

MAINSHAFT AND COUNTERSHAFT

DISASSEMBLY

1. Remove transmission assembly. See [TRANSMISSION CASE, REMOVAL](#) on [page 6-16](#). Remove shifter forks and drum as described under [SHIFTER FORKS AND DRUM](#) on [page 6-18](#).
2. See [Figure 6-20](#). Clamp transmission assembly in vise, with protective jaws, as shown, to work on disassembly.

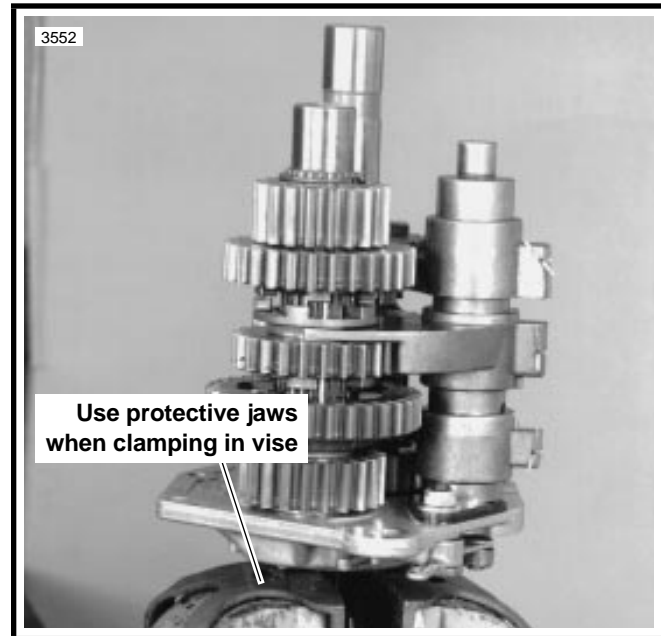


Figure 6-20.

NOTE

As the transmission runs, each part develops a certain wear pattern and a kind of "set" with its mating parts. For this reason, it is important that each component be reinstalled in its original location and facing its original direction.

3. See [Figure 6-21](#). As each component is removed, place it on a clean surface in the exact order of removal.

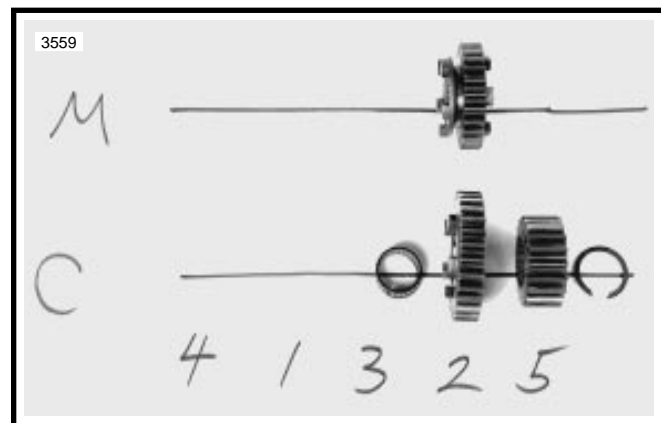


Figure 6-21.

See [Figure 6-22](#). Using [RETAINING RING PLIERS \(Part No. J-5586\)](#) remove and discard retaining ring (5) next to countershaft 5th gear (12). Slide countershaft 5th (12), mainshaft 2nd (22) and countershaft 2nd (11) off end of shafts. Remove split bearing (7) that was under gear (11) and thrust washer (6) on the countershaft.

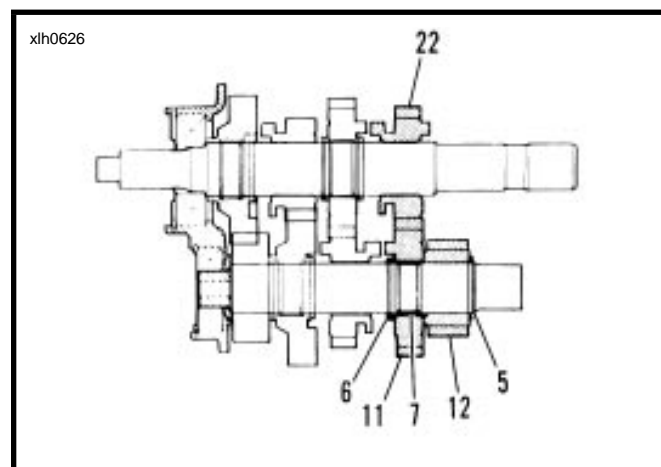


Figure 6-22.

