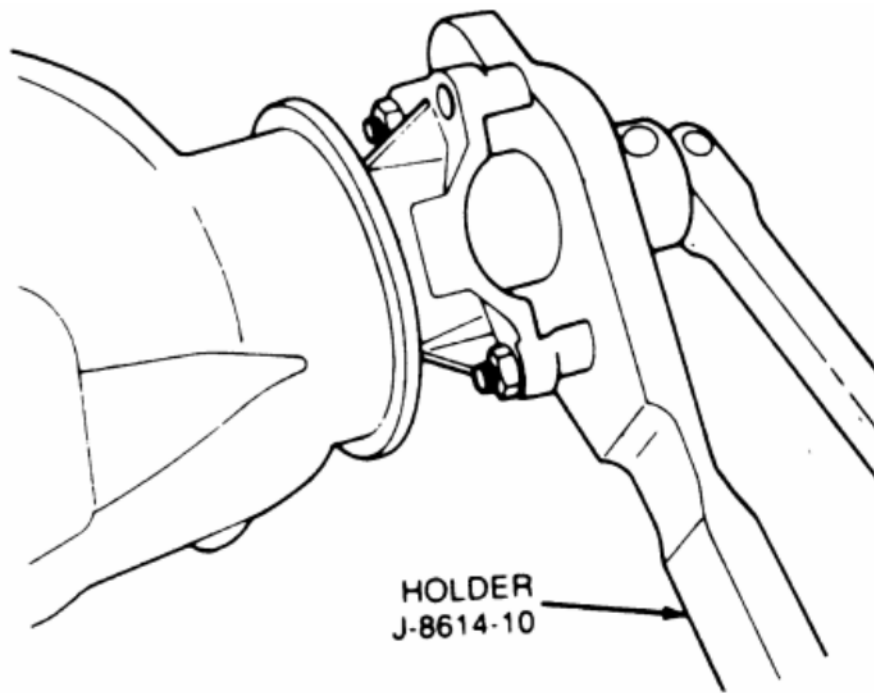


Fig. 1: Pinion nut removal

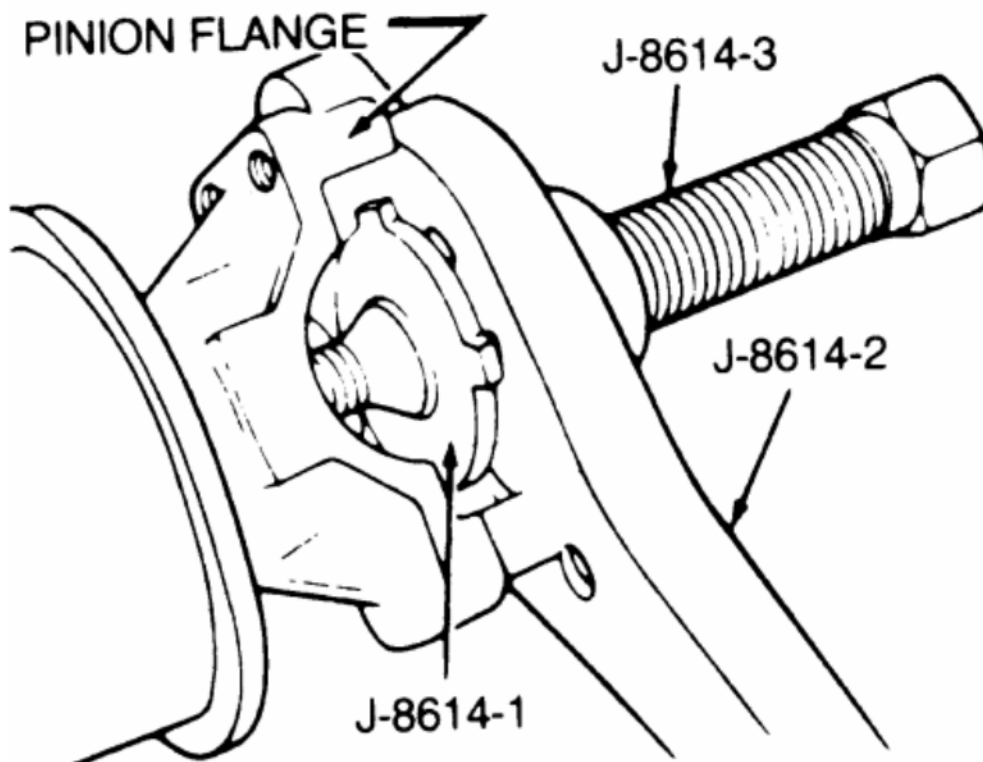


Fig. 2: Flange removal

5. Using a suitable tool, hold the pinion flange in place, then remove the pinion flange nut and washer.
6. Place a container under the differential to catch any fluid that may drain from the rear axle. Using a suitable tool, remove the pinion yoke.

