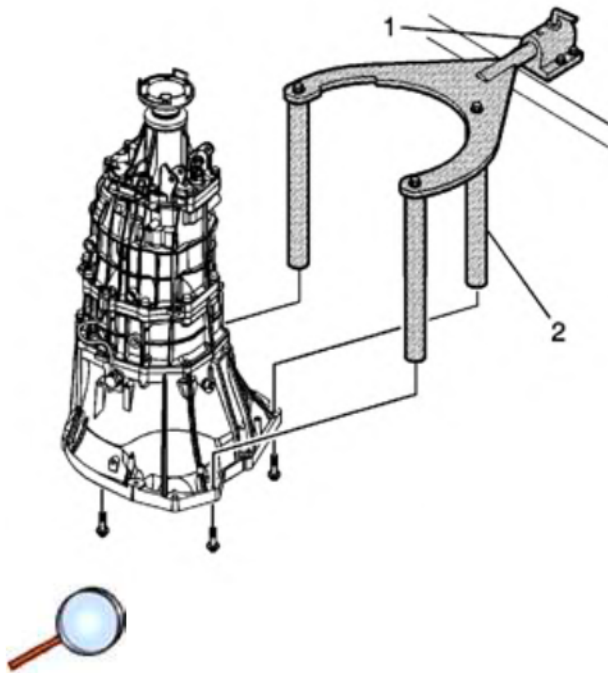


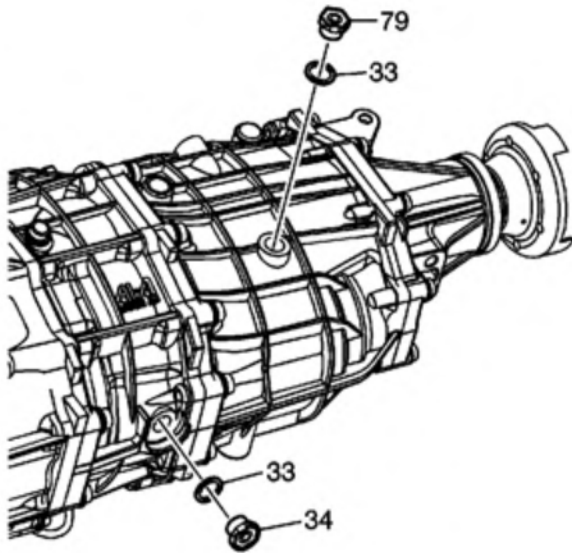
Transmission Disassemble

Special Tools

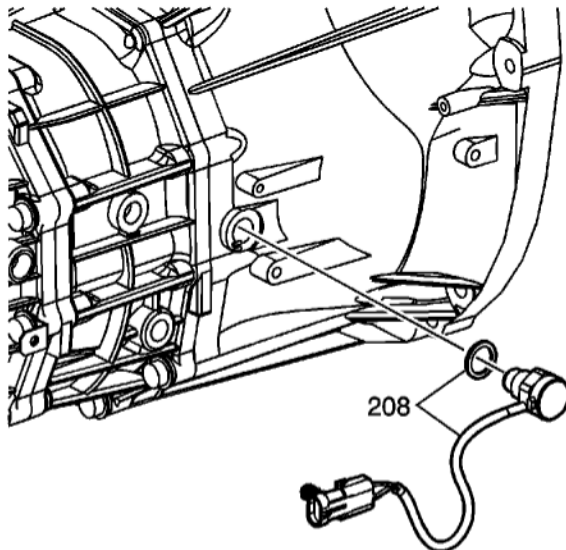
- *DT-47678* Transmission Holding Fixture
- *DT-49027* Coil Pin Remover and Installer
- *J 3289-20* Holding Fixture
- *J 6125-1B* Slide Hammer with Adapter
- *J 8433* Two Jaw Puller
- *J 35467* One-Way Clutch Tester



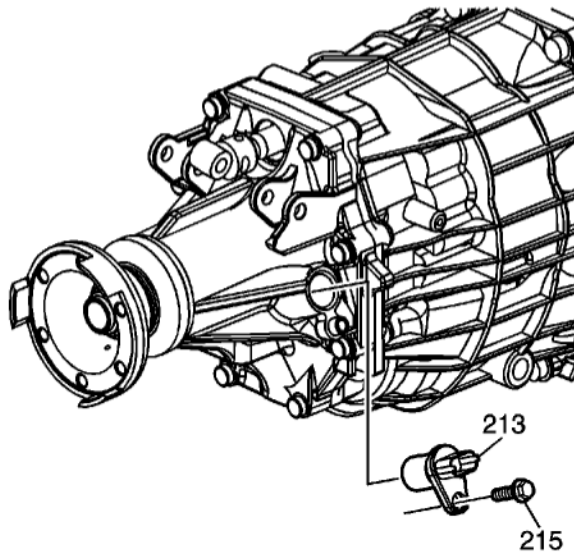
1. Install *DT-47678* fixture (2) to the transmission clutch housing.
2. Mount the transmission to a workbench using *J 3289-20* fixture (1).
3. Remove the clutch release cylinder bolts and the clutch release cylinder. Refer to [Clutch Concentric Actuator Cylinder Replacement](#).



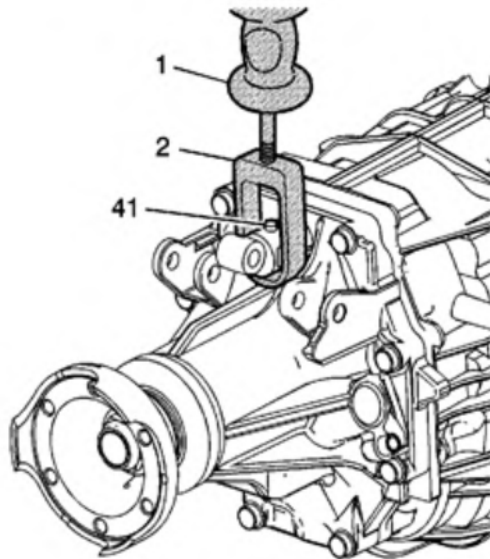
4. Remove the fill plug (79) and the washer (33).
5. Remove the drain plug (34) and the washer (33) then drain the transmission fluid.



6. Remove the backup lamp switch and washer (208) from the case.

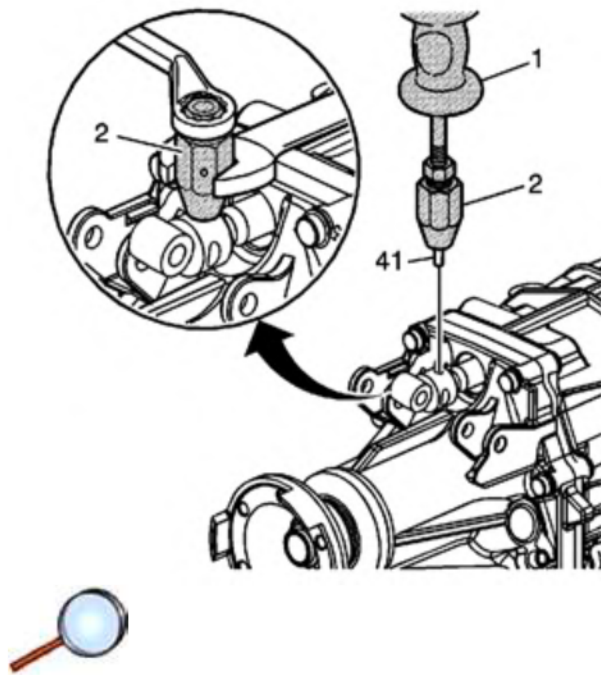


7. Remove the output sensor (213) and bolt (215) from the rear extension housing.



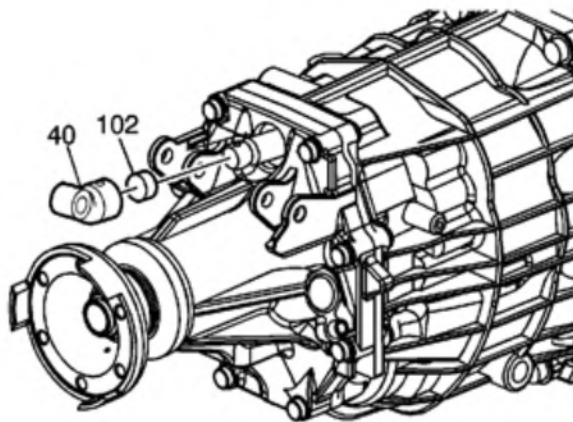
Note: Prior to the shift lever pin removal, the shift control shaft must be shifted forward into the transmission.

8. Install *DT-49027-1* coil pin puller (2) onto *J 6125-1B* slide hammer (1).
9. Position *DT-49027-1* puller (2) directly beneath the shift lever pin (41), then repeatedly pull up on the slide hammer handle until the bottom of the shift lever pin is flush with the machined O.D. of the shift lever rod universal joint.

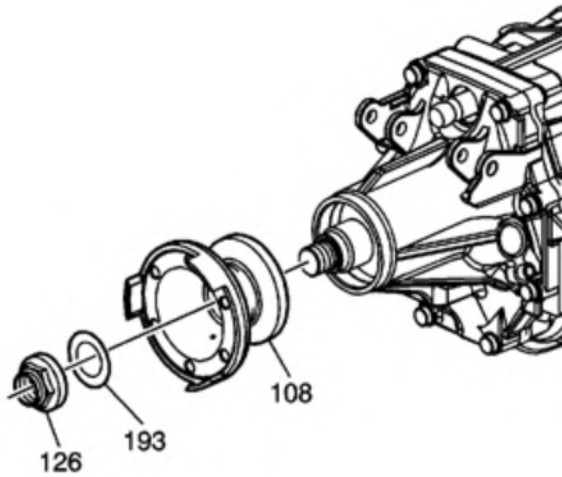


Note: Only rotate the wrench attached to the outer body of *DT-49027-2* coil pin remover . The wrench attached to the inner body must remain stationary.

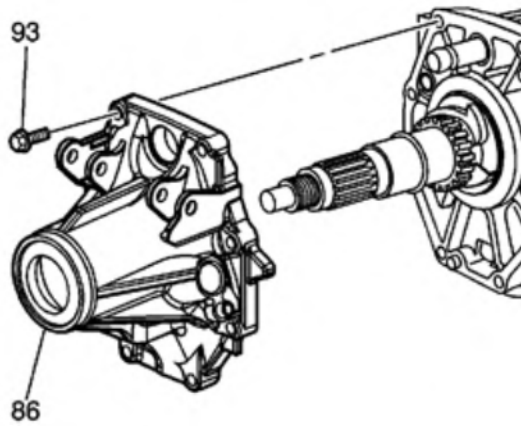
10. Install *DT-49027-2* coil pin remover (2) onto the top of the shift lever pin (41) and tighten.
11. Install *J 6125-1B* slide hammer (1) onto *DT-49027-2* coil pin remover (2). Repeatedly, pull up on the slide hammer handle until the shift lever pin (41) is removed from the shift lever rod universal joint.



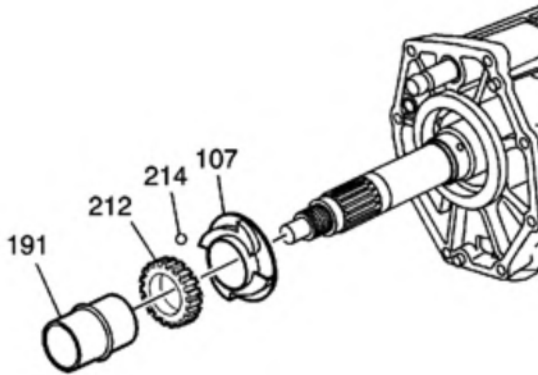
12. Remove the shift lever rod universal joint (40) and dampener (102) from the end of the shift control shaft.