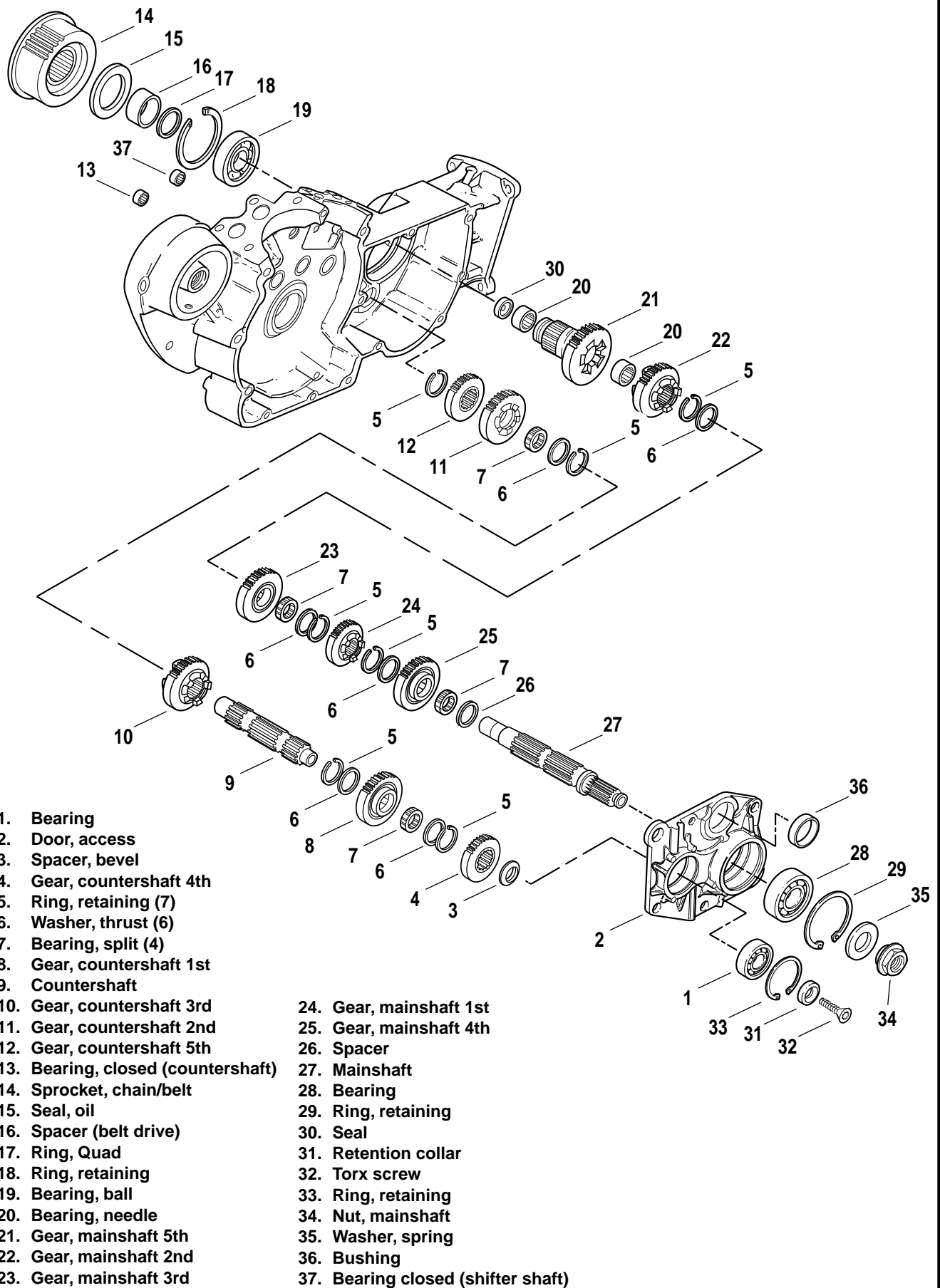


Figure 6-23. Transmission Assembly



4. See [Figure 6-24](#). Remove retaining ring (5) next to countershaft 3rd gear (10). Slide countershaft 3rd gear (10) off free end of shaft.
5. At mainshaft, between mainshaft 1st gear (24) and mainshaft 3rd gear (23), expand retaining ring (5) and move next to mainshaft 1st gear along with thrust washer (6). Move mainshaft 3rd gear as far as possible toward mainshaft 1st gear (24). Expand retaining ring (5) at opposite side of mainshaft 3rd gear and slide off end of shaft. Remove mainshaft 3rd gear (23) and its split bearing (7).
6. Slide thrust washer (6) off end of mainshaft. Expand retaining ring (5), which is next to mainshaft 1st gear (24), and slide off end of shaft.

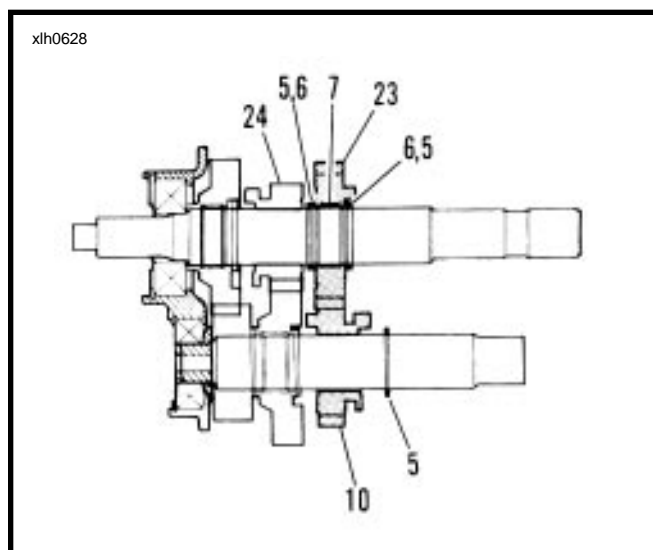


Figure 6-24.

7. See [Figure 6-25](#). Place **COUNTERSHAFT GEAR SUPPORT PLATE** (Part No. HD-37404) under countershaft 4th gear (4). Place assembly on press with suitable metal blocks under the support plate. Place a socket or mandrel, smaller than inside diameter of bearing, and press countershaft free of access cover. Slide mainshaft 1st gear (24) off mainshaft.

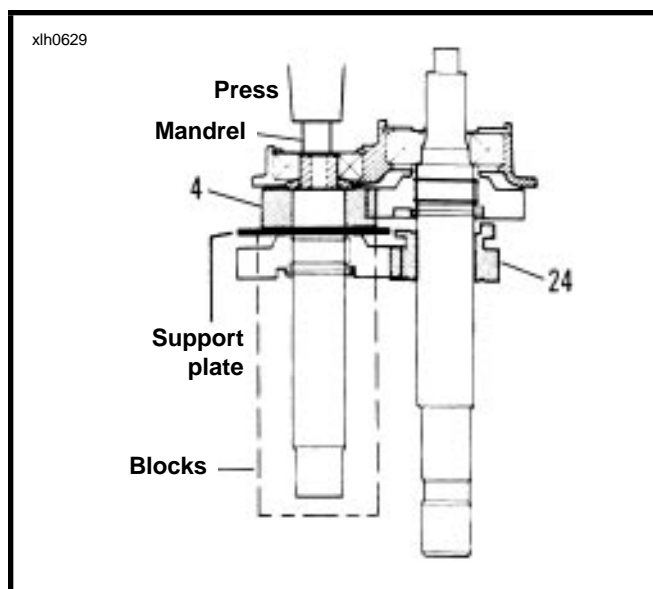


Figure 6-25.

8. See [Figure 6-26](#). Remove beveled spacer (3) and countershaft 4th gear (4).
9. Expand retaining ring (5) located next to countershaft 1st gear (8). Remove retaining ring (5) and thrust washer (6). Slide countershaft 1st gear off end of shaft. Remove split bearing (7).
10. Remove thrust washer (6). Expand remaining retaining ring (5) and slide off shaft. This completes disassembly of countershaft.

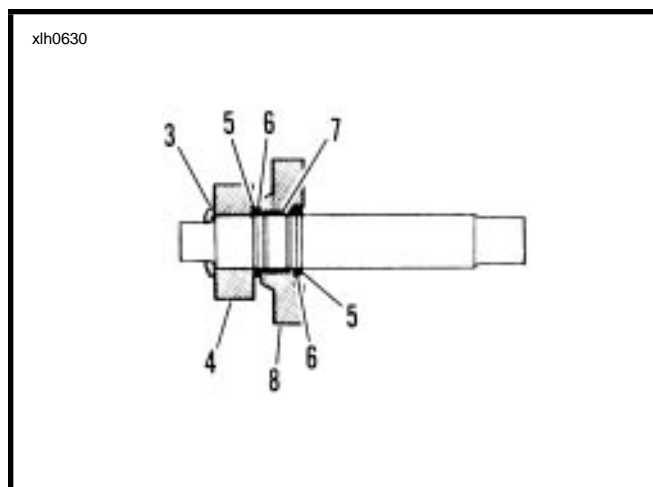


Figure 6-26.

11. See [Figure 6-27](#). Place mainshaft and access door assembly on arbor press with support under mainshaft 4th gear (25). Press on end of shaft until mainshaft is free of access door bearing. Remove spacer (26), mainshaft 4th gear (25) and split bearing (7).
12. Remove thrust washer (6). Expand and remove remaining retaining ring (5).