7. Use a suitable tool to remove the pinion seal.

To install:

8. Inspect the sealing surfaces of the pinion yoke for nicks or damage and replace, as necessary. Examine the carrier bore and remove any burrs that may cause leaks around the outside of the seal.

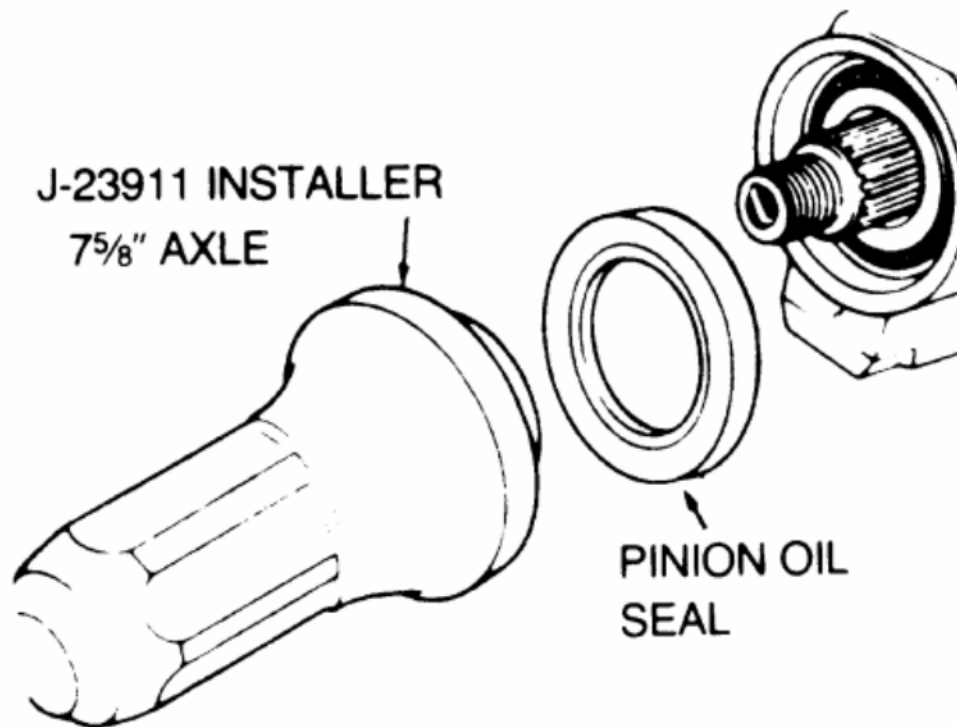


Fig. 3: Seal installation

9. Install the seal using a suitable installer.
10. Apply a seal lubricant to the outer diameter of the pinion flange and the sealing lip of the new seal.
11. Install the pinion yoke on the drive pinion by tapping with a soft-face hammer until a few pinion threads project through the pinion yoke.
12. Install the washer and pinion flange nut. While holding the pinion yoke, tighten the nut to the same position as marked earlier, then tighten an additional $\frac{1}{16}$ in. (1.6mm) turn beyond the marks.
13. Install the driveshaft.
14. Install the rear wheels and tires. Check and add the correct lubricant, as necessary.

BORG-WARNER REAR AXLE

1. Raise and safely support the vehicle.
2. Remove both rear wheel and tire assemblies.
3. Matchmark the driveshaft and pinion yoke so they may be reassembled in the same position. Remove the driveshaft.
4. Using a beam-type inch pound torque wrench on the pinion yoke nut, measure and record the amount of pinion bearing, axle bearings and

seal preload. Turn the torque wrench smoothly for several rotations and record the amount of preload as the assembly is turning, not the initial force required to start the assembly moving.

Preload is measured as the amount of torque required to turn the assembly.