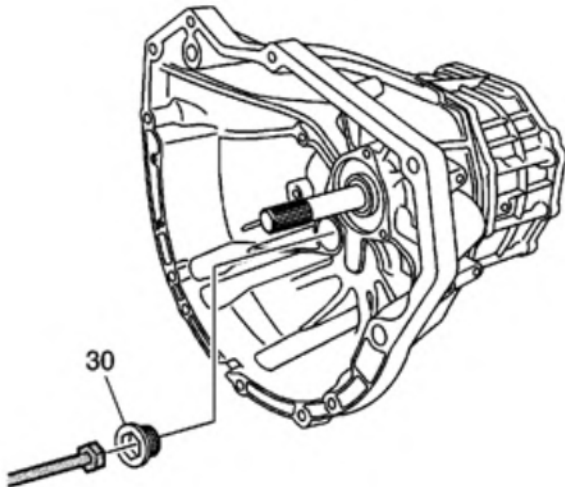
13. Using a screwdriver, release the staking of the propshaft flange nut (126).
14. Remove the propshaft flange nut (126) and propshaft flange fluid seal (193).
15. Remove the propshaft flange (108).



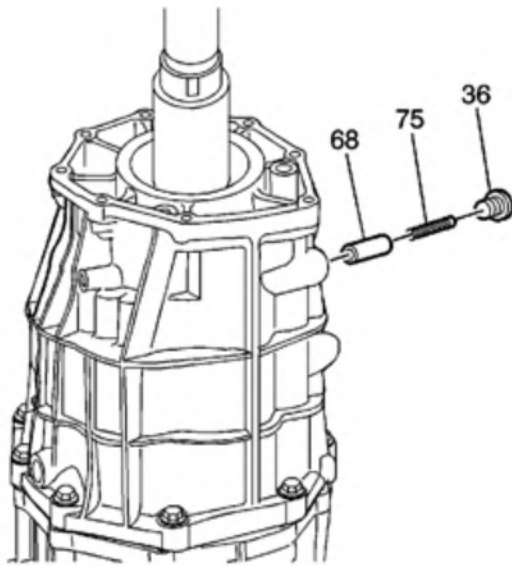
16. Remove the 8 bolts (93) from the extension housing (86).
17. Remove the extension housing.



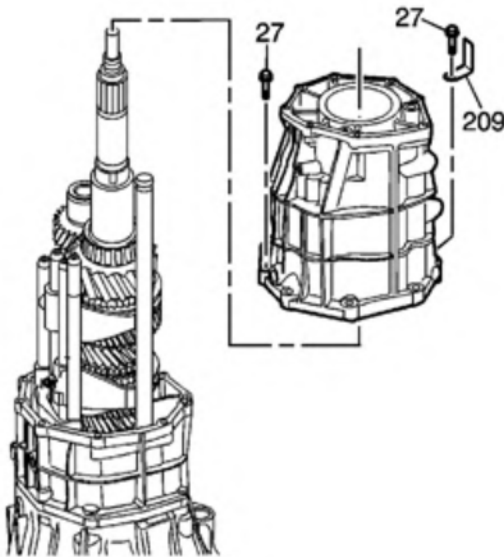
18. Remove the rear output shaft rear bearing spacer (191).
19. Remove the vehicle speed sensor drive gear (212).
20. Remove the locking ball (214).
21. Remove the main shaft bearing oil slinger (107).



22. Using J 35467 clutch tester , remove the clutch housing hole plug (30) from the clutch housing.



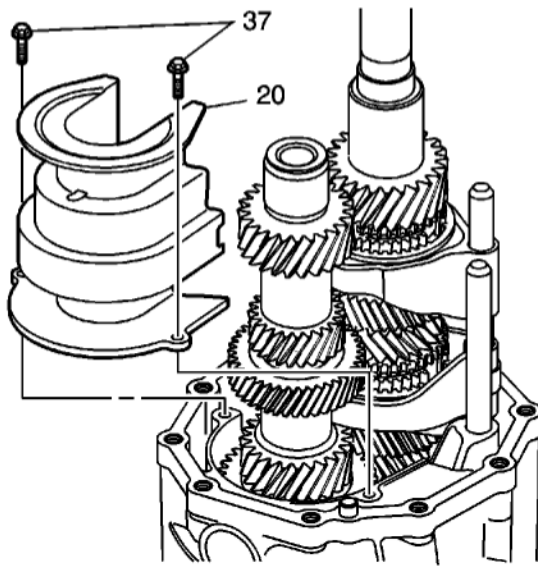
23. Remove the following components:
- The shift shaft detent plug (36)
 - The shift shaft detent spring (75)
 - The shift shaft detent pin (68)



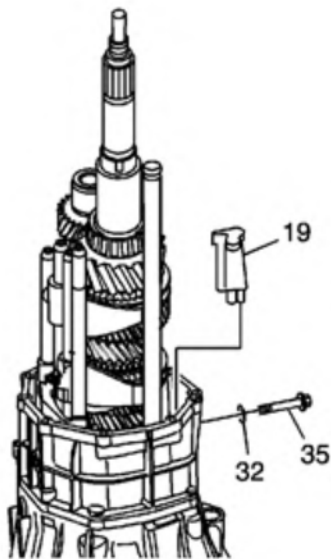
24. Remove the 10 bolts (27) and retainer (209) from the rear case housing.

Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.

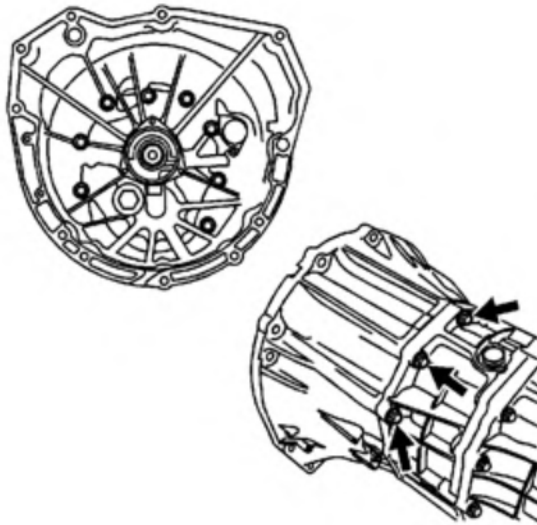
25. Using a soft-face hammer, separate the rear case housing from the intermediate case housing.
26. Remove the rear case housing.



27. Remove the 2 oil trough bolts (37) and oil trough (20).

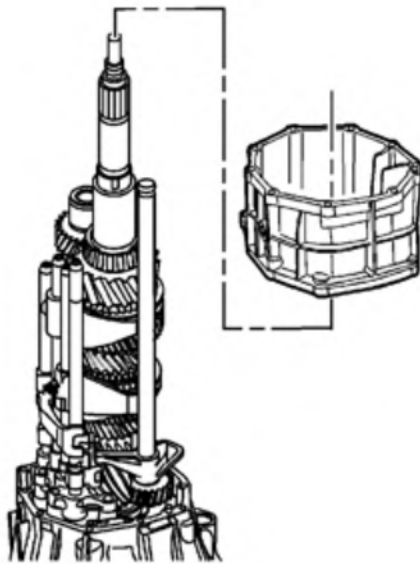


28. Remove the oil trough pipe (19).
29. Remove the reverse idler gear shaft bolt (35) and gasket (32).

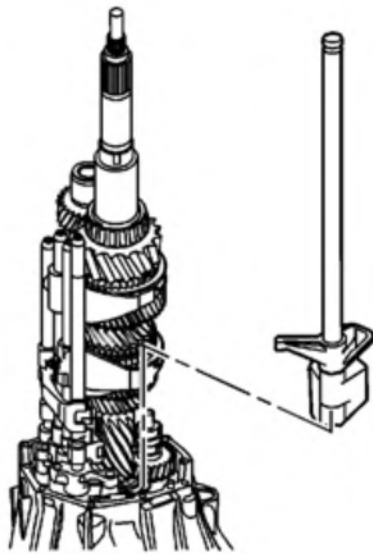


30. Remove the 11 flange bolts retaining the clutch housing. This includes 8 bolts from the front and 3 bolts from the rear.

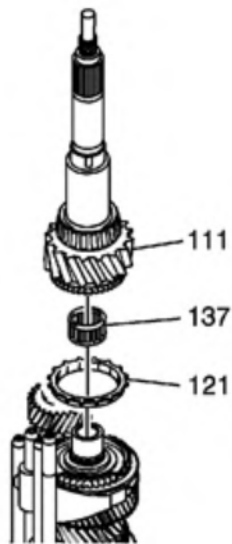
Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.



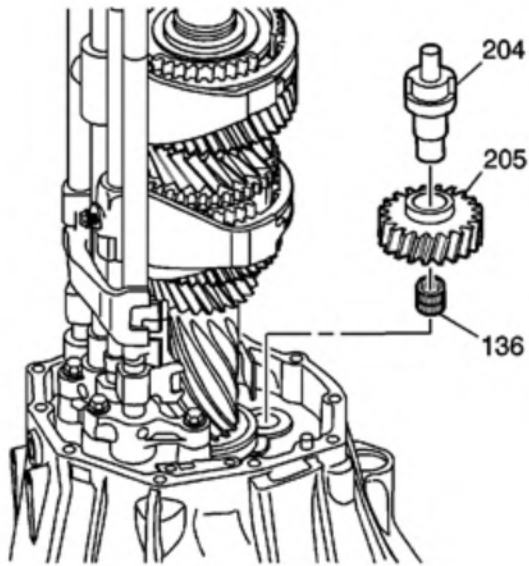
31. Using a soft-face hammer, separate the intermediate case from the front clutch housing.
32. Remove the intermediate case housing.



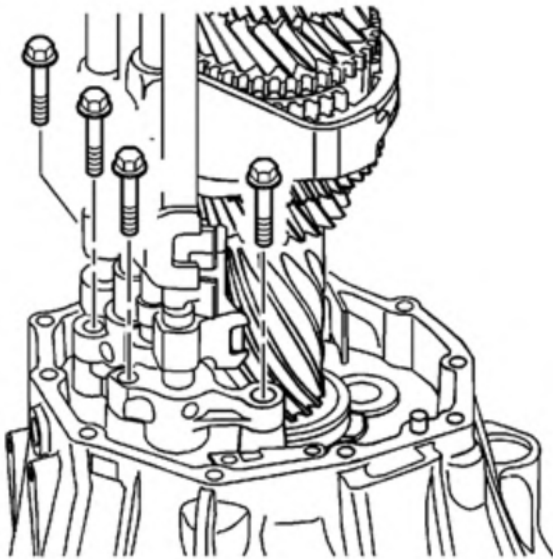
33. Remove the shift shaft selector lever.



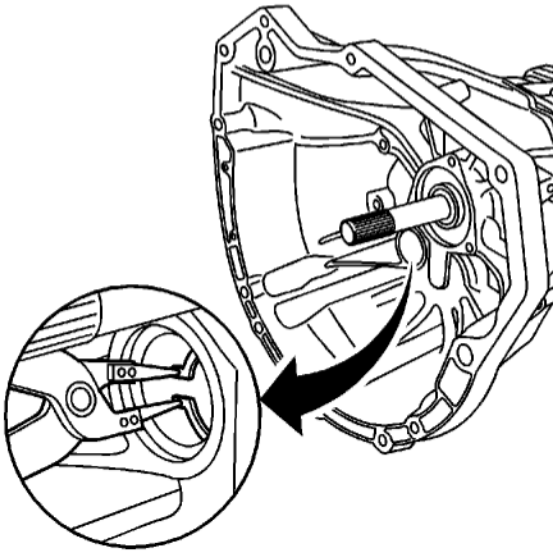
34. Remove the rear output shaft (111), input shaft bearing (137) and blocking ring (121) from the 6th gear synchronizer assembly.



