

1992 Volvo 940

Submodel: | Engine Type: L4 | Liters: 2.3
Fuel Delivery: FI | Fuel: GAS

Shift linkage adjustments are neither necessary nor possible on Volvo manual transmissions.

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- 1. Disconnect the negative battery cable.
- 2. Raise and safely support the vehicle.
- 3. Unplug the back-up light switch connector.
- 4. Unscrew the back-up light switch connector from the transaxle and remove it.

To install:

- 5. Thread the switch into the transaxle and tighten.
- 6. Plug the electrical connector in.
- 7. Lower the vehicle.
- 8. Connect the negative battery cable.

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1. Disconnect the negative battery cable.
2. Raise the vehicle and support it safely on jackstands.
3. Matchmark and remove the front driveshaft from the transmission or overdrive unit; lower the shaft out of the way.
4. Position and support the transmission with a jack or transmission hoist.
5. Loosen, but do not separate the exhaust joint at the right side of the transmission case.
6. Carefully remove the transmission crossmember from the body.
7. Lower the rear end of the transmission.
8. Disconnect the wiring from the switch. Thoroughly clean the area around the switch before removing it.
9. Remove the switch using a suitable socket (5250 or equivalent).

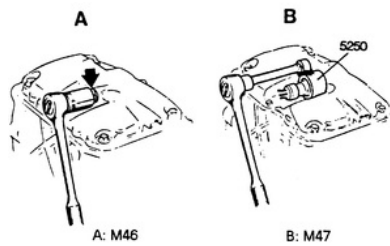
To install:

10. Install the switch into the transmission, and connect the wiring.

NOTE: After replacing the switch and connecting the wiring, check its function before reassembling everything.

11. Raise the transmission back into position and install the crossmember.
12. Position and tighten the exhaust joint.
13. Reinstall the driveshaft.
14. Lower the vehicle.
15. Connect the negative battery cable.

Fig. 1: Removing the back-up light switch on the M46 and M47 manual transmissions



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NOTE: This procedure covers removal and installation of the extension housing seal with the transmission mounted in the vehicle.

1. Disconnect the negative battery cable.
2. Raise and support the vehicle safely.
3. Matchmark the driveshaft with the coupling.
4. Disconnect the driveshaft. Use tool 5244 or equivalent for a round coupling flange.
5. Remove the coupling flange nut. Use spanner 5149 or equivalent to prevent the flange from rotating.
6. Remove the coupling flange, using a suitable puller (tool 2261 or equivalent).
7. Carefully pry the seal from the housing.

To install:

8. Clean the sealing areas thoroughly.
9. Install a new seal using a suitable drift (2412 for M46 or 5064 for M47 or their equivalent).
10. Press the coupling flange into place, using tool 1845 or equivalent.
11. Install the coupling flange nut. Tighten to 126 ft. lbs. (175 Nm) on the M46 or 65–80 ft. lbs. (90–110 Nm) on the M47.
12. Install the driveshaft.
13. Lower the vehicle.
14. Connect the negative battery cable.

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These vehicles use several different types of joints. Engine size, transaxle type, whether the joint is an inboard or outboard joint, even which side of the vehicle is being serviced could make a difference in joint type. Be sure to properly identify the joint before attempting joint or boot replacement. Look for identification numbers at the large end of the boots and/or on the end of the metal retainer bands.

The 3 types of joints used are the Birfield Joint, (B.J.), the Tripod Joint (T.J.) and the Double Offset Joint (D.O.J.).

NOTE: Do not disassemble a Birfield joint. Service with a new joint or clean and repack using a new boot kit.

The distance between the large and small boot bands is important and should be checked prior to and after boot service. This is so the boot will not be installed either too loose or too tight, which could cause early wear and cracking, allowing the grease to get out and water and dirt in, leading to early joint failure.

NOTE: The driveshaft joints use special grease; do not add any grease other than that supplied with the kit.

Double Offset Joint

The Double Offset Joint (D.O.J.) is bigger than other joints and, in these applications, is normally used as an inboard joint.