CLEANING, INSPECTION AND REPAIR

1. Clean all parts (except bearings) in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, cracked, battered, chipped or dimpled.
4. Discard all retaining rings that were removed.

ASSEMBLY

⚠ CAUTION

During assembly, the split bearings (7) and the internal bores of the gears must be lubricated with SPORT-TRANS FLUID prior to assembly. Leaving these parts dry could accelerate wear at start-up.

1. Find a section of pipe that matches the inner race of bearing (28). See [Figure 6-28](#). Place the door assembly, outside downward, on a press with the inner race of bearing (28) resting on the section of pipe. Insert the splined end of the shaft through the bearing and hold in a vertical position. Press the shaft into the bearing until the bearing bottoms against the shaft shoulder.

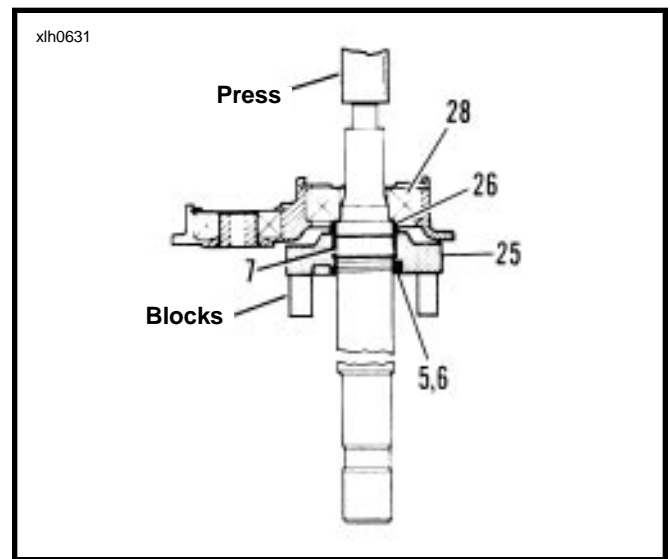


Figure 6-27.

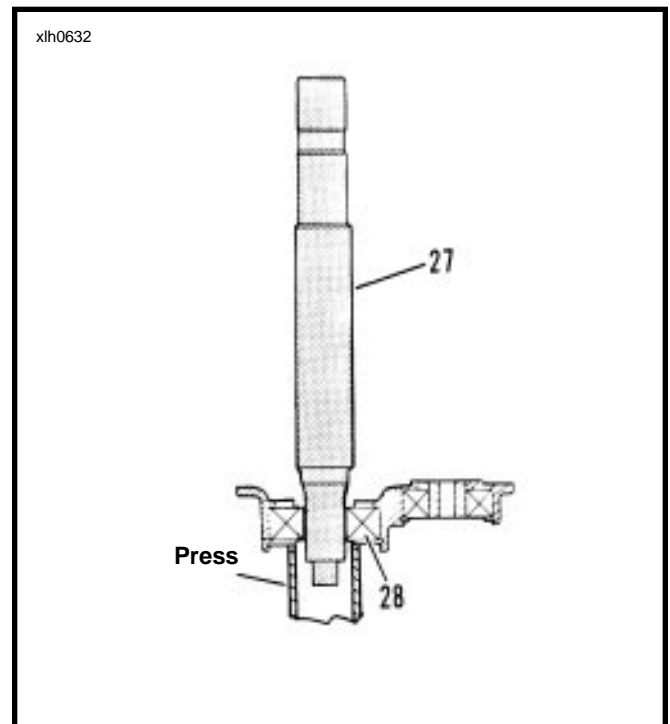


Figure 6-28.



2. See [Figure 6-29](#). Place spacer (26) over mainshaft and position next to bearing (28). Position split bearing (7) into machined seat next to spacer (26). Locate mainshaft 4th gear (25), which can be identified by the two radial grooves at one side. Slide gear (25) onto shaft with radial grooves facing door. Position gear over bearing next to spacer (26).
3. Install thrust washer (6) and retaining ring (5) next to gear (25). It will be necessary to push the retaining ring into final position with a screwdriver.
4. Slide mainshaft 1st gear (24) onto mainshaft with the locking dogs facing gear (25).
5. See [Figure 6-30](#). Install retaining ring (5). Position retaining ring in the second ring groove from the end with internal threads. Install thrust washer (6) next to retaining ring. Install split bearing (7) in seat next to washer (6).
6. Locate countershaft first gear (8). Gear (8) has a ring groove at one side of the gear. Install gear (8) over split bearing (7).
7. Install thrust washer (6) and retaining ring (5) next to gear (8).
8. Locate countershaft 4th gear (4). This gear is splined and has a single radial groove at one side. Position gear next to retaining ring (5). Place beveled washer (3) over end of shaft with beveled side away from gear (4).

NOTE

When correctly installed, countershaft 4th gear should have zero end play.

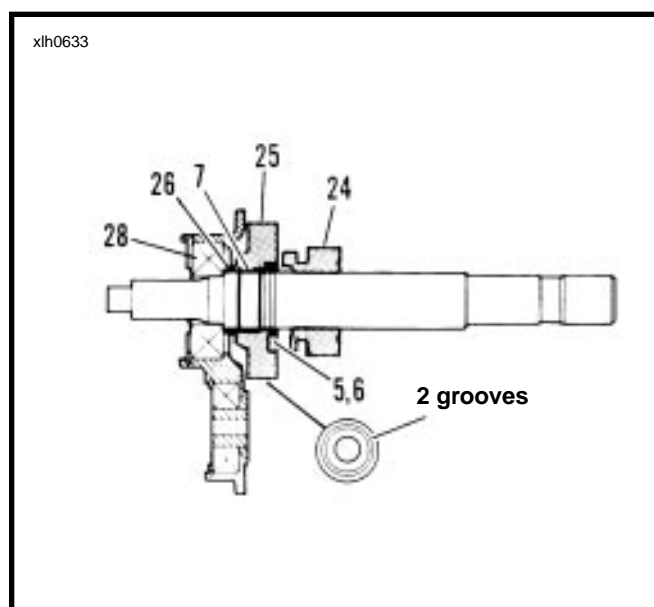


Figure 6-29.

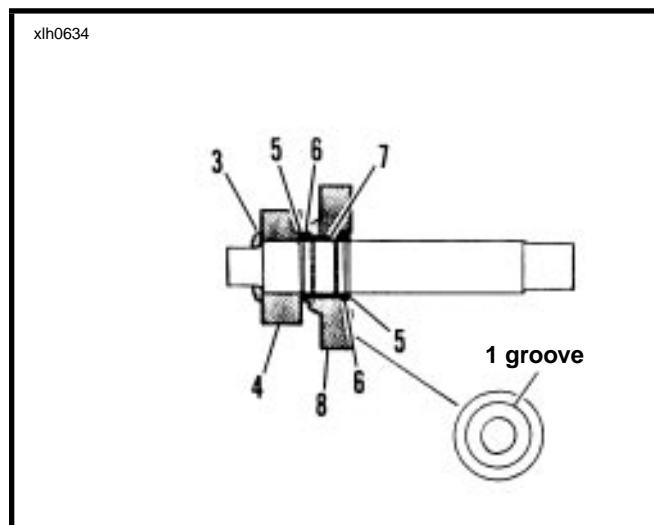


Figure 6-30.