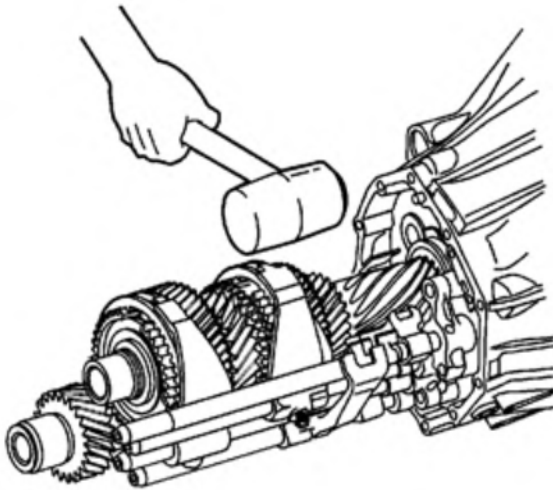
35. Remove the reverse idler gear bearing (136), reverse idler gear (205) and the reverse idler gear shaft (204).



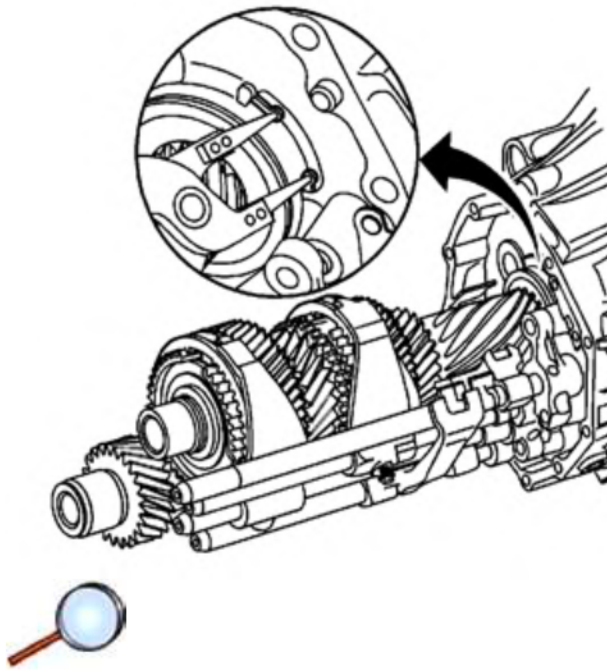
36. Remove the 4 bracket bolts from the shift counter lever bracket.



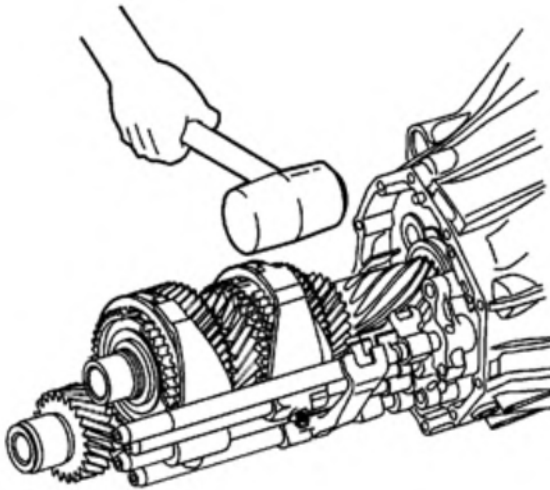
37. Stretch snap ring on the front countershaft bearing. Maintain stretch.



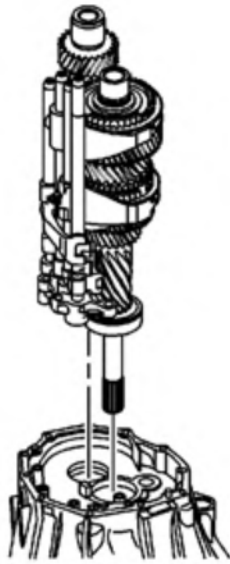
38. Using a rubber hammer, tap on transmission front case in order to disengage the countershaft bearing's snap ring.



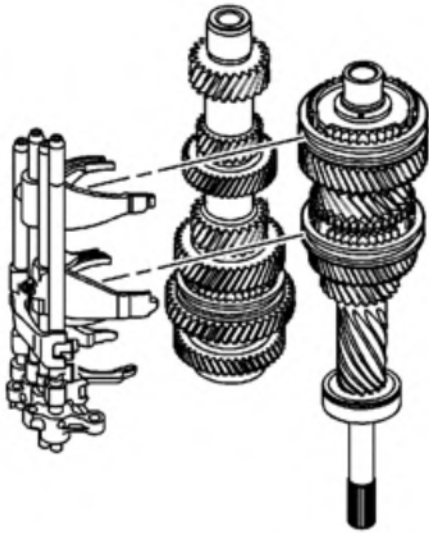
39. Stretch the snap ring on the rear input shaft bearing. Maintain stretch.



40. Hold the countershaft. Using a soft rubber hammer tap on the transmission front case in order to disengage the snap ring. Separate the input shaft and countershaft from clutch housing.



41. Remove the input shaft, countershaft and shift rails as an assembly.

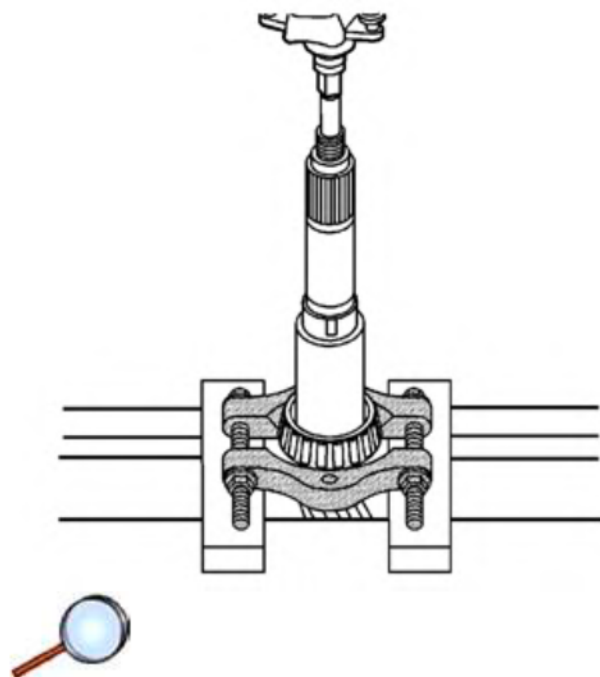


42. Separate the shift rails, the input shaft and countershaft.

Output Shaft Disassemble

Tools Required

[J 22912-B](#) Split Plate Bearing Puller



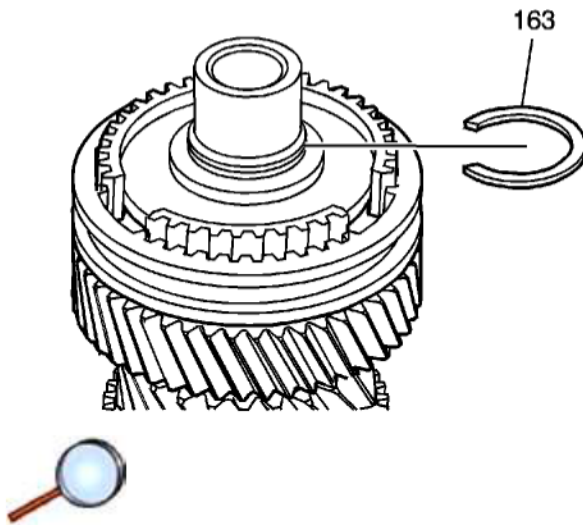
Important: Inspect the output shaft gear subassembly before disassemble. Refer to [Gears and Shafts Cleaning and Inspection](#).

Using a hydraulic press and [J 22912-B](#) , remove the tapered roller bearing.

Input Shaft Disassemble

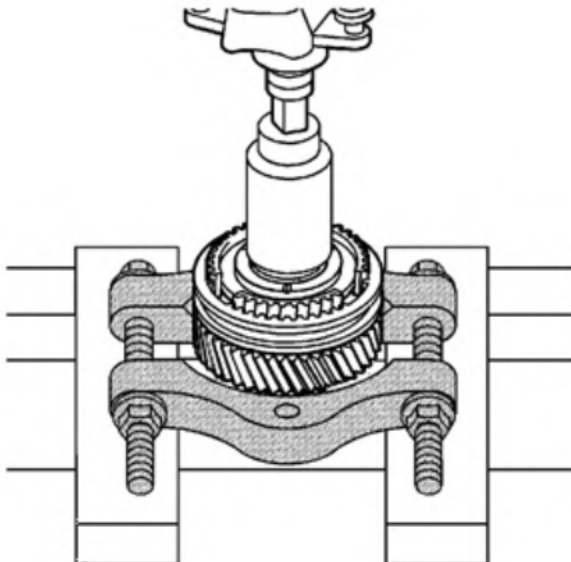
Tool Required

[J 22912-B](#) Split Plate Bearing Puller



Important: Inspect the input shaft subassembly before disassemble. Refer to [Gears and Shafts Cleaning and Inspection](#).

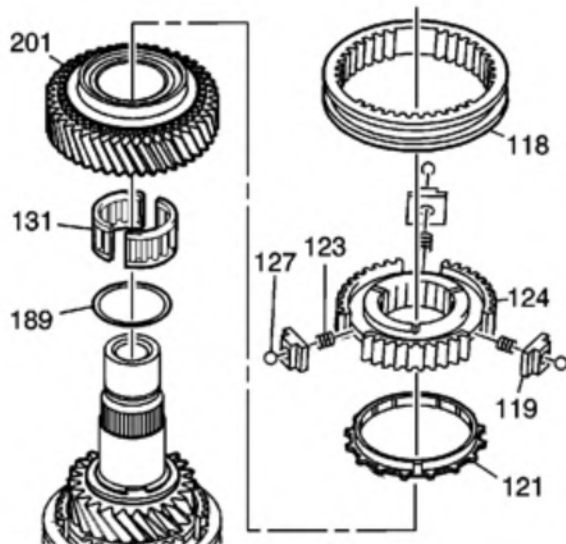
1. Remove the 5th/6th gear synchronizer hub snap ring (163).





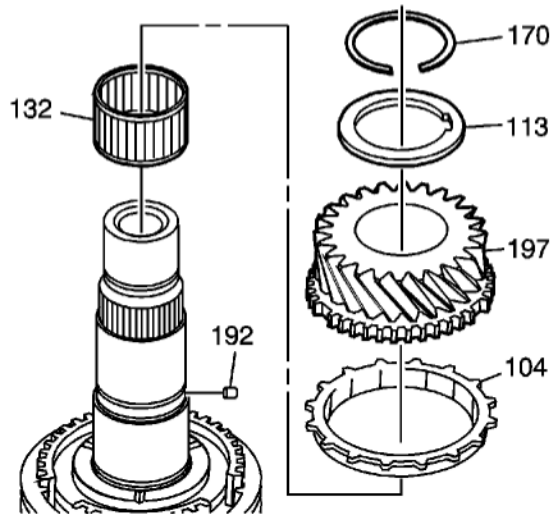
Important: Place the edge of gear on press plate.

2. Using a hydraulic press and [J 22912-B](#) , remove the 6th gear and the synchronizer as a unit.

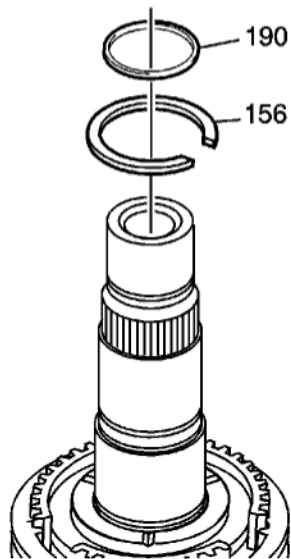


Important: Before removing sleeve (118), cover components in order to keep the ball and spring from ejecting loose.