1. Remove the halfshaft from the vehicle.
2. Side cutter pliers can be used to cut the metal retaining bands. Remove the boot from the joint outer race.
3. Locate and remove the large circlip at the base of the joint. Remove the outer race (the body of the joint).
4. Remove the small snapping and take off the inner race, cage and balls as an assembly. Clean the inner race, cage and balls without disassembling.
5. If the boot is to be reused, wipe the grease from the splines and wrap the splines in vinyl tape before sliding the boot from the shaft.
6. Remove the inner (D.O.J.) boot from the shaft. If the outer (B.J.) boot is to be replaced, remove the boot retainer rings and slide the boot down and off of the shaft at this time.

To install:

7. Be sure to tape the shaft splines before installing the boots. Fill the inside of the boot with the specified grease. Often the grease supplied in the replacement parts kit is meant to be divided in half, with half being used to lubricate the joint and half being used inside the boot.
8. Install the cage onto the halfshaft so the small diameter side of the cage is installed first. With a brass drift pin, tap lightly and evenly around the inner race to install the race until it comes into contact with the rib of the shaft. Apply the specified grease to the inner race and cage and fit them together. Insert the balls into the cage.
9. Install the outer race (the body of the joint) after filling with the specified grease. The outer race should be filled with this grease.
10. Tighten the boot bands securely. Make sure the distance between the boot bands is correct.
11. Install the halfshaft to the vehicle.

Except Double Offset Joint

1. Disconnect the negative battery cable. Remove the halfshaft.
2. Use side cutter pliers to remove the metal retaining bands from the boot(s) that will be removed. Slide the boot from the T.J. case.
3. Remove the snapping and the tripod joint spider assembly from the halfshaft. Do not disassemble the spider and use care in handling.
4. If the boot is to be reused, wrap vinyl tape around the spline part of the shaft so the boot(s) will not be damaged when removed. Remove the dynamic damper, if used, and the boots from the shaft.

To install:

5. Double check that the correct replacement parts are being installed. Wrap vinyl tape around the splines to protect the boot and install the boots and damper, if used, in the correct order.
6. Install the joint spider assembly to the shaft and install the snapping.
7. Fill the inside of the boot with the specified grease. Often the grease supplied in the replacement parts kit is meant to be divided in half, with half being used to lubricate the joint and half being used inside the boot. Keep grease off the rubber part of the dynamic damper (if used).
8. Secure the boot bands with the halfshaft in a horizontal position. Make sure distance between boot bands is correct.
9. Install the halfshaft to the vehicle and reconnect the negative battery cable.

Fig. 1: Check the CV-boot for wear



Fig. 2: Removing the outer band from the CV-boot

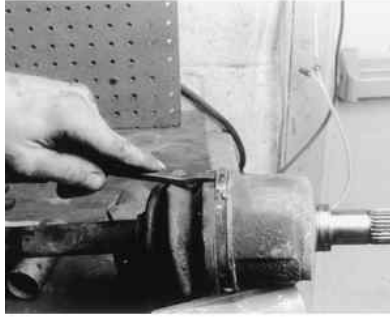


Fig. 3: Removing the inner band from the CV-boot



Fig. 4: Removing the CV-boot from the joint housing



Fig. 5: Clean the CV-joint housing prior to removing boot



Fig. 6: Removing the CV-joint housing assembly



Fig. 7: Removing the CV-joint



Fig. 8: Inspecting the CV-joint housing



Fig. 9: Removing the CV-joint outer snapping



Fig. 10: Checking the CV-joint snapping for wear



Fig. 11: CV-joint snapping (typical)



Fig. 12: Removing the CV-joint assembly



Fig. 13: Removing the CV-joint inner snapping



Fig. 14: Installing the CV-joint assembly (typical)



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[850, C70, S70 and V70 Models](#)

1. With the vehicle sitting on all four wheels, loosen the axle shaft nut.
2. Raise and safely support the vehicle.
3. Remove the wheels.
4. Disconnect the ABS sensor from the halfshaft, but do not disconnect the harness.
5. Disconnect all brackets for brake lines and ABS wiring on both sides and let them hang.
6. Remove the axle nut.
7. Push the end of the halfshaft from hub using a soft drift and a mallet.
8. Disconnect the sway bar from the link.
9. Remove all splash guards.
10. Separate the ball joint from control arm, being careful not to damage the boots.
11. For the right side halfshaft, remove the bearing cap and pull the shaft out of the transmission while holding the strut out of the way.
12. Install a plug in the transmission.

NOTE: Be careful not to damage the transmission seal.

13. For left side, remove the halfshaft by carefully prying between the transmission and the halfshaft.
14. Hold the strut assembly out of the way.
15. Install a plug in the transmission.