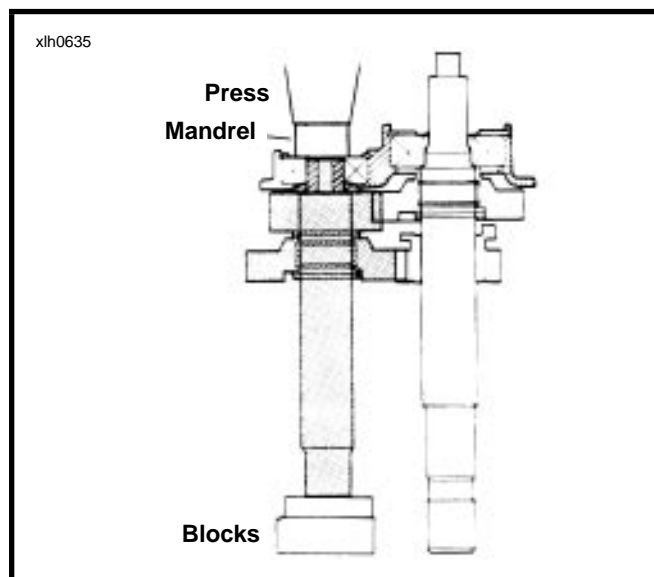


Figure 6-31.

10. See [Figure 6-32](#). At mainshaft, install retaining ring (5) and thrust washer (6). Install split bearing (7) in seat next to thrust washer (6).
11. Install mainshaft 3rd gear (23) onto shaft over bearing (7).
12. Install thrust washer (6) and retaining ring (5) next to gear (23).
13. Install countershaft 3rd gear (10) onto shaft.

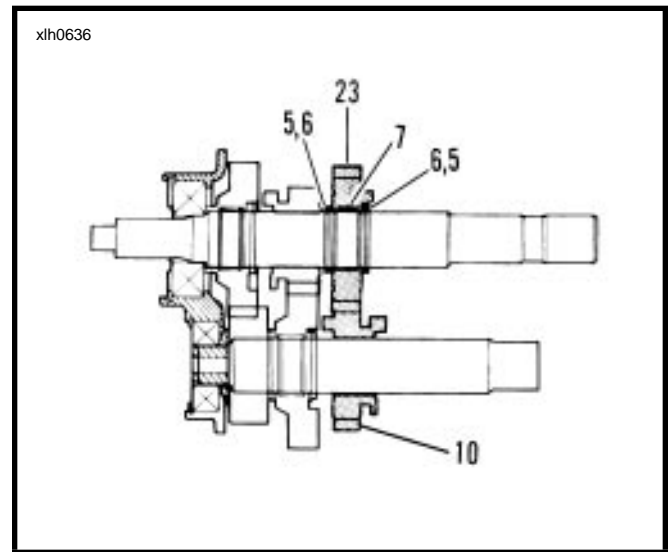


Figure 6-32.

14. See [Figure 6-33](#). Install retaining ring (5) and thrust washer (6). Install split bearing (7) into seat next to thrust washer (6).
15. Install countershaft 2nd gear (11) over bearing (7).
16. Install mainshaft 2nd gear (22) onto shaft.
17. Install countershaft 5th gear (12).
18. Expand retaining ring (5) and slide into groove next to countershaft 5th gear (12).

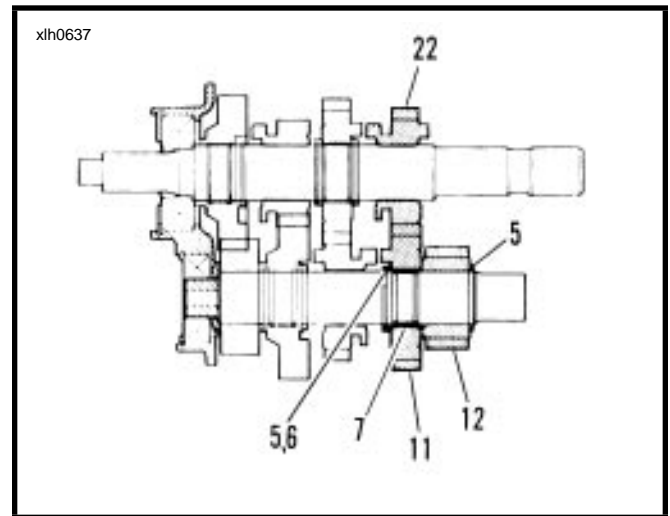


Figure 6-33.

19. See [Figure 6-34](#). At outside of access door, position retention collar (31) next to end of countershaft with beveled side facing outward. Apply a few drops of LOCTITE THREADLOCKER 242 (blue) to the threads of TORX screw (32). Insert TORX screw (32) through retention collar, and thread into end of shaft. Place transmission in gear, and tighten TORX screw to 13-17 ft-lbs (18-23 Nm).

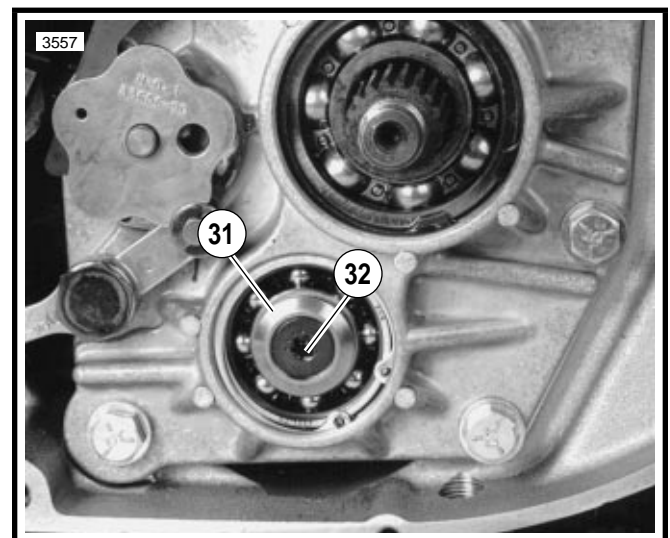


Figure 6-34.

MAIN DRIVE GEAR

REMOVAL

1. Remove transmission. See [TRANSMISSION CASE, REMOVAL](#) on [page 6-16](#).
2. See [Figure 6-35](#). From inside case tap out seal (3) at end of mainshaft 5th gear (1). Discard seal (3).
3. See [Figure 6-36](#). Use [MAIN DRIVE GEAR REMOVER AND INSTALLER \(Part No. HD-35316-A\)](#) with [CROSS PLATE \(Part No. HD-35316-91\)](#). Take support bracket (1) and insert pins, at one side, into holes which are now exposed under access cover.
4. See [Figure 6-37](#). Insert bolt (2) through support bracket (1) and 5th gear (3).

CAUTION

When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing will also have to be replaced.