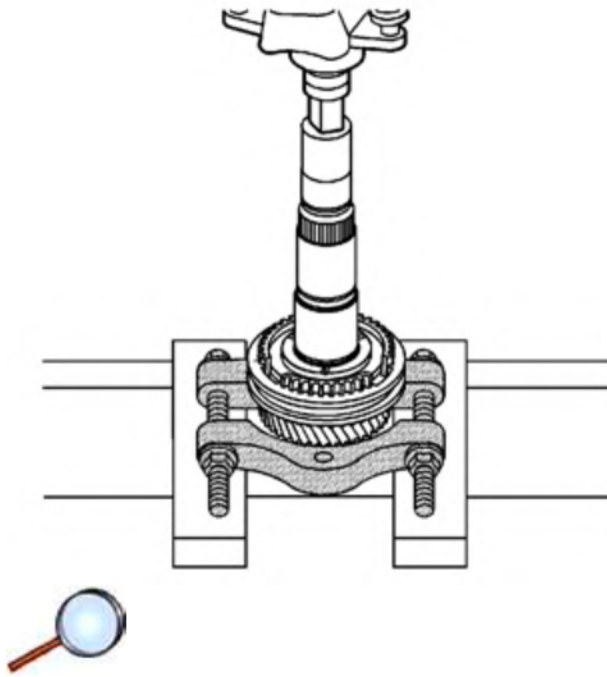
3. Remove the following components as an assembly:
- The 5th/6th gear synchronizer sleeve (118)
 - The 5th/6th gear synchronizer hub (124) including insert (119), detent ball (127) and spring (123)
 - The 5th gear synchronizer blocking ring (121)
 - The 6th gear (201)
 - The 6th gear bearing (131)
 - The 6th gear bearing spacer (189)



4. Remove the 6th gear snap ring (170).
5. Remove the 3rd gear thrust washer (113).
6. Remove the locating pin (192).
7. Remove the 3rd gear assembly which includes:
 - The 3rd gear (197)
 - The 3rd gear blocking ring (104)
8. Remove the 3rd gear bearing (132).

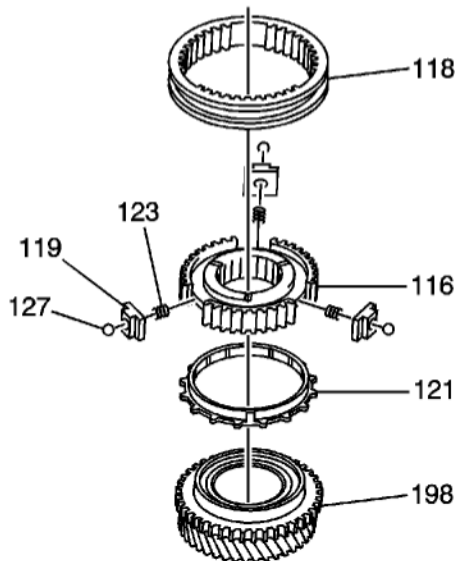


9. Remove the 3rd/4th gear spacer (190).
10. Remove the snap ring (156) and discard.



Important: Place the edge of gear on press plate.

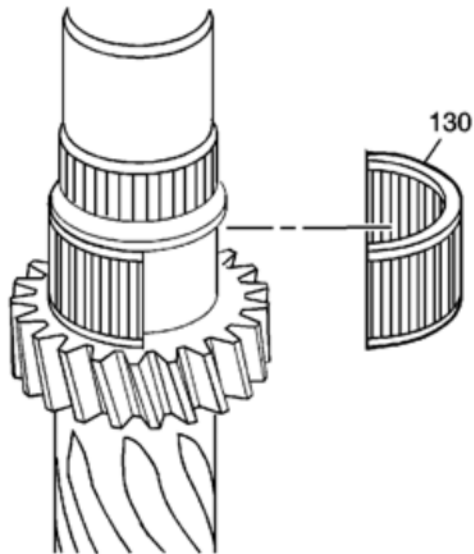
11. Using a hydraulic press and [J 22912-B](#) , remove the 4th gear and the synchronizer as a unit.



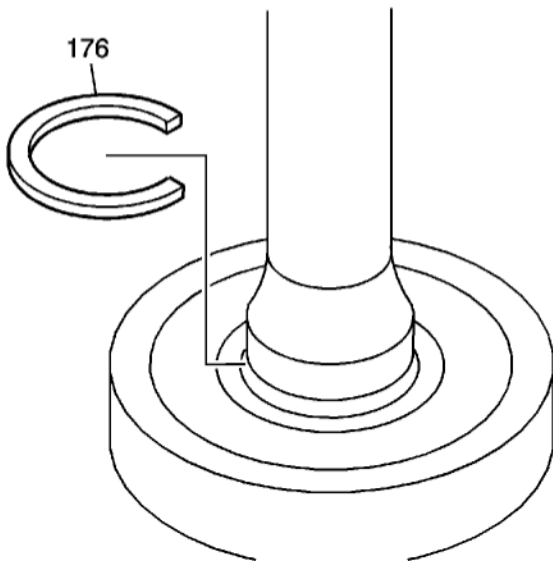
Important: Before removing sleeve (118), cover components in order to keep the ball and spring from ejecting loose.

12. Remove the following components as an assembly:
- The 3rd/4th gear synchronizer sleeve (118)
 - The 3rd/4th gear synchronizer hub (116) including insert (119), detent ball (127) and spring (123)

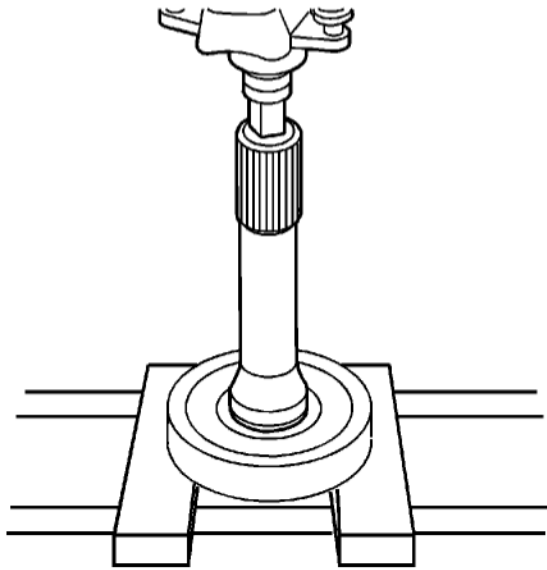
- The 4th gear blocking ring (121)
- The 4th gear (198)



13. Remove the 4th gear bearing (130) from the input shaft.



14. Remove the snap ring (176) and discard.

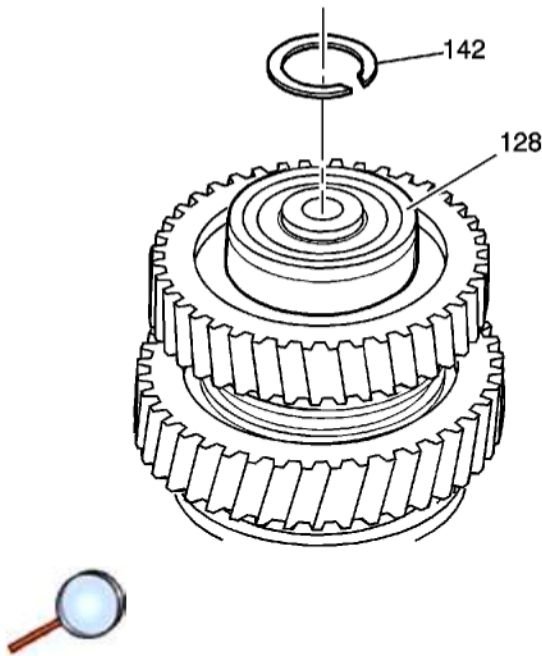


15. Using a hydraulic press, remove the counter gear front bearing from the input shaft.

Counter Gear Shaft Disassemble

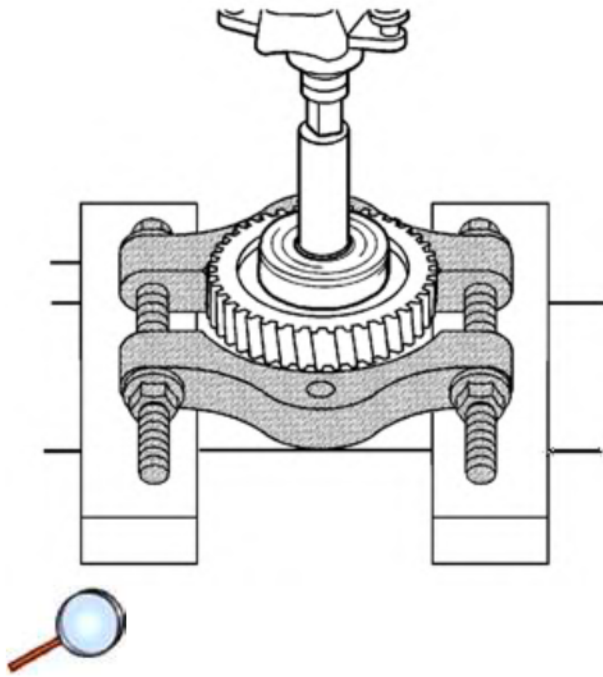
Tools Required

[J 22912-B](#) Split Plate Bearing Puller



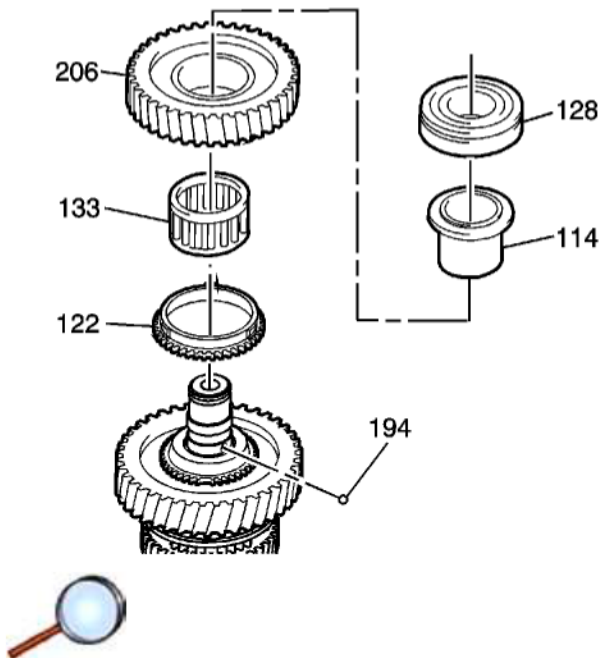
Important: Inspect the countershaft gear subassembly before disassemble. Refer to [Gears and Shafts Cleaning and Inspection](#).

1. Remove the snap ring (142) from the countershaft above the counter gear front bearing (128). Discard the snap ring (142).



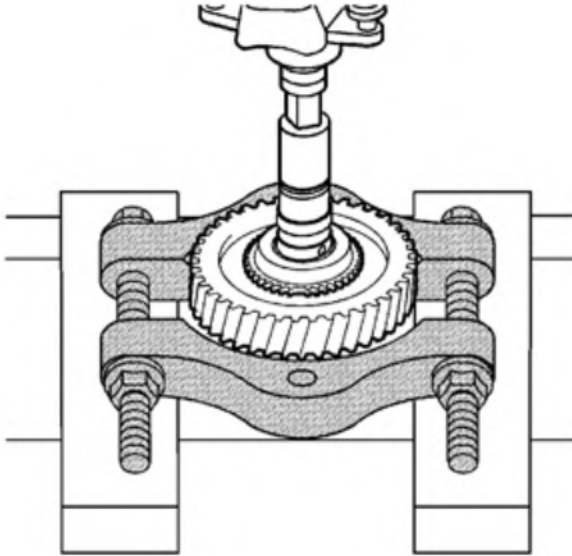
Important: Place the edge of gear on press plate.

2. Using a hydraulic press and [J 22912-B](#) , remove the counter gear front bearing and reverse synchronizer assembly as a unit.