5. Using a suitable tool to hold the pinion yoke in place, remove the pinion yoke nut and washer.
6. Place a suitable container under the differential to catch any fluid that may drain from the rear axle. Using a suitable tool, remove the pinion flange.
7. Use a suitable tool to remove the pinion seal.

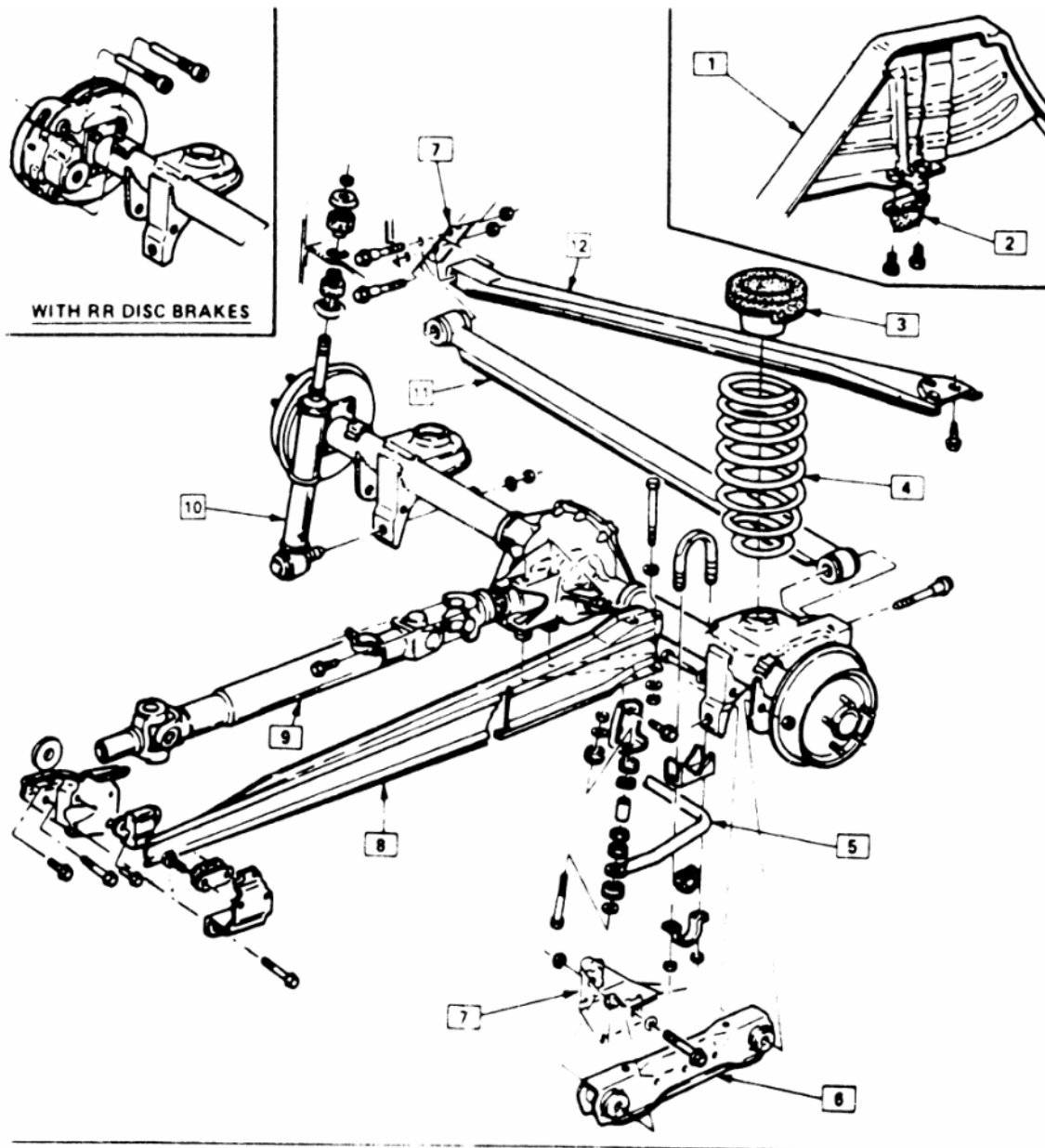
To install:

8. Inspect the seal surface of the pinion flange for tool marks, nicks or damage and replace, as necessary. Examine the carrier bore and remove any burrs that might cause leaks around the outside of the seal.
9. Install the seal 0.010 in. (0.25mm) below the flange surface using a suitable seal installer.
10. Apply suitable seal lubricant to the outer diameter of the pinion flange and the sealing lip of the new seal.
11. Install the pinion flange on the drive pinion by tapping with a soft hammer until a few pinion threads project through the pinion flange.
12. Install the washer and pinion flange nut. While holding the pinion flange, tighten the nut a little at a time and turn the drive pinion several revolutions after each tightening, to set the bearing rollers. Check the preload each time with a suitable inch pound torque wrench until the preload is 5 inch lbs. (0.6 Nm) more than the reading obtained during disassembly.
13. Install the driveshaft.
14. Install the rear wheels and tires. Check and add the correct lubricant, as necessary.

AXLE HOUSING

REMOVAL & INSTALLATION

1. Raise the vehicle and support it safely. Be sure that the rear axle assembly is supported safely.
2. Disconnect shock absorbers from axle. Remove the wheel assemblies.
3. Mark driveshaft and pinion flange, then disconnect driveshaft and support out of the way.
4. Remove brake line junction block bolt at axle housing. If necessary, disconnect the brake lines at the junction block.



- | | |
|-----------------------------|--------------------|
| 1 RAIL | 7 UNDERBODY |
| 2 JOUNCE BUMPER | 8 TORQUE ARM |
| 3 SPRING INSULATOR ASSEMBLY | 9 PROP SHAFT |
| 4 COIL SPRING | 10 SHOCK ABSORBER |
| 5 OPTIONAL STABILIZER BAR | 11 TRACK BAR |
| 6 LOWER CONTROL ARM | 12 TRACK BAR BRACE |

Fig. 1: Exploded view of the rear axle and rear suspension component mounting

5. Disconnect the upper control arms from the axle housing.
6. Lower the rear axle assembly. Remove the springs.
7. Continue lowering the rear axle assembly and remove it from the vehicle.

To install:

8. Position the rear axle assembly into place and install the springs.
9. Connect the upper control arms to the axle housing.

10. Install the brake line junction block bolt at the axle housing. Connect any brake lines that were disconnected.
11. Install and secure the driveshaft aligning the match marks made earlier.
12. Connect the shock absorbers to the axle and install the wheel assemblies.
13. Lower the vehicle and replace any lost rear axle fluid.

DIFFERENTIAL ASSEMBLY

REMOVAL & INSTALLATION

1. Raise and safely support the vehicle.
2. Place a suitable container under the differential. Remove the carrier cover and drain the gear oil.
3. Remove the drive axles.
4. Mark the differential bearing caps *L* and *R* to make sure they will be reassembled in their original location.
5. Using a suitable tool, remove the differential carrier. Be careful not to damage the gasket sealing surface when removing the unit. Place the right and left bearing outer races of the side bearing assemblies and shims in sets with the marked differential bearings caps so they can be reinstalled in their original positions.

To install:

6. Inspect the differential carrier housing for foreign material. Check the ring and pinion for chipped teeth, excessive wear and scoring. Check the carrier bearings visually and by feel. Clean the differential housing and replace components, as necessary.
7. Install the differential carrier. Check the carrier bearing preload along with the ring and pinion backlash, then adjust, as necessary. Tighten the differential bearing cap bolts to 55 ft. lbs. (75 Nm) except on Borg-Warner rear axles which are tightened to 40 ft. lbs. (54 Nm).
8. Install the axles.
9. Install the carrier cover using a new gasket. Tighten the carrier cover bolts to 20 ft. lbs. (27 Nm). Add the proper type and quantity of gear oil to axle assembly.