5. At outside of case, place driver (4) and thrust washer (5) over end of bolt (2). Install and tighten nut (6) until 5th gear (3) is free.

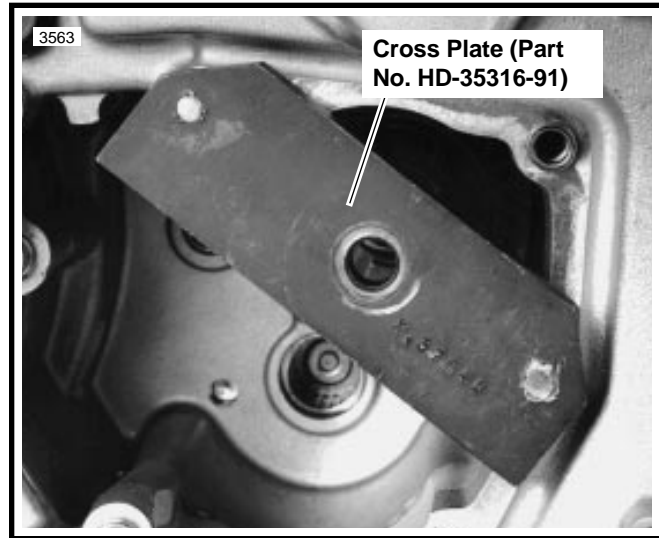


Figure 6-36. Support Bracket Mounting

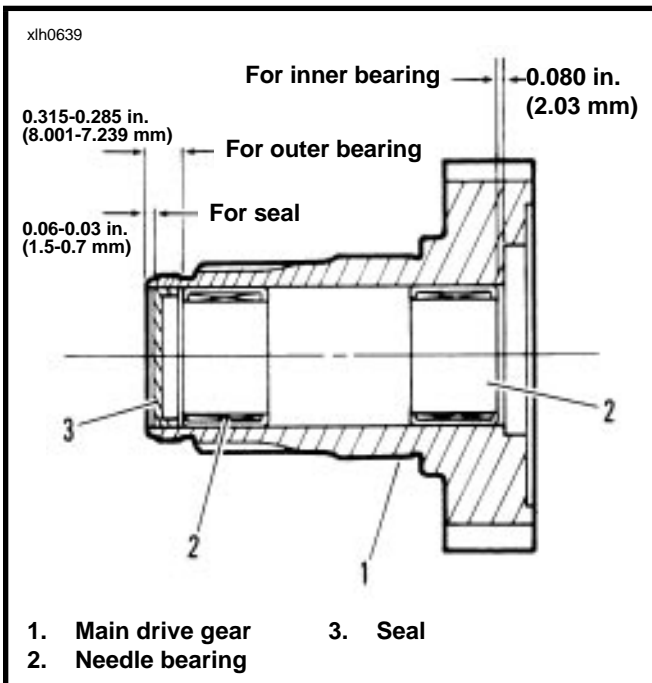


Figure 6-35. Main Drive Gear Assembly

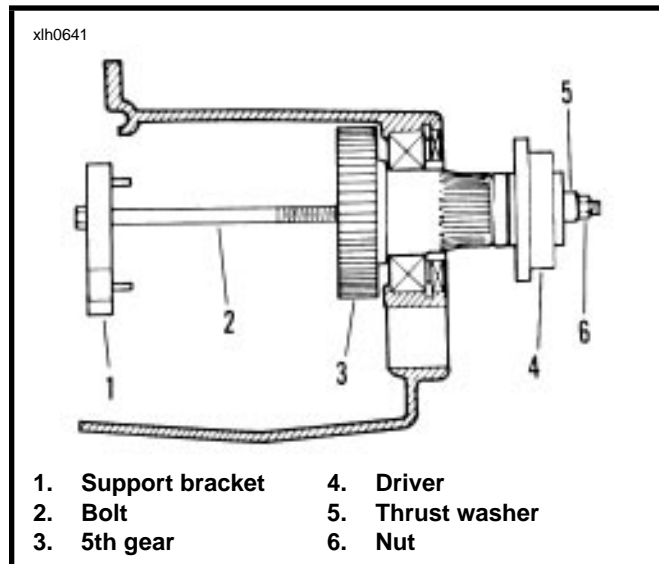


Figure 6-37. Removing Main Drive Gear

DISASSEMBLY

Drive out needle bearings, from inside bore of main drive gear. Do not reuse bearings after removal.

ASSEMBLY

1. Use [INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL \(Part No. HD-37842A\)](#). See [Figure 6-38](#). The tool is stamped 0.080 in. (2.032 mm) for the end of the tool to be used for driving the bearing into the inner end and 0.315 in. (8.001 mm) for the outer end bearing.
2. Place main drive gear on a press. With the bearing installation tool, press in the outer bearing to a depth of 0.315-0.285 in. (8.001-7.239 mm). Press in the inner bearing to a depth of 0.080 in. (2.032 mm). The installation tool will automatically bottom on the gear when the correct depth is reached.

INSTALLATION

1. Replace main drive gear bearing. See [ACCESS DOOR BEARINGS, INSTALLATION](#) on [page 6-28](#).
2. Use MAIN DRIVE GEAR REMOVER AND INSTALLER TOOL. See [Figure 6-39](#). Take bolt (2) and place washer (5) followed by main drive gear (4) over end of bolt. From inside of case insert bolt and main drive gear through inner race of ball bearing.
3. Insert threaded end of bolt (2) through installer cup (3) and thrust washer (1). Thread nut (6) onto end of bolt (2). Tighten nut (6) until shoulder on gear (4) bottoms against inner race of bearing.
4. See [Figure 6-35](#). Tap in **new** seal (3) at threaded end of 5th gear.