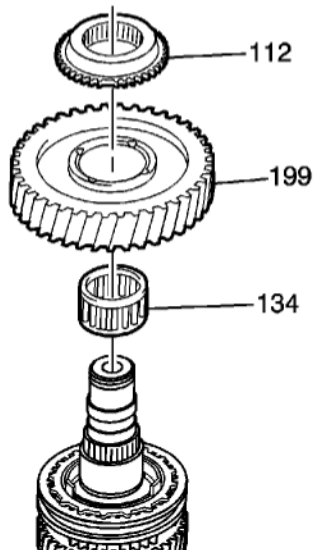


3. Remove the following components as an assembly:
 - The counter gear front bearing (128)
 - The reverse gear bushing (114)
 - The reverse gear (206)
 - The reverse gear bearing (133)
 - The reverse gear blocking ring (122)

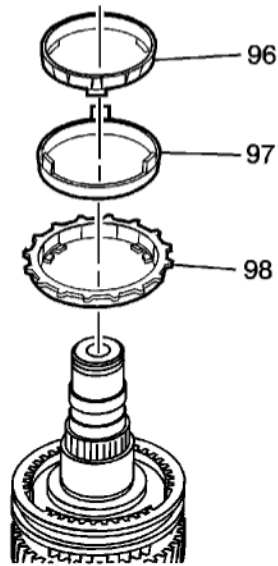
4. Using a magnet, remove the locking ball (194) from the countershaft.



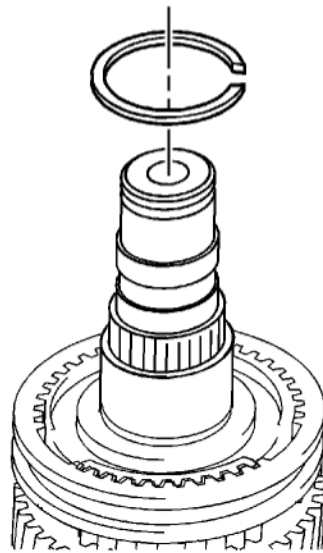
5. Using a hydraulic press and [J 22912-B](#) , remove the reverse gear spline and 1st gear as a unit.



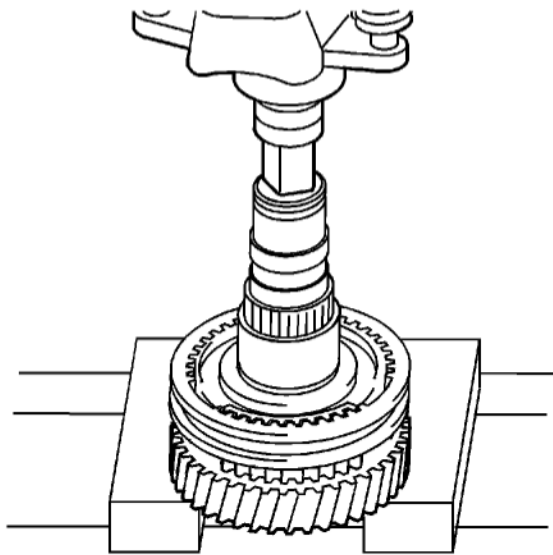
6. Remove the reverse gear spline (112).
7. Remove the 1st gear (199).
8. Remove the 1st gear bearing (134).



9. Remove the 1st gear synchronizer inner cone (96).
10. Remove the 1st gear synchronizer outer cone (97).
11. Remove the 1st gear outer blocking ring (98).

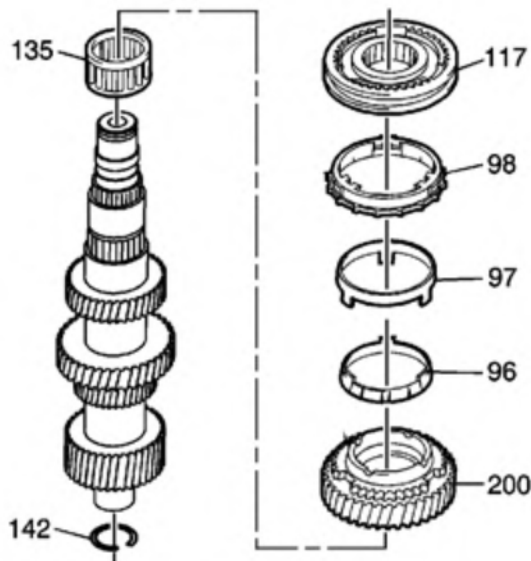


12. Remove the snap ring and discard.



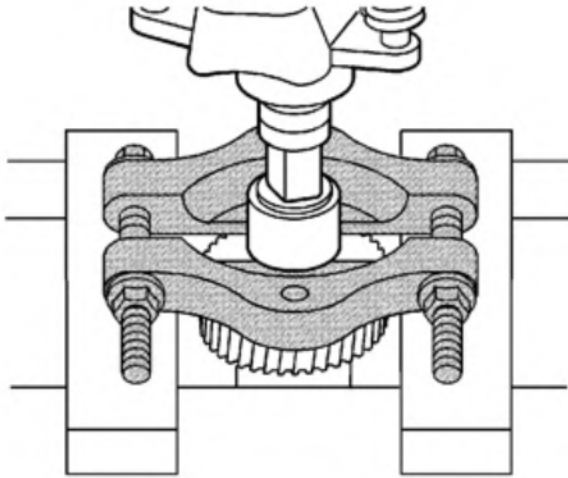
Important: Place the edge of gear on press plate.

13. Using a hydraulic press, remove the 2nd gear and the 1-2 synchronizer assembly as a unit.



14. Remove the following components as an assembly:
- The 1st/2nd gear synchronizer sleeve (117)
 - The 2nd gear outer blocking ring (98)
 - The 2nd gear synchronizer outer cone (97)
 - The 2nd gear synchronizer inner cone (96)
 - The 2nd gear (200)
 - The 2nd gear bearing (135)

- The snap ring (142)



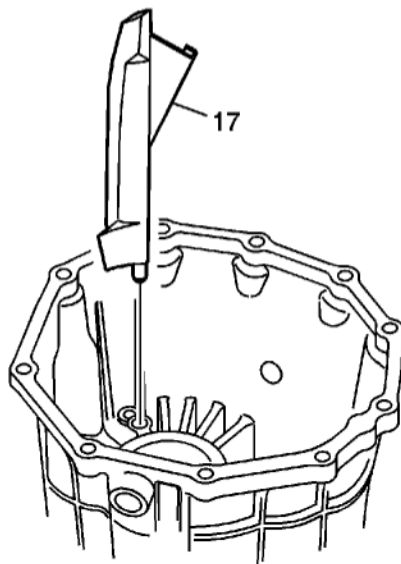
15. Using [J 22912-B](#) and a hydraulic press, remove the cylindrical roller bearing inner race.

Transmission Case Disassemble

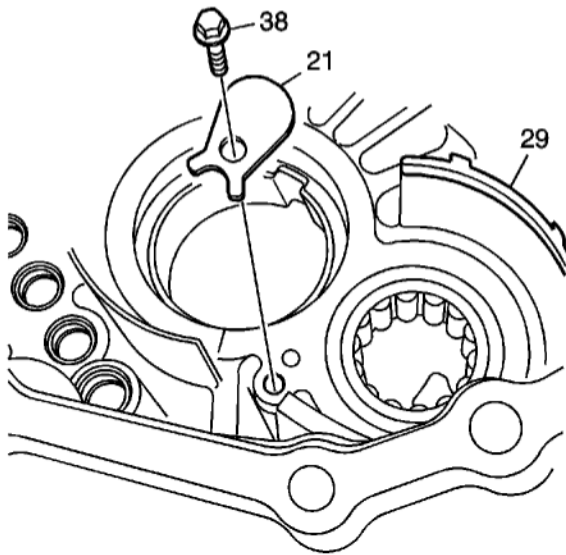
Special Tools

- [DT-47722](#) Shift Rail Bushing Remover and Installer
- [J 2619-01](#) Slide Hammer
- [J 26941](#) Bushing and Bearing Remover 3-4 in

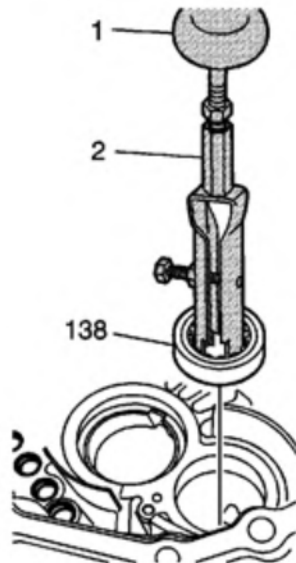
Rear Case Disassemble



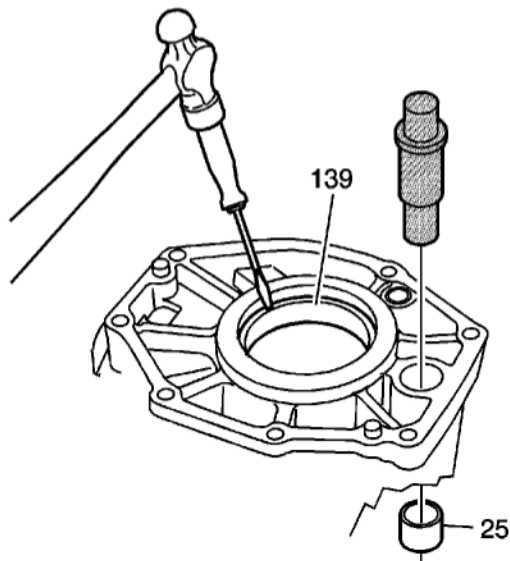
1. Remove the oil trough (17).



2. Remove the bolt (38) and retainer (21).
3. Remove the gasket (29).

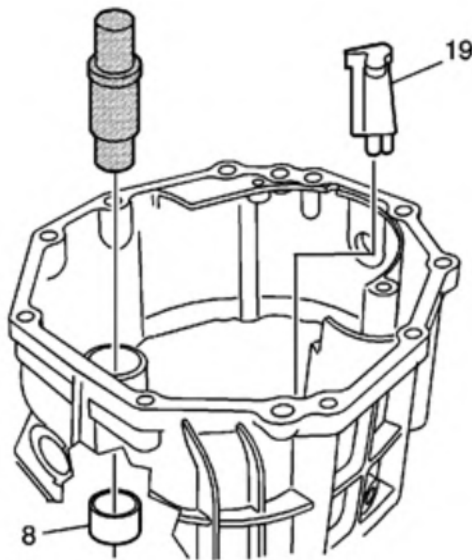


4. Using [J 26941](#) (2) and [J 2619-01](#) (1) , remove and discard the counter gear roller bearing (138).



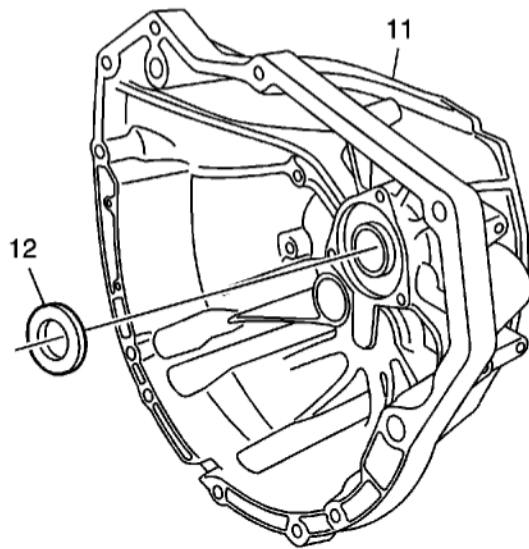
5. Using [DT-47722](#) , remove the shift shaft bearing (25) from the case.
6. Remove the output shaft bearing race (139).