SPECIFICATION CHARTS

AUTOMATIC TRANSMISSION TORQUE SPECIFICATIONS

Component	U.S.	Metric
200C		
Control valve-to-case	9–12 ft. lbs.	13–17 Nm
Converter housing lower cover	84 inch lbs.	10 Nm
Converter-to-flex plate	35 ft. lbs.	47 Nm
Cooler line connectors	26–30 ft. lbs.	35–40 Nm
Final drive-to-transmission	30 ft. lbs.	41 Nm
Governor pressure switch	5–10 ft. lbs.	7–14 Nm
Oil pan-to-case	10–13 ft. lbs.	14–18 Nm
Oil screen-to-case	9–12 ft. lbs.	13–17 Nm
Park bracket-to-case	15–20 ft. lbs.	20–27 Nm
Pump cover-to-body	15–20 ft. lbs.	20–27 Nm
Pump-to-case	15–20 ft. lbs.	20–27 Nm
Solenoid-to-pump	24–48 inch lbs.	3–5 Nm
Speedometer gear retainer	6–10 ft. lbs.	8–14 Nm
Throttle lever link	9–12 ft. lbs.	13–17 Nm
Transmission-to-engine	35 ft. lbs.	47 Nm
700-R4 (4L60)		
Control valve-to-case	9–12 ft. lbs.	13–17 Nm
Converter housing lower cover	84 inch lbs.	10 Nm
Converter-to-flex plate	35 ft. lbs.	47 Nm
Cooler line connectors	26–30 ft. lbs.	35–40 Nm
Final drive-to-transmission	30 ft. lbs.	41 Nm
Governor pressure switch	5–10 ft. lbs.	7–14 Nm
Oil pan-to-case	10–13 ft. lbs.	14–18 Nm
Oil screen-to-case	9–12 ft. lbs.	13–17 Nm
Park bracket-to-case	15–20 ft. lbs.	20–27 Nm
Pump cover-to-body	15–20 ft. lbs.	20–27 Nm
Pump-to-case	15–20 ft. lbs.	20–27 Nm
Solenoid-to-pump	24–48 inch lbs.	3–5 Nm
Speedometer gear retainer	6–10 ft. lbs.	8–14 Nm
Throttle lever link	9–12 ft. lbs.	13–17 Nm
Transmission-to-engine	35 ft. lbs.	47 Nm

CLUTCH TORQUE SPECIFICATIONS

Component	U.S.	Metric
Clutch housing-to-engine	55 ft. lbs.	75 Nm
Clutch reservoir bracket	30 inch lbs.	5 Nm
Heat shield	15 ft. lbs.	21 Nm
Master cylinder-to-firewall	10 ft. lbs.	13 Nm
Neutral start switch	26 inch lbs.	3 Nm
Pedal-to-bracket	25 ft. lbs.	35 Nm
Pressure plate-to-flywheel		
4-cyl.	68 ft. lbs.	92 Nm
V6	50 ft. lbs.	70 Nm
V8	60 ft. lbs.	81 Nm
Slave cylinder-to-clutch housing	15 ft. lbs.	21 Nm
Starter-to-clutch housing	30 ft. lbs.	41 Nm