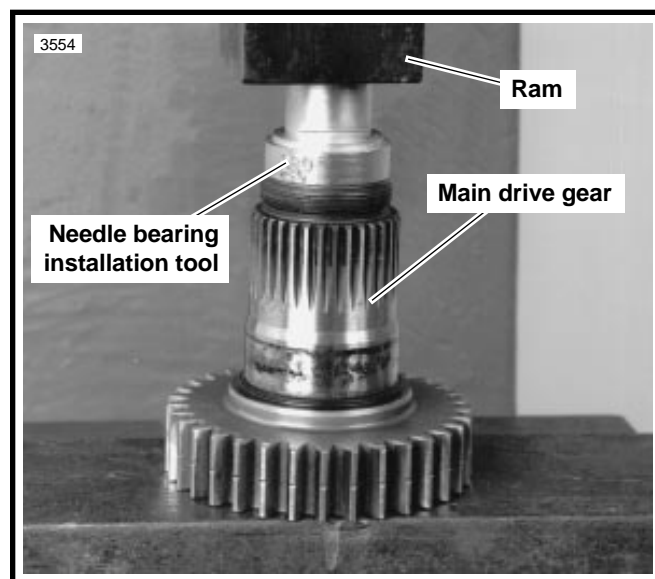


Figure 6-38. Needle Bearing Installation Tool

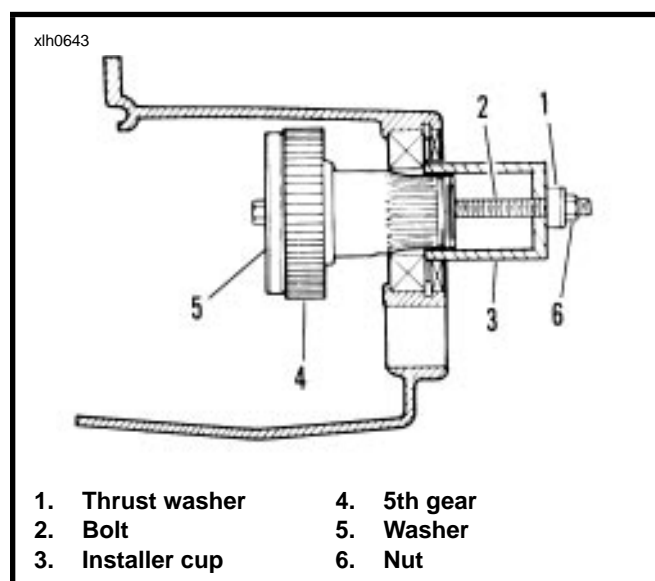


Figure 6-39. Main Drive Gear Installation

ACCESS DOOR BEARINGS

REMOVAL

Mainshaft and Countershaft Bearings

1. Remove transmission assembly. See [TRANSMISSION CASE, REMOVAL](#) on [page 6-16](#). Remove shifter forks and drum as described under [SHIFTER FORKS AND DRUM](#) on [page 6-18](#). Remove countershaft and mainshaft. See [MAINSHAFT AND COUNTERSHAFT](#) starting on [page 6-20](#).
2. Inspect the mainshaft and countershaft ball bearings for pitting, scoring, discoloration or other damage.
3. See [Figure 6-40](#). If bearing replacement is required, remove retaining rings (1, 2). Press out bearings (3, 4) from the inside of the door.

Shift Drum Bushing

1. Inspect the shifter drum bushing for pitting, scoring, discoloration or excessive wear. If bushing requires replacement press bushing out of door from either side.

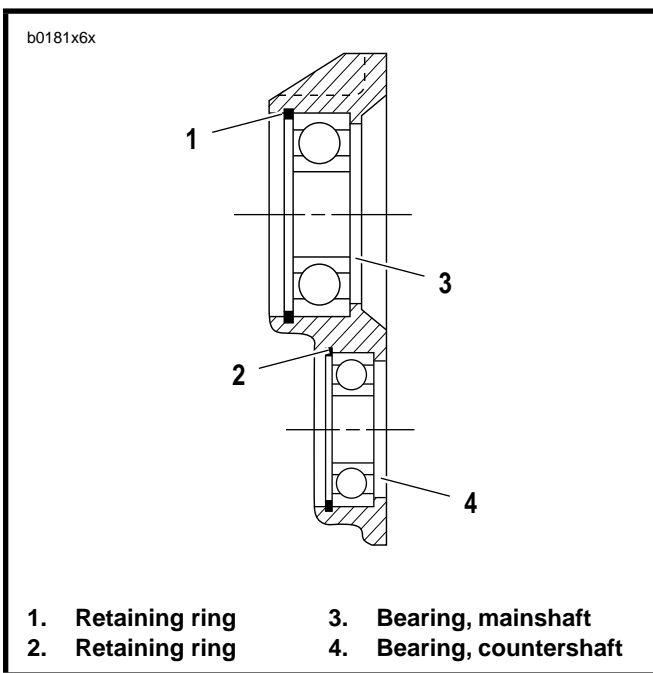


Figure 6-40. Ball Bearing Assembly

INSTALLATION

Mainshaft and Countershaft Bearings

1. Lay access door on press with inside surface of door downward.
2. Lay bearing squarely over bore with printed side of bearing upward. Place section of pipe or tubing (slightly smaller than outside diameter of bearing) against outer race. Press bearing into bore until bearing bottoms against shoulder.
3. Install **new** retaining ring with beveled side facing away from bearing.

Shift Drum Bushing

1. Lay access door on press with outside surface of door downward.
2. See [Figure 6-41](#). Lay bushing squarely over bore. Locate socket or pipe that is slightly larger than diameter of bushing. Place socket or pipe on bushing and press into bore until bushing is flush with or 0.020 in. (0.51 mm) below inside surface. If using a pressing tool larger than diameter of bushing, the pressing tool will bottom against door when bushing is flush with top surface.

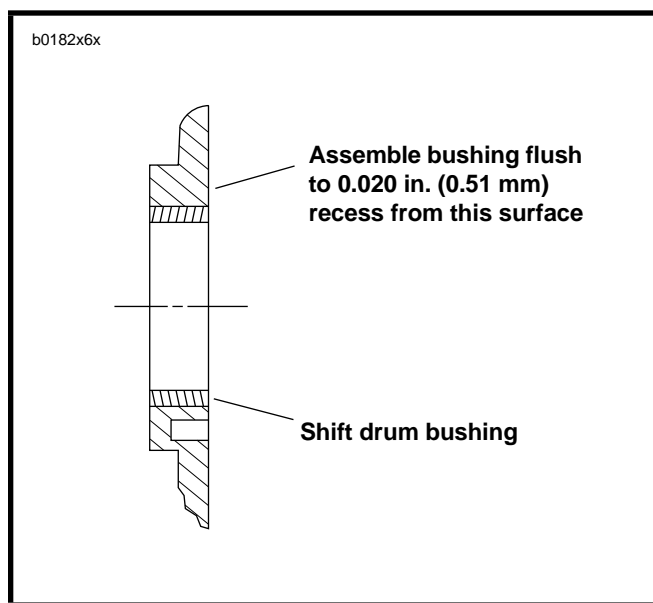


Figure 6-41. Shift Drum Bushing Assembly

RIGHT TRANSMISSION CASE BEARINGS

REMOVAL

1. Remove transmission assembly. See [TRANSMISSION CASE, REMOVAL](#) on [page 6-16](#). Remove main drive 5th gear. See [MAIN DRIVE GEAR](#) on [page 6-26](#).
2. At outside of case remove seal next to 5th gear bearing retainer. Remove retaining ring.
3. From inside transmission case drive bearings (5th gear, countershaft or shifter shaft) out of bores. Carefully tap bearings free by working around bearing diameter to keep bearing from skewing.

INSTALLATION

Mainshaft 5th Gear Ball Bearing

1. Locate [MAIN DRIVE GEAR REMOVER AND INSTALLER \(Part No. HD-35316-A\)](#). See [Figure 6-42](#). Place support bracket pins in appropriate holes in transmission case.
2. See [Figure 6-43](#). Insert bolt (2) through support bracket (1), **new** bearing (3), driver (4) and thrust bearing (5). Thread nut (6) on end of bolt. Tighten nut carefully until bearing is started in bore squarely. Tighten nut (6) until bearing is seated against shoulder in bore.
3. At outside of case install beveled retaining ring in groove inside bearing bore with beveled side facing outside of case.
4. Lubricate bearing with SPORT-TRANS FLUID.