To install:

16. Install the right halfshaft and tighten the bearing cap to 19 ft. lbs. (25 Nm).
17. Install the splashguard.

NOTE: Make sure that the transmission axle seal and axle boot are not damaged.

18. Clean the ABS wheel if necessary.
19. Apply metal adhesive to the halfshaft splines. Carefully press shaft in so that the lock ring engages with the differential gear. Check it by carefully pulling on the shaft joint housing.
20. Install the axle nut and hand-tighten.
21. Connect the ball joints using new nuts.
22. Install the sway bar link using new nuts.
23. Connect the brake line and ABS cable bracket on both sides.
24. Install the ABS sensor on the halfshaft and clean it with a soft brush.
25. Install the wheels.
26. With all four wheels on the ground, tighten the axle nut to 89 ft. lbs. (120 Nm) plus an additional 60°. Lock the nut by staking its flange into the driveshaft groove.

Fig. 1: Loosening the axle nut will be tough; it is sometimes easier to do with the wheels on the ground



Fig. 2: After loosening, remove the axle nut



Fig. 3: Remove the nut retaining the lower ball joint to the spindle



Fig. 4: After the lower control arm is separated from the spindle, tap the halfshaft out of the hub

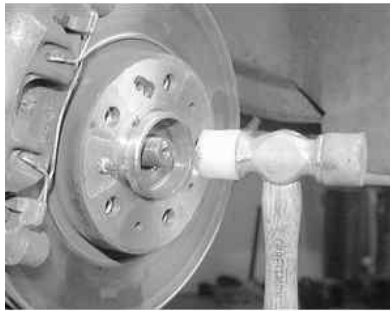


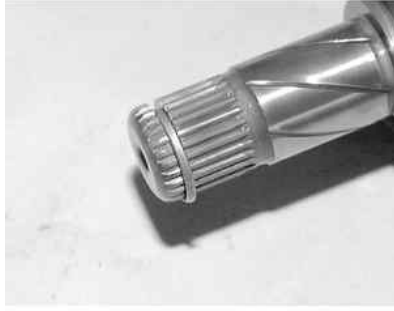
Fig. 5: The halfshaft will need to be removed from the transaxle with a prybar or suitable tool



Fig. 6: After the halfshaft is removed, inspect the axle seal and . . .



Fig. 7: . . . the halfshaft retaining ring on the spline shaft



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[850](#)