MANUAL TRANSMISSION TORQUE SPECIFICATIONS

Component	U.S.	Metric
76mm 4-speed		
Cover-to-case	15 ft. lbs.	20 Nm
Crossmember-to-frame	35 ft. lbs.	50 Nm
Drive gear retainer	15 ft. lbs.	20 Nm
Extension housing bolts	45 ft. lbs.	60 Nm
Filler plug	15 ft. lbs.	20 Nm
Mount-to-crossmember	35 ft. lbs.	50 Nm
Mount-to-transmission	35 ft. lbs.	50 Nm
Shift lever-to-shifter shaft	25 ft. lbs.	30 Nm
Transmission-to-clutch housing	55 ft. lbs.	75 Nm
77mm 4-speed		
Cover-to-case	1013 Nm	
Crossmember-to-frame	35 ft. lbs.	50 Nm
Damper	30 ft. lbs.	40 Nm
Drive gear retainer	15 ft. lbs.	20 Nm
Extension housing bolts	25 ft. lbs.	30 Nm
Filler plug	20 ft. lbs.	27 Nm
Front bearing retainer	5 ft. lbs.	20 Nm
Mount-to-crossmember	35 ft. lbs.	50 Nm
Mount-to-transmission	30 ft. lbs.	40 Nm
Reverse pivot bolt	20 ft. lbs.	27 Nm
Shift lever-to-shifter shaft	25 ft. lbs.	30 Nm
Transmission-to-engine	30 ft. lbs.	40 Nm
77mm 5-speed		
Back-up switch	28 ft. lbs.	38 Nm
Cover-to-case	10 ft. lbs.	13 Nm
Crossmember-to-frame	35 ft. lbs.	50 Nm
Damper	30 ft. lbs.	40 Nm
Drive gear retainer	15 ft. lbs.	20 Nm
Extension housing bolts	25 ft. lbs.	30 Nm
Filler plug	20 ft. lbs.	27 Nm
Front bearing retainer	15 ft. lbs.	20 Nm
Mount-to-crossmember	35 ft. lbs.	50 Nm
Mount-to-transmission	30 ft. lbs.	40 Nm
Reverse lockout	13 ft. lbs.	18 Nm
Reverse pivot bolt	20 ft. lbs.	27 Nm
Shift lever-to-shifter shaft	25 ft. lbs.	30 Nm
Speed sensor	89 inch lbs.	10 Nm
Transmission-to-engine	30 ft. lbs.	40 Nm
83mm 4-speed		
Cover-to-case	15 ft. lbs.	20 Nm
Crossmember-to-frame	35 ft. lbs.	50 Nm
Drive gear retainer	18 ft. lbs.	25 Nm
Extension housing bolts	40 ft. lbs.	55 Nm
Extension housing-to-rear retainer	25 ft. lbs.	35 Nm
Filler plug	15 ft. lbs.	20 Nm
Mount-to-crossmember	35 ft. lbs.	50 Nm
Mount-to-transmission	35 ft. lbs.	50 Nm
Rear bearing retainer	25 ft. lbs.	35 Nm
Shift lever-to-shifter shaft	18 ft. lbs.	25 Nm
Side cover	18 ft. lbs.	25 Nm
Transmission-to-clutch housing	55 ft. lbs.	75 Nm

MANUAL TRANSMISSION TORQUE SPECIFICATIONS

Component	U.S.	Metric
Borg-Warner T5 5-speed		
Back-up switch	15 ft. lbs.	20 Nm
Cover-to-case	115 inch lbs.	13 Nm
Crossmember-to-frame	35 ft. lbs.	50 Nm
Drive gear retainer	18 ft. lbs.	25 Nm
Extension housing-to-case	22 ft. lbs.	30 Nm
Filler plug	20 ft. lbs.	27 Nm
Front bearing retainer	15 ft. lbs.	20 Nm
Mount-to-crossmember	35 ft. lbs.	50 Nm
Mount-to-transmission	40 ft. lbs.	54 Nm
Rear bearing retainer	25 ft. lbs.	35 Nm
Reverse lockout	13 ft. lbs.	18 Nm
Shift lever-to-shifter shaft	18 ft. lbs.	25 Nm
Side cover	18 ft. lbs.	25 Nm
Speed sensor	89 inch lbs.	10 Nm
Transmission-to-clutch housing	26 ft. lbs.	75 Nm

REAR DRIVE AXLE TORQUE SPECIFICATIONS

Component	U.S.	Metric
7.625 inch axle		
Brake backing plate bolts	35 ft. lbs.	48 Nm
Differential bearing cap bolts	60 ft. lbs.	81 Nm
Differential cover bolts	30 ft. lbs.	41 Nm
Differential ring gear bolts ①	90 ft. lbs.	120 Nm
Filler plug	20 ft. lbs.	27 Nm
Pinion lockbolt	20 ft. lbs.	27 Nm
7.5 inch axle		
Brake backing plate bolts	35 ft. lbs.	48 Nm
Differential bearing cap bolts	60 ft. lbs.	81 Nm
Differential cover bolts	30 ft. lbs.	41 Nm
Differential ring gear bolts ①		
1982-83	80 ft. lbs.	108 Nm
1984-85	90 ft. lbs.	120 Nm
Filler plug	20 ft. lbs.	27 Nm
Pinion lockbolt	20 ft. lbs.	27 Nm
7.75 inch axle		
Axle shaft retainer nuts	31 ft. lbs.	40 Nm
Brake backing plate bolts	35 ft. lbs.	48 Nm
Breather	10 ft. lbs.	14 Nm
Differential bearing cap bolts	40 ft. lbs.	52 Nm
Differential case half bolts	29 ft. lbs.	38 Nm
Differential cover bolts	20 ft. lbs.	26 Nm
Differential ring gear bolts ①	101 ft. lbs.	131 Nm
Filler plug	20 ft. lbs.	27 Nm

① Use thread locking compound