Countershaft Needle Bearing

1. Find a suitable bearing driver 1-1/4 in. (31.75 mm) in diameter.
2. From the outside of the case place the needle bearing open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven inward flush or 0.030 in. (0.76 mm) below the outside surface of the case.
3. Lubricate bearing with SPORT-TRANS FLUID.

Shift Drum Needle Bearing

1. Find a suitable bearing driver 13/16 in. (20.64 mm) in diameter.
2. From the outside of the case place the needle bearing, open end first, next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when driven inward flush or 0.030 in. (0.76 mm) below the outside surface.
3. Lubricate bearing with SPORT-TRANS FLUID.

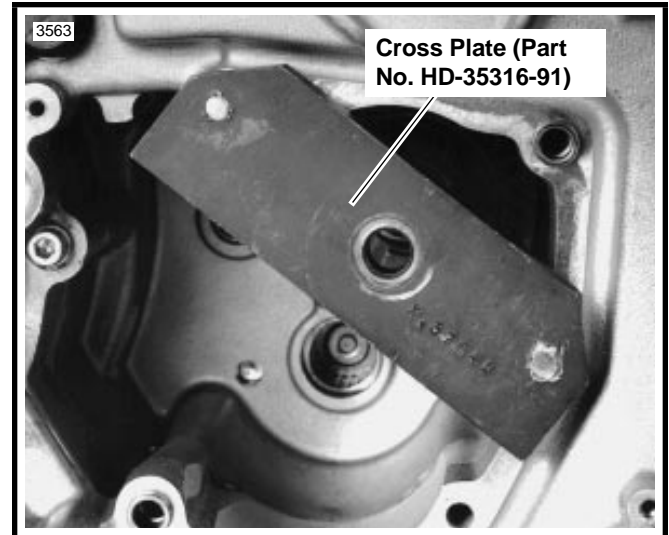


Figure 6-42. Cross Plate Mounting

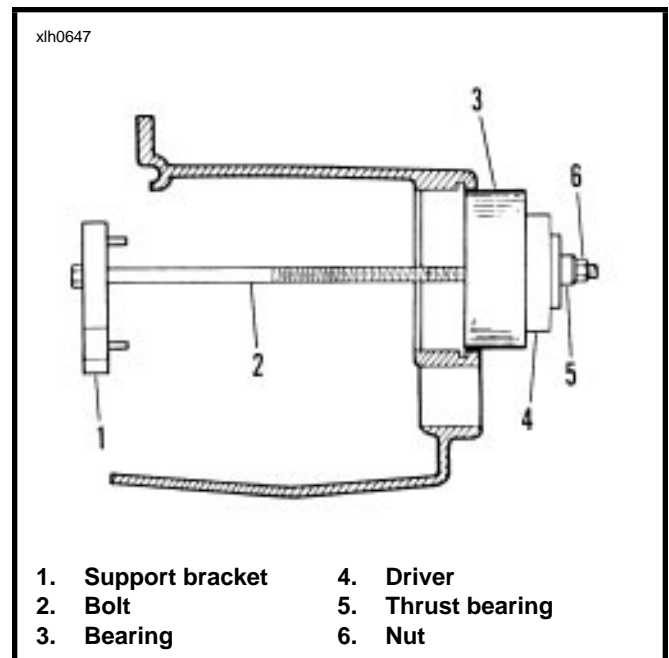


Figure 6-43. Installing Mainshaft Ball Bearing

TRANSMISSION INSTALLATION AND SHIFTER PAWL ADJUSTMENT

Verify that all parts have been properly installed, as described earlier in this section under [RIGHT TRANSMISSION CASE BEARINGS](#), [MAIN DRIVE GEAR](#), [MAINSHAFT AND COUNTERSHAFT](#), and [SHIFTER FORKS AND DRUM](#).

1. Carefully insert transmission into case opening. Position the assembly so that the mainshaft enters fifth gear, and so that the countershaft and drum shifter shaft enter their respective bearings.
2. See [Figure 6-15](#). Apply a few drops of LOCTITE THREADLOCKER 242 (blue) to the threads of the five access door mounting bolts (7). Insert the bolts with washers (8) through holes in access door, and thread into tapped holes in right transmission case. Tighten bolts to 13-17 ft-lbs (18-23 Nm).
3. Lift pawl (5) over drum pins, and place shifter shaft assembly (6) on studs at transmission case. Loosely install a washer (11) and locknut (3) on each stud.
4. Attach the loop of spring (1) over and into groove in post (2).
5. Place detent plate (9) over drum pins. Rotate plate until blind holes in plate align with pins in end of drum shaft. Install **new** retaining ring (10) using [SHIFT DRUM RETAINING RING INSTALLER \(Part No. HD-39151\)](#). Verify that retaining ring is fully engaged with drum groove.
6. See [Figure 6-44](#). Place transmission in third gear. Place a No. 32 drill bit (0.116 in. dia.) through hole in detent plate (3), and between pawl (2) and drive pin at end of shifter drum shaft. Push down top of crank (4) to remove all clearance between pawl and drill bit; this will correctly align pawl to shift drum pins (do not push down with too great a force, as this might cause the shifter drum to rotate). With bit in place, tighten shifter shaft assembly bottom nut (1) first to 90-110 **in-lbs** (10.2-12.4 Nm). Then, tighten shifter shaft assembly top nut (1) to the same torque. **Remove drill bit.**
7. See [Figure 6-23](#). Place **new** quad ring (17) over threaded end of fifth gear (21), and position next to the gear taper. Install spacer (16) over threaded end of fifth gear with chamfered end toward quad ring. Slide spacer up against bearing (19).
8. Coat lips of seal (15) with SPORT-TRANS FLUID. Position seal over spacer (16) with lips of seal toward case. Gently tap seal into bore of case until the outside of seal is flush with outer edge of bore. It is acceptable to recess seal to about 0.030 in. (0.76 mm) below outer edge of bore; seal recession will be limited by seal bottoming against retaining ring (18).
9. See [Figure 6-45](#). Install transmission sprocket (2) with secondary drive belt onto main drive gear shaft (1).
10. Place transmission in neutral. Apply a few drops of LOCTITE THREADLOCKER 262 (red) to the **left-hand threads** of transmission sprocket nut (3). Position nut with washer-faced side facing transmission sprocket.