Middle Case Disassemble

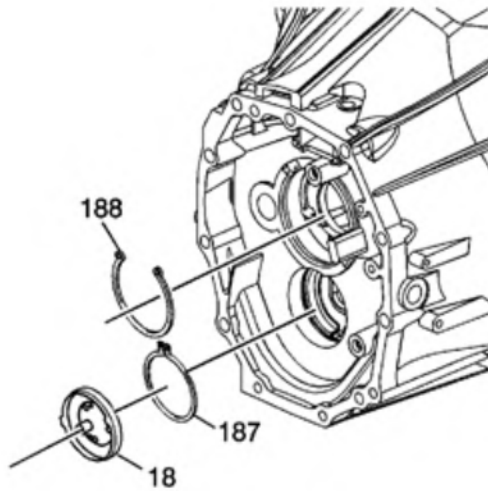


1. Using [DT-47722](#) , remove the shift shaft bearing (8) from the middle case.
2. Remove the oil trough (19) from the middle case.

Clutch Housing Disassemble



1. Remove and discard the input shaft seal (12) from the front case (11).

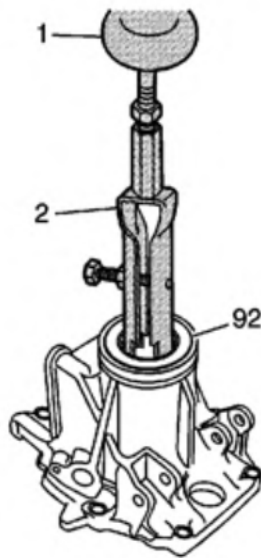


2. Pry the front input shaft oil slinger (18) from the transmission front case using a suitable tool.
3. Remove the front input shaft oil slinger (18).
4. Remove the input shaft bearing front retainer (188).
5. Remove the counter shaft bearing front retainer (187).

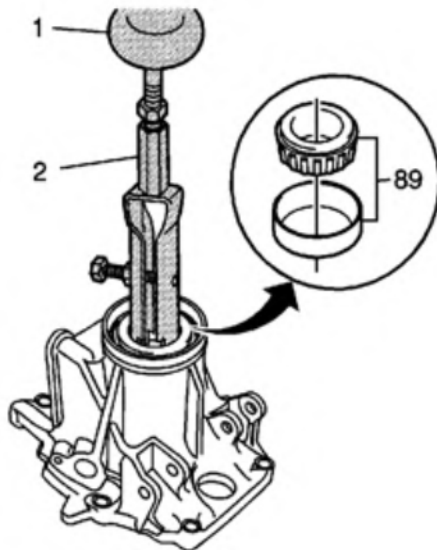
Extension Disassemble

Tools Required

- [DT-47722](#) Shift Shaft Seal Installer
- [J 2619-01](#) Slide Hammer
- [J 26941](#) Bushing and Bearing Remover 3-4 in

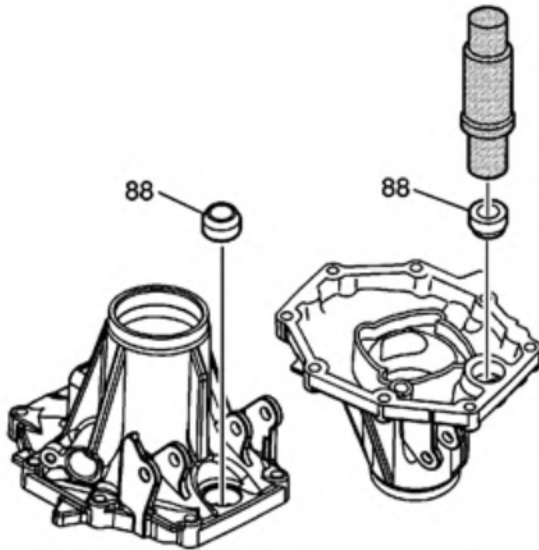


1. Using [J 2619-01](#) (1) and [J 26941](#) (2) , remove the rear output shaft seal (92).





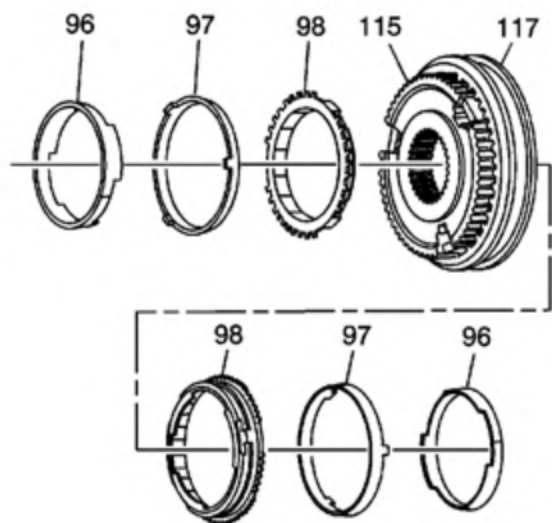
2. Using [J 2619-01](#) (1) and [J 26941](#) (2) , remove the rear output shaft bearing assembly (89).



3. Using tool [DT-47722](#) , remove the shift shaft seal (88).

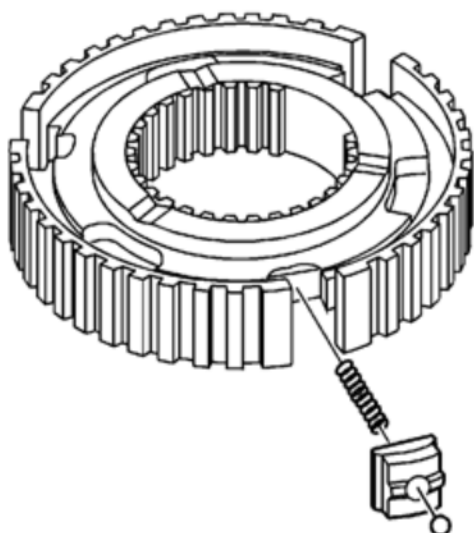
Synchronizers Disassemble

1st/2nd, 3rd/4th Gear Synchronizer

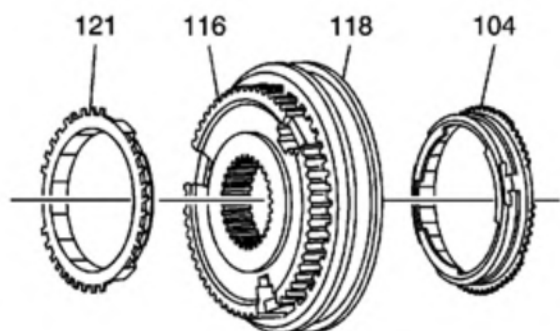


Important: When you service the synchronizers, retain them in the same order that they are removed. Keep the synchronizer components together and mark them to identify correct location.

1. Remove the following components from the 1st/2nd gear synchronizer hub (115/117):
 - the 1st gear synchronizer inner cone (96)
 - the 1st gear synchronizer outer cone (97)
 - the 1st gear synchronizer outer blocking ring (98)
 - the 1st gear synchronizer outer blocking ring (98)
 - the 1st gear synchronizer outer cone (97)
 - the 1st gear synchronizer inner cone (96)

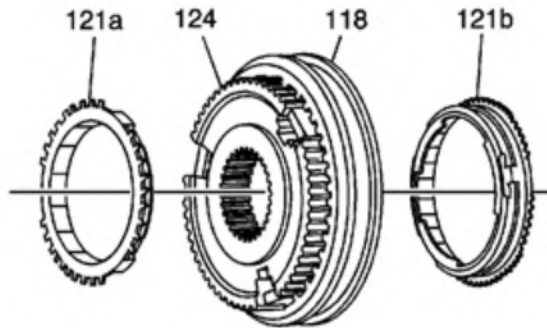


2. Remove the synchronizer insert and spring from the synchronizer hub. Press the spring and slide the insert out.

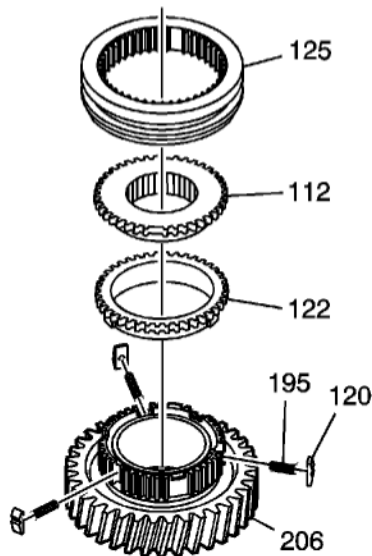


3. Remove the following components from the 3rd/4th gear synchronizer hub (116/118):
 - the 4th gear blocking ring (121)
 - the 3rd gear blocking ring (104)

5th / 6th Gear Synchronizer



1. Remove the following components from the 5th/6th synchronizer hub (124/118):
 - The 6th gear blocking ring (121a)
 - The 5th gear blocking ring (121b)



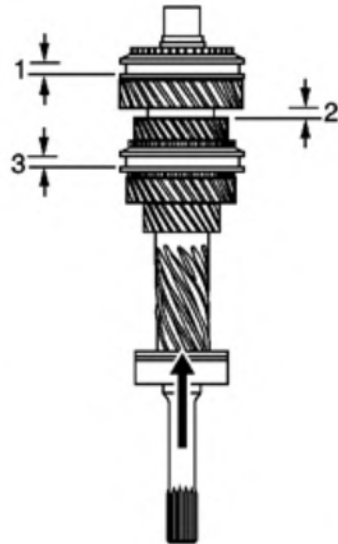
2. Remove the following components from the reverse gear (206):
 - the synchronizer sleeve (125)
 - the reverse driven gear (112)
 - the reverse gear blocking ring (122)
 - the reverse gear synchronizer insert (120) and the spring (195)

Gears and Shafts Cleaning and Inspection

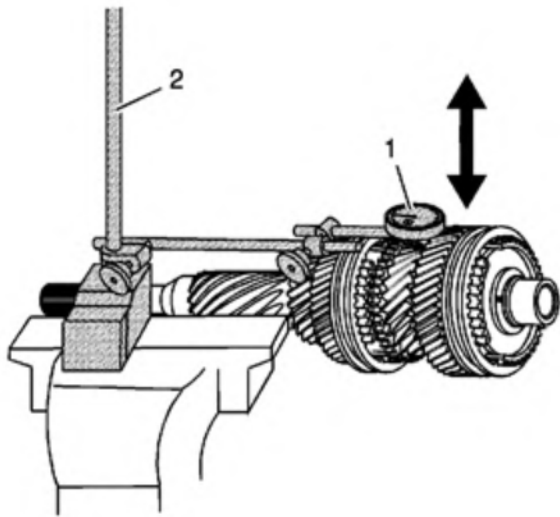
Tools Required

- [J 8001-3](#) Dial Indicator
- [J 26900-12](#) Dial Indicator - 1-10 mm
- [J 26900-13](#) Magnetic Indicator Base

Input Shaft



1. Inspect 3rd (2), 4th (3), and 6th gear (1) for axial clearance. Lift up on the gear from the settled position and measure travel. Refer to [Transmission Clearance Specifications](#) , Gear Axial Clearance table.



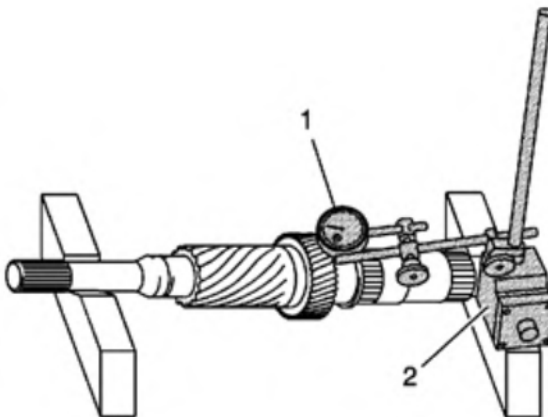
2. Measure the radial clearance for each of the speed gears.
 - 2.1. Place the speed gear, with the needle roller bearing, on the input shaft at the correct journal.
 - 2.2. Use [J 8001-3](#) or [J 26900-12](#) (1) and [J 26900-13](#) (2).
 - 2.3. Position [J 8001-3](#) or [J 26900-12](#) on the gear.
 - 2.4. Move the gear up and down.