1. With all four wheels on the ground, loosen the front axle shaft locknuts.
2. Place the transaxle in **N** and set the parking brake.
3. Disconnect and remove the battery, air cleaner air intake ducts.
4. Remove the battery tray.
5. On turbocharged models, disconnect the timing valve from air cleaner and the turbocharger air duct clamp and hose.
6. Disconnect the gear selector cables from the brackets and lever.
7. Remove the selector link plate after tapping out the lock pin.
8. Detach the back-up light switch connector.
9. On turbocharged models remove the control pulley cover.
10. Disconnect the turbocharger inlet pipe and tie it back out of the way.
11. Disconnect the upper coolant hose to the engine oil cooler.
12. Disconnect the clutch slave cylinder and remove the clip.
13. Remove the ground strap from the transaxle.
14. Loosen the rear engine mount and splash guard nut.
15. Remove the bolts connecting the engine, transaxle and starter.
16. Disconnect the transaxle ground strap.
17. Disconnect the ground strap from the firewall.
18. Remove the torque arm bolt.
19. Secure the engine from above with an engine support that rests on the inner edges of the engine compartment.
20. Lift the engine up slightly to take weight off the engine mounts.
21. Raise and safely support the vehicle and remove the wheels.
22. Disconnect the ABS sensor from the left side axle shaft, but do not unfasten the connector.
23. Drain the gear oil from the transaxle.
24. Disconnect all brackets for the front brake lines and ABS wiring for both sides of the vehicle.
25. Remove the plastic inner fender liners on both sides.
26. Remove and discard the axle shaft locknuts.
27. Separate the ball joint from control arm, being careful not to damage the boots.
28. Disconnect the sway bar links on both sides.
29. Remove the mounting screws holding the cable to the front of the subframe and disconnect the cable from the subframe.
30. Disconnect the carbon canister hoses.
31. Disconnect the exhaust pipe clamp behind the catalytic converter.
32. Remove the left and right halfshafts.
NOTE: Be careful not to damage the transaxle seal.
33. Install seal plugs in the transaxle.
34. Loosen the two right side subframe-to-body bolts approximately $\frac{1}{2}$ in. (15mm).
35. Remove the subframe-to-body bolts on the left side.
NOTE: Make sure the steering gear bolts come out of the subframe and the control arm is free of the axle shaft boot on the right side.
36. Remove the jack and let the frame hang down from the right side bolts.
37. Tie the left side of the steering gear to the left side frame rail for support.
38. Remove the steering gear engine mount bolt and nut at the top of the mount and remove.
NOTE: Make sure the steering gear is properly secured so the lower steering shaft does not slide out of the steering column.
39. Disconnect the oxygen sensor wiring clamps from the cover, as well as the connector and wiring to the vehicle speed sensor.
40. Remove the cover at the back of the engine and the mount from the transaxle.
41. Lower the engine and transaxle with the lifting hook.
WARNING
If the engine is lowered too far, the exhaust pipe will be crushed against the steering rack. Be careful not to pinch any wiring or hoses and be sure that the engine dipstick tube is free of the fan.
42. Remove the seven remaining transaxle-to-engine bolts. Pull the gearbox away from the engine. Lower the jack and move the transaxle away.
To install:
43. Secure the throwout bearing fork to the transaxle.
44. Make sure the mating surfaces on the transaxle and engine are clean and that the dowel pins are in place on the engine.
NOTE: Do not grease the primary shaft or throwout bearing sleeve. Make sure there are no breaks in the clutch plate.
45. Lift the transaxle into place and mate to the engine.
46. Install the seven bolts securing the engine and transaxle and tighten them a little at a time to draw the transaxle into place. Tighten the bolts to 37 ft. lbs. (50 Nm) and remove the transaxle jack.
47. Lift the engine and transaxle up until the distance between the engine support beam and spark plug cover is 0.20 in. (5mm).
48. Install the rear transaxle mount and bolts.
49. Tighten the rear two bolts to 37 ft. lbs. (50 Nm), then remove the front bolt.
50. Install the cover.
51. Install the engine mount by fitting its guide pin into the cover.
52. Install a new nut and hand-tighten.
53. Install the steering rack engine mount bolt, but do not tighten.
54. Remove the support for the steering gear.
55. Reconnect the oxygen sensor wiring and clamps on the cover.
56. Install the vehicle speed sensor connector and wiring and connect the transaxle ground strap.
57. Install the subframe using new 4 x M14 bolts and apply grease to the threads.
58. Starting on the left side, lift the frame with a jack.

59. Mount the support brackets on both sides.
60. Tighten the frame bolts to 78 ft. lbs. (105 Nm), then tighten an additional 120°.
61. Tighten the bracket bolts to 37 ft. lbs. (50 Nm).
62. Remove the jack and repeat the procedure for the right side.
63. Remove the engine support tool and lifting eyelet from engine.
64. Tighten the engine mount nut to 37 ft. lbs. (50 Nm).
65. Install five new nuts on the steering rack and tighten them to 37 ft. lbs. (50 Nm).
66. Install the front engine mount nut, then tighten the front and rear bolts to 37 ft. lbs. (50 Nm).
67. Install the torque rod mount on the transaxle using new bolts. On earlier vehicles equipped with M18 bolts, tighten the bolts to 13 ft. lbs. (18 Nm) and then an additional 90 degrees. On later models with M10 bolts, tighten to 26 ft. lbs. (35 Nm) and then an additional 40 degrees.
68. Install the oil line bracket bolts and tighten to 19 ft. lbs. (25 Nm).
69. Tighten the exhaust pipe clamp while rocking the pipe back and forth to seat it properly.
70. Install the right and left halfshafts.

NOTE: Make sure the transaxle axle seal and axle boot are not damaged.