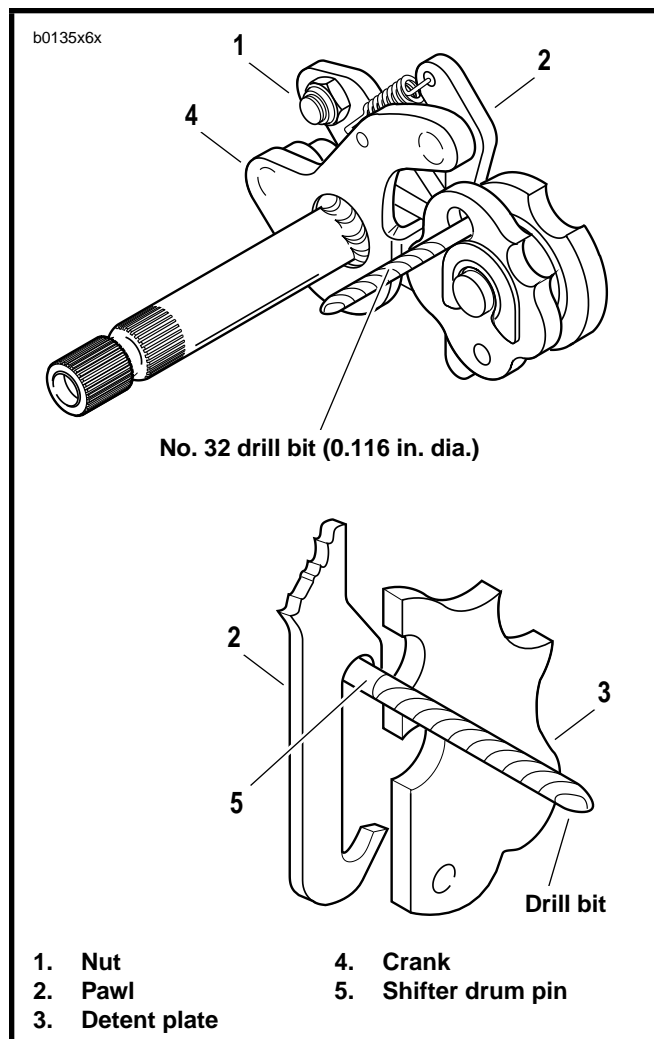


Figure 6-44. Shifter Shaft Assembly Alignment

11. Increase belt deflection by loosening rear axle and moving rear wheel forward. Turn the nut **counterclockwise** to install it onto main drive gear shaft.
 - a. Use [SPROCKET HOLDING TOOL \(Part No. HD-41321\)](#) and [MAINSHAFT LOCKNUT WRENCH \(Part No. HD-94660-37B\)](#) and a torque wrench. Tighten nut to 50 ft-lbs (68 Nm) **INITIAL** torque, **ONLY**.
 - b. See [Figure 6-46](#). Scribe a line on the transmission sprocket nut and continue the line on the transmission sprocket as shown.
 - c. Tighten the transmission sprocket nut an additional 30°-40°.
 - d. See [Figure 6-45](#). Install lockplate (4) over nut (3) so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's (2) two tapped holes.

NOTE

The lockplate has four screw holes and can be turned to either side, so you should be able to find a position without having to additionally tighten the nut. If you cannot align the screw holes properly, the nut may be additionally **TIGHTENED** until the screw holes line up, but do not exceed 45° as specified above. Never **LOOSEN** nut to align the screw holes.

- e. See [Figure 6-46](#). If lockplate will not align with holes, tighten nut to 45° maximum.

CAUTION

Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation, after initially tightening to 50 ft-lbs. Do not loosen sprocket nut while attempting to align the screw holes. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened 45° as specified above. Tightening too much or too little may cause the nut to come loose during vehicle operation.

12. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened until screw holes align.
13. Install two socket head screws (5) through aligned holes of lockplate and into tapped holes of sprocket. Tighten screws to 90-110 in-lbs (10.2-12.4 Nm).

NOTE

The original equipment socket head screws (5) have thread-locking compound applied to them. Since this compound remains effective for about three removal/installation cycles, the original screws may be reused up to three times. After the third removal/installation cycle, replace both screws with **new** screws identical to the original.

14. Install the remaining removed components in the reverse order of the removal procedures. See the procedures listed in the respective component sections.
15. Adjust drive belt tension. See [REAR BELT DEFLECTION](#) in Section 1.
16. Fill transmission to proper level with fresh lubricant. See [CLUTCH, TRANSMISSION FLUID](#) in Section 1.

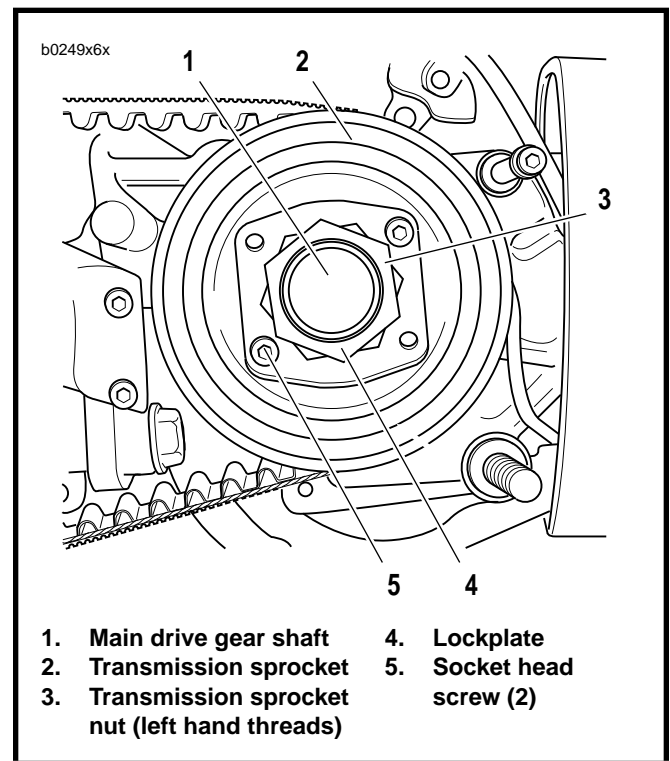


Figure 6-45. Transmission Sprocket

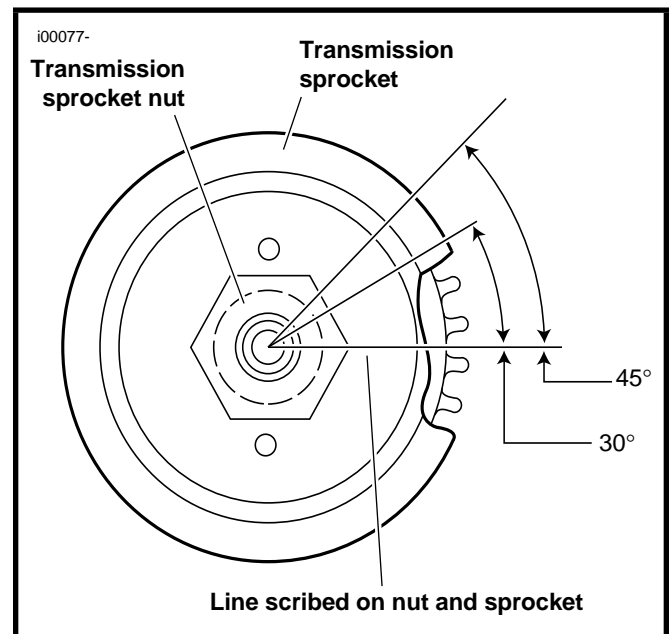


Figure 6-46. Aligning Transmission Sprocket