Specification

- Standard Clearance 1st gear: 0.02-0.073 mm (0.0008-0.0029 in)
 - Standard Clearance 2nd and 3rd gear: 0.015-0.068 mm (0.0006-0.0027 in)
 - Maximum Clearance 1st gear: 0.160 mm (0.0063 in)
 - Maximum Clearance 2nd and 3rd gear: 0.160 mm (0.0063 in)
3. If the clearance exceeds the maximum, replace either the gear, the needle roller bearing, or the input shaft.



4. Clean the input shaft in a suitable solvent.
5. Clean and air dry the oil gallery.
6. Inspect the input shaft bearing surfaces for the following conditions:
 - Wear
 - Lack of lubricant
 - Debris embedded in the oil grooves
 - Brinelling
7. Inspect the input shaft splines for wear or damage.
8. Replace the input shaft if any of the above conditions are found.

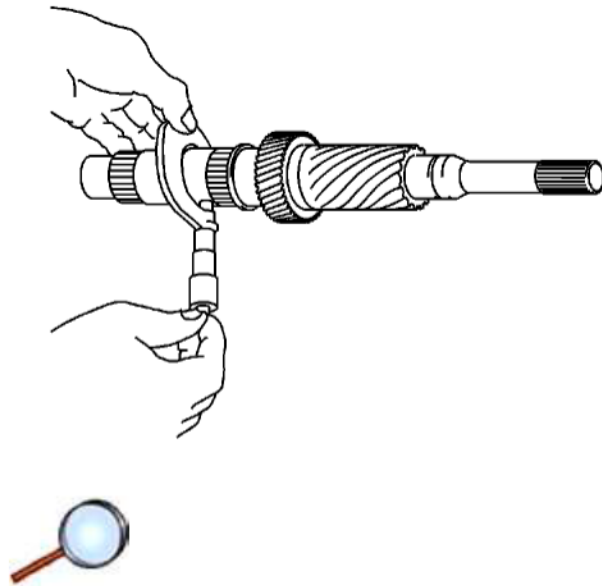


9. Using [J 8001-3](#) or [J 26900-12](#) (1), [J 26900-13](#) (2) and V-blocks, inspect the input shaft for runout.

Specification

Maximum runout: 0.06 mm (0.0024 in)

10. If the runout exceeds the maximum, replace the input shaft.



Important: To calculate the radial clearance, measure shaft diameter, needle roller bearing diameter and gear inner diameter.

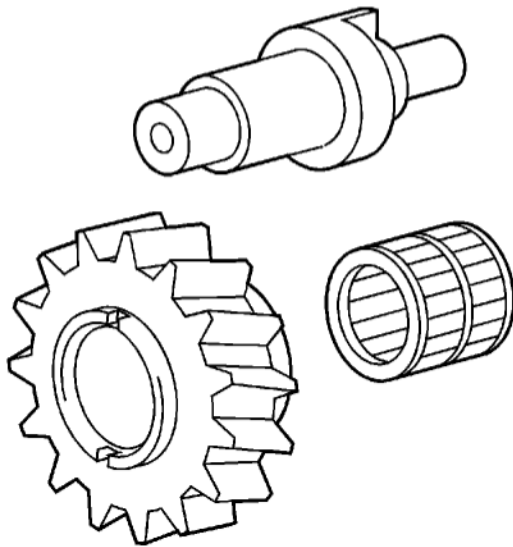
11. Using a micrometer, measure the diameter of the input shaft journals.

Specification

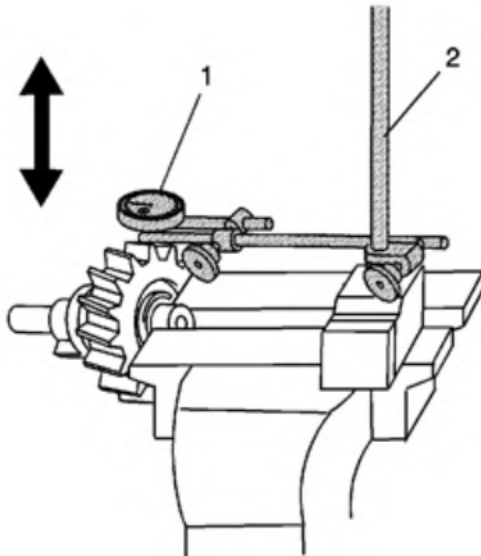
- Minimum diameter 1st gear (a): 38.860 mm (1.5299 in)
- Minimum diameter 2nd gear (b): 46.860 mm (1.8449 in)
- Minimum diameter 3rd gear (c): 37.869 mm (1.4905 in)

12. If the journal diameter is less than the minimum, replace the input shaft.

Reverse Idler Gear and Shaft



1. Clean the reverse idler gear and shaft in a suitable solvent and air dry all the parts.
2. Inspect the bushing in the reverse idler gear for the following conditions:
 - Excessive wear
 - Scoring
 - Pitting
3. Replace the reverse idler gear if the bushing is faulty.
4. Inspect the reverse idler gear shaft for the following conditions:
 - Excessive wear
 - Scoring
 - Pitting
5. Replace the reverse idler gear shaft if it is faulty.

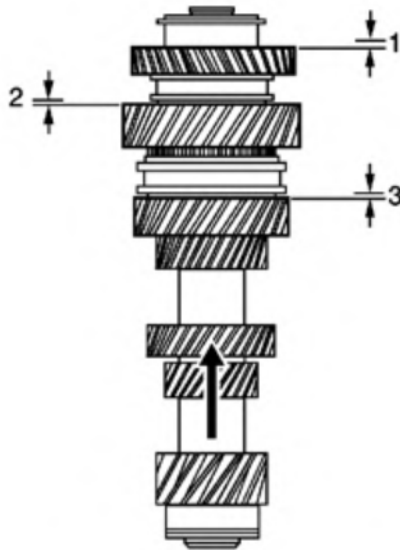


6. Using [J 8001-3](#) or [J 26900-12](#) (1) and [J 26900-13](#) (2), measure the reverse idler gear radial clearance.

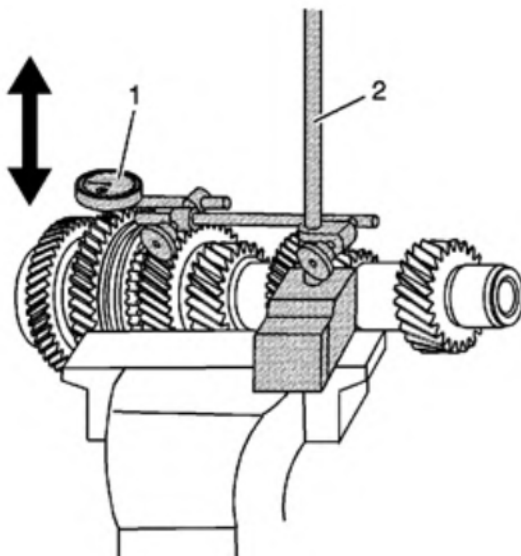
Specification

- Standard Clearance: 0.040-0.082 mm (0.0016-0.0032 in)
 - Maximum Clearance: 0.130 mm (0.0051 in)
7. If the clearance exceeds the maximum, replace the reverse idler gear or the reverse idler gear shaft.

Countershaft



1. Inspect 1st (2), 2nd (3), and reverse gear (1) for axial clearance. Lift up on the gear from the settled position and measure travel. Refer to [Transmission Clearance Specifications](#) , Gear Axial Clearance table.

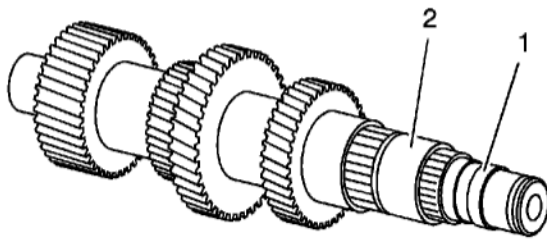




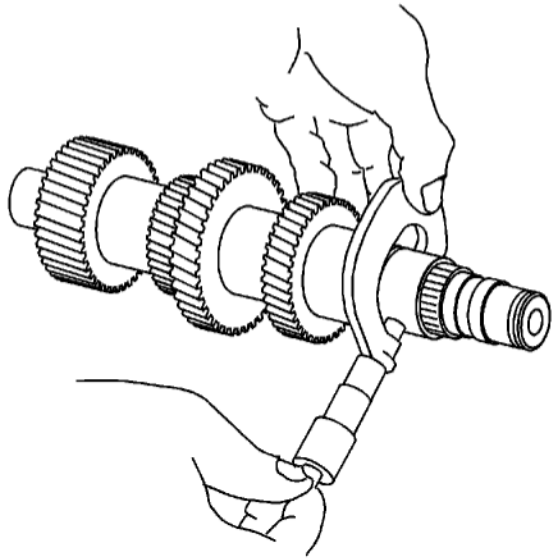
2. Measure the radial clearance for 5th countershaft gear.
 - 2.1. Place the 5th countershaft gear, with the needle roller bearing, on the countershaft journal.
 - 2.2. Use [J 8001-3](#) or [J 26900-12](#) (1) and [J 26900-13](#) (2).
 - 2.3. Position [J 8001-3](#) or [J 26900-12](#) on the gear.
 - 2.4. Move the gear up and down.

Specification

- Standard Clearance: 0.015-0.068 mm (0.0006-0.0027 in)
 - Maximum Clearance: 0.160 mm (0.0063 in)
3. If the clearance exceeds the maximum, replace the gear, the roller bearing, or the countershaft.



4. Clean the countershaft in a suitable solvent and air dry all the parts.
5. Inspect the rear bearing race (1) on the countershaft for the following conditions:
 - Brinelling
 - Wear
 - Scoring
6. Inspect the 5th countershaft gear bearing race (2) for the following conditions:
 - Brinelling
 - Wear
 - Scoring



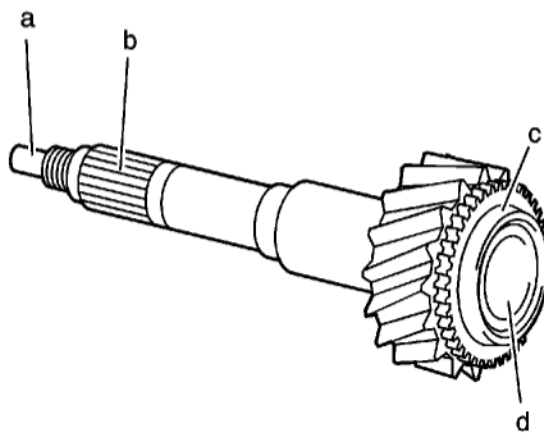
7. Using a micrometer, measure the outer diameter of the countershaft journal.

Specification

Minimum diameter: 29.860 mm (1.1756 in)

8. Inspect all of the countershaft gears for being faulty following the gear inspection steps.
9. Replace the countershaft if it is faulty.

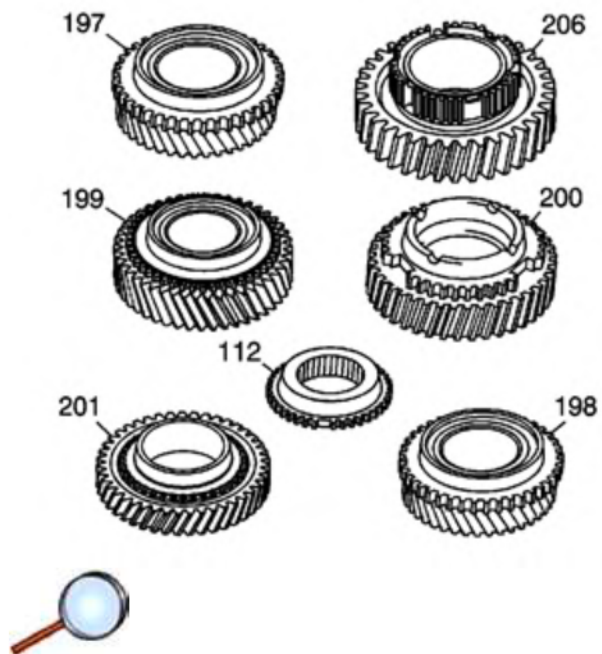
Output Shaft



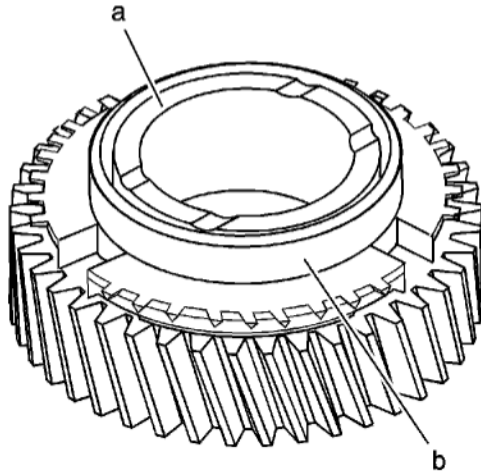
1. Clean the output shaft in a suitable solvent and air dry all the parts.
2. Inspect the pilot bearing journal (a) for wear or scoring.