71. Connect the control arms to the ball joints using new nuts.
72. Connect the brake line and ABS cable bracket on both sides.
73. Install the ABS sensor on the axle shaft and clean if needed.
74. Tighten the sensor to 7.4 ft. lbs. (10 Nm).
75. Attach the cable pipe and carbon canister to the subframe.
76. Install the front splash guard.
77. Install the wheels.
78. Install the starter and tighten the bolts to 30 ft. lbs. (40 Nm).
79. Connect the cable conduit and oxygen sensor connectors.
80. Install the dipstick tube with a new O-ring and tighten the bolt to 19 ft. lbs. (25 Nm).
81. Connect the slave cylinder and clips.
82. Fasten the back-up light switch connector.
83. Position the shift lever plate and secure with the lock pin.
84. Install the cables and lubricate the levers, cables, washers and clips with grease.
85. Connect ground strip to the firewall.
86. Install a new bolt and nut for the extension arm and torque rod.
87. Connect the oil cooler hose to the cooler, if equipped.
88. Lower the vehicle.
89. Install the throttle body and cover over control pulley.
90. Connect the intake manifold to the turbocharger.
91. Install the coolant expansion tank, battery tray, air cleaner and connectors.
92. Connect the control valve to air cleaner on turbocharged models.
93. Install the battery and attach leads.
94. Tighten the axle shaft nut to 89 ft. lbs. (120 Nm), then tighten an additional 60 degrees. Lock the axle shaft nut by notching its flange into the axle shaft groove.
95. Fill the transaxle with the specified amount of oil.
96. Reinstall the plug.
97. Check the function of the clutch before driving.

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[240](#)

1. Disconnect the negative battery cable.
2. At the firewall, disconnect the back-up light connector.
3. Raise the front of the vehicle and install jackstands.
4. From under the vehicle:
 - A. Loosen the setscrew and drive out the pin for the shifter rod.
 - B. Disconnect the shift lever from the rod.
5. From inside the vehicle:
 - A. Remove the shifter.
6. Disconnect the clutch cable and return spring at the fork.
7. Disconnect the exhaust pipe bracket(s) from the flywheel cover.
8. Remove the oil pan splash guard.
9. Using a floor jack and a block of wood, support the engine beneath the oil pan.
10. Remove the transmission support crossmember.
11. Disconnect the driveshaft.
12. Disconnect the speedometer cable.
13. If so equipped, disconnect the overdrive wire.
14. Remove the starter retaining bolts and pull the starter free of the flywheel housing. Leave the starter wiring connected and secure the starter out of the way.

CAUTION

The transmission is heavy. Support its weight with a second jack or hoist before removing. Do not allow the transmission to hang partially removed on the shaft.

15. Support the transmission using another floor jack.
16. Remove the flywheel bell housing-to-engine bolts and remove the transmission by pulling it straight back.

To install:

17. Prior to installation, inspect the condition of the clutch and throwout bearing. Replace the bearing if it is scored or has been noisy in operation.
18. After reinstalling the transmission, tighten the mounting bolts to 30 ft. lbs. (41 Nm).
19. Secure the starter to the bell housing.
20. Fill the transmission with fluid to the proper level.
21. Connect the driveshaft, the speedometer cable and if necessary, the overdrive wiring.
22. Reinstall the transmission cross member. When secure, remove the jack from beneath the engine.
23. Replace the splash guard and attach the exhaust bracket to the bell housing.
24. Reconnect the clutch cable and return spring to the fork.
25. Install the shifter.
26. Under the vehicle: Connect the shifter rod to the shift lever. Don't forget to tighten the setscrew.
27. Connect the back-up light wiring.
28. Lower the vehicle.
29. Connect the negative battery cable.

[700 Series Vehicles](#)

1. If possible, support the engine with a hoist or support apparatus such as Volvo tool 5006 or equivalent. The purpose of supporting the rear of the engine is to prevent damage to the fan, radiator or front engine mounts by limiting the downward travel of the engine when the transmission crossmember is removed. If no lifting apparatus is available, place a jack with a protective wooden block beneath the engine oil pan. Do not place the jack under the flywheel (clutch) housing.
2. Disconnect the battery ground cable.
3. Remove the ashtray and holder assembly.
4. Remove the trim box around the gear shift lever.
5. Disconnect the shift lever cover from the floor.
6. Remove the snapping at the base of the shift lever.
7. Raise the vehicle and safely support it.
8. From underneath the vehicle, disconnect the gear shift rod at the gear shift lever.
9. Remove the lock screw, and press out the pivot pin.
10. Push up on the shift lever, and pull it up and out of the vehicle.
11. Matchmark the driveshaft and transmission flanges for later assembly.
12. Disconnect the driveshaft from the transmission.
13. Separate the exhaust pipe at the joint under the vehicle.
14. Detach the bracket from the front end of the exhaust pipe (near the bend).
15. Unbolt the transmission crossmember; at the same time, detach it from the rear support (rubber bushing).
16. Remove the rear support from the transmission.
17. Lower the transmission, as required.
18. Tag and disconnect the electrical connectors from the overdrive, back-up light connector and the solenoid.
19. Cut the plastic clamp at the gear shift assembly from the wiring harness.
20. Remove the starter motor retaining bolts.
21. Remove the cover plate under the bell housing and the cover plate from the other starter motor opening, as required.
22. Remove the slave cylinder from the bell housing and upper bolts holding the bell housing.