3. Inspect the clutch disc splines (b) for wear. Steps in the splines may cause concerns with clutch operation.
4. Inspect the synchronizer blocking ring surface (c) for the following conditions:
 - Grooves
 - Excessive wear
 - Heat marks
 - Scoring
5. Inspect the input shaft front support bearing journal (d) for the following conditions:
 - Brinelling
 - Pitting
 - Excessive wear
6. Inspect the gear teeth and selector teeth for being faulty following the gear inspections steps.
7. Replace the output shaft if any of the above conditions are found.

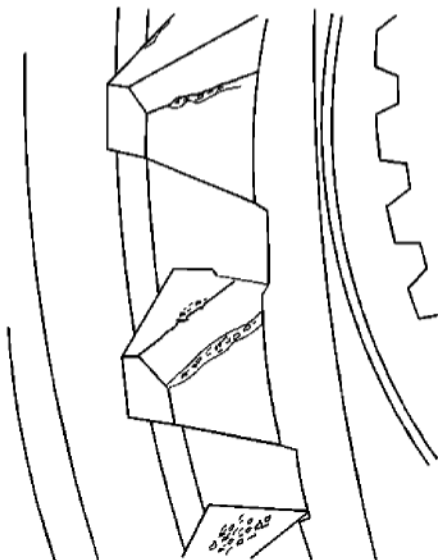
Gears



1. Clean the 1st gear (199), the 2nd gear (200), the 3rd gear (197), the 4th gear (198), reverse drive gear (112), the 6th gear (201), the reverse gear (206), and the countershaft gear in a suitable solvent and air dry all the parts.



2. Inspect the thrust surfaces (a) on both sides of the gears for the following conditions:
 - Wear
 - Galling
 - Scoring
3. Replace any gears that have faulty thrust surfaces. Worn thrust surfaces may cause gear clashing or hard shifting, by not allowing full engagement of the synchronizer blocking rings. Worn thrust surfaces may also cause gear noise or may cause clunking during acceleration or deceleration.
4. Inspect the synchronizer blocking ring surface (b) for the following conditions:
 - Grooves
 - Excessive wear
 - Heat marks
 - Scoring
5. Replace any gear that has a faulty blocking ring surface.

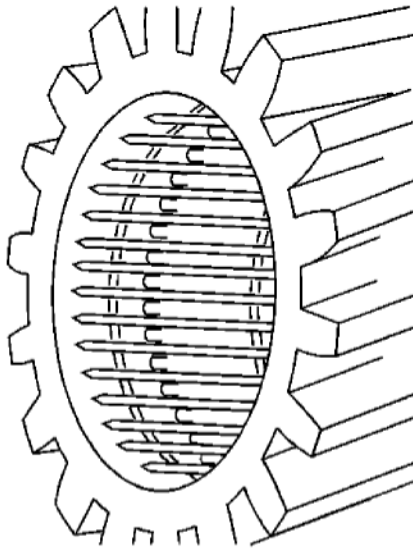




6. Inspect the selector teeth of the gears for gear change damage.

If there is gear change damage, the tooth edges are worn and chipped and, in some cases, affected by plastic deformation because of high shift loads that resemble ragged edges. Such severe deformation of the selector teeth edges causes hard gearshift changes. The spline flanks may also show signs of wear resembling fretting corrosion.

7. If gear change damage is present, replace or repair the affected parts. Gear change damage is caused by any of the following conditions:
 - Corresponding speeds of gears not adequately matched
 - Operating the transmission incorrectly
 - Incorrect clutch operation



8. Inspect the gears for brinelling.

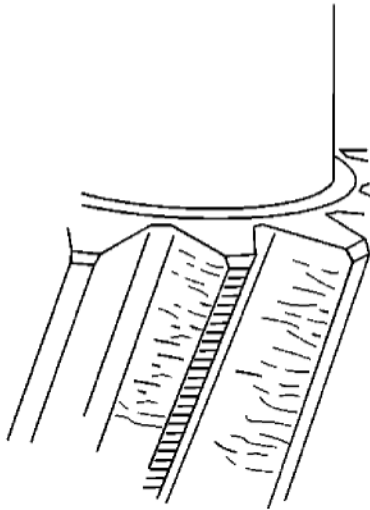
Brinelling occurs on the roller races of the gears and is characterized by what appears to be the impression of the bearing rollers.

9. Replace any gears showing brinelling.



10. Inspect the gears for break-in-wear or running-in-wear.

Break-in-wear is not considered damage because it usually ceases after the running-in-period has expired, without damaging the components. Rough peaks produced during manufacture are worn away or, to some extent, are rolled into the surface. The grinding and shaving marks on the surface are still visible.



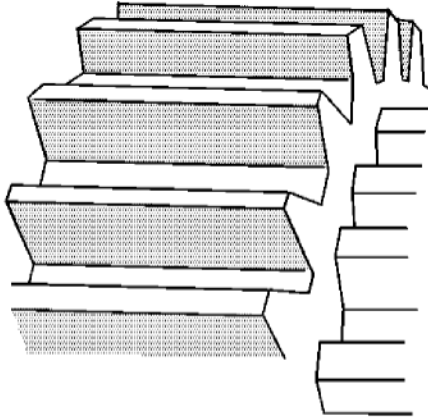
11. Inspect the gear teeth for scratches.

Scratches are linear indentations on the flank, running in the direction of sliding.

12. If scratches are present, replace the affected parts.

Scratches can be caused by the following conditions:

- Dust and abrasive particles, including those caused by flank contact, in the lubricating oil
- The sliding action of the flanks



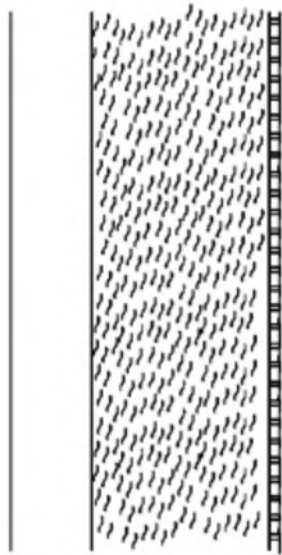
13. Inspect the gear teeth for abrasive wear.

The marks left by the machining process are erased from the active flank. Instead, the entire flank takes on a matte gray appearance. Substantial changes take place in the tooth profile and clearance once abrasive wear has reached an advanced stage. This not only increases the noise level, but can also cause secondary damage.

14. If abrasive wear is present, replace the affected parts.

Abrasive wear is caused by the following conditions:

- Oil contamination resulting from wear or surface fatigue in other areas of the transmission
- Sand, sludge, etc. penetrating into the transmission from the outside



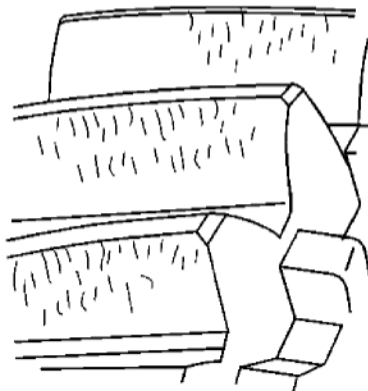
15. Inspect the gear teeth for rippling or brinelling.

The polished tooth flanks show signs of ripple-like alterations in the surface structure, which run perpendicular to the direction of sliding, and may resemble a washboard.

16. If rippling or brinelling is present, replace the affected parts.

Rippling or brinelling is caused by the following conditions:

- A combination of inadequate lubrication, high flank loads and low peripheral speeds
- Friction-induced vibration



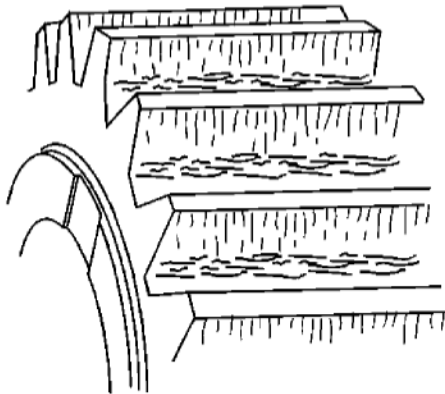
17. Inspect the gear teeth for light scoring.

Light scoring is identified as rough, partially porous lines or areas aligned in the direction of sliding. When the film of lubricant is torn away between the flanks, this permits direct metal-to-metal contact causing seizure or welding. These welded zones are immediately torn apart again, producing the damage associated with scoring. Scoring initially occurs in areas subjected to high hertz frequency stresses and high sliding speeds, usually along the tooth root and tooth tip. Light scoring only covers a part of the entire surface of the flank, or is not strongly developed and has caused only insignificant wear after smoothing.

18. If light scoring is present, replace the affected parts.

Light scoring is caused by the following conditions:

- Inadequate oil viscosity
- Unfavorable gear geometry
- Temporary lack of lubricant
- Surface roughness
- Faulty heat treatment of the gears



19. Inspect the gear teeth for severe scoring.

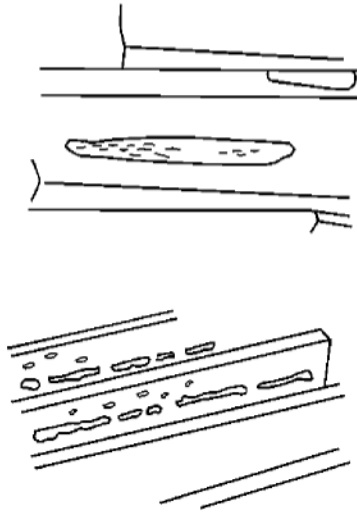
Severe scoring is the same as light scoring, except large areas of the tooth flank are affected. At an advanced stage, the flank may heat up to such an extent that localized discoloring occurs.

20. If severe scoring is present, replace the affected parts.

Severe scoring is caused by the following conditions:

- Inadequate oil viscosity

- Unfavorable gear geometry
- Temporary lack of lubricant
- Surface roughness
- Faulty heat treatment of the gears



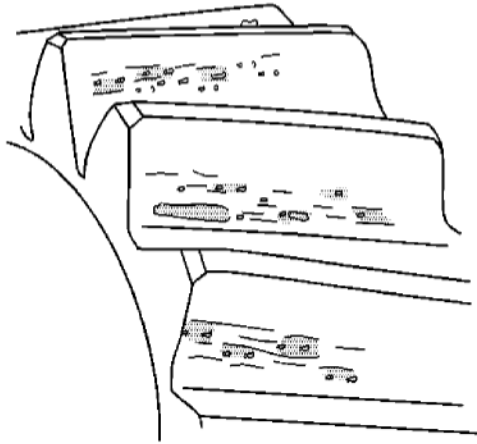
21. Inspect the gears for flank fatigue, causing gray spots.

Gray spots are localized pittings on the flank caused by material fatigue and extremely fine pittings formed on the load-bearing flanks. If they are in cluster, they appear to the naked eye as matte gray staining. Under high magnification, a large number of microscopic cracks become visible on the flank. Pittings originating from these cracks may create the appearance of local flank wear. Most of the gray spots