CAUTION

The transmission is heavy. Support its weight with a second jack or hoist before removing. Do not allow the transmission to hang partially removed on the shaft.

23. Place a transmission jack or a hydraulic floor jack underneath the transmission so that the transmission is resting on the jack pad. If possible, have another person steadying and guiding the transmission on the jack as it is lowered.
24. Remove the lower bolts holding the bell housing, and lower the transmission a few inches as you roll it back so the input shaft will clear. Stop the jack and make sure all wires

and linkage are disconnected, then lower the transmission the rest of the way.

To install:

25. When installing the transmission, make sure the release bearing is correctly positioned in the shift fork, and that the input shaft is aligned in the clutch disc.
26. Install the upper bolts in the bell housing.
27. Raise the end of the transmission and attach the gear lever.
28. Attach the slave cylinder or clutch cable to its mounts.
29. Reinstall the starter motor.
30. Remount the gear lever to the transmission. Secure the connectors for the back-up lights, the solenoid and (on M46) the overdrive unit.
31. Replace the transmission crossmember.
32. Set the engine back to its normal position.
33. Tighten the exhaust pipe joint, attach its bracket and attach the gear shift rod to the gear shift lever.
34. Install and tighten the driveshaft.
35. Refill the transmission with the proper amount of fluid.
36. Connect the gear shift rod to the gear shift lever.
37. Inside the vehicle, mount and secure the shifter assembly.
38. Double check all installation items, paying particular attention to loose hoses or hanging wires, untightened nuts, poor routing of hoses and wires (too tight or rubbing) and tools left in the work area.
39. Lower the vehicle.
40. Install the ashtray, interior trim and shifter boot.
41. Connect the negative battery cable.

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1. Disconnect the negative battery cable.
2. Raise and safely support the vehicle on jackstands.
3. From under the vehicle:
 - A. Loosen the setscrew and drive out the pin for the shifter rod.
 - B. Disconnect the shift lever from the rod.
4. From inside the vehicle:
 - A. Pull up the shift boot.
 - B. Remove the fork for the Reverse gear detent.
 - C. Remove the snapping and lift up the shifter.
 - D. If overdrive-equipped, disconnect the engaging switch wire.

To install:

5. If equipped, connect the overdrive switch.
6. Install the shifter and install the snapping.
7. Install the fork for the Reverse gear detent.
8. Install the shift boot.
9. From under the vehicle:
 - A. Connect the shift lever rod.
 - B. Install the pin and setscrew.
10. Lower the vehicle.
11. Connect the negative battery cable.

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Because of the way an internal combustion engine breathes, it can produce torque, or twisting force, only within a narrow speed range. Most modern, overhead valve pushrod engines must turn at about 2500 rpm to produce their peak torque. 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 transaxle and clutch are employed to vary the relationship between engine speed and the speed of the wheels so that adequate engine power can be produced under all circumstances. The clutch allows engine torque to be applied to the transaxle input shaft gradually, due to mechanical slippage. Consequently, the vehicle may be started smoothly from a full stop. The transaxle changes the ratio between the rotating speeds of the engine and the wheels by the use of gears. The gear ratios allow full engine power to be applied to the wheels during acceleration at low speeds and at highway/passing speeds.

In a front wheel drive transaxle, power is usually transmitted from the input shaft to a mainshaft or output shaft located slightly beneath and to the side of the input shaft. The gears of the mainshaft mesh with gears on the input shaft, allowing power to be carried from one to the other. All forward gears are in constant mesh and are free from rotating with the shaft unless the synchronizer and clutch is engaged. 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 employ synchronizers; friction members which smoothly bring gear and shaft to the same speed before the toothed dog clutches are engaged.

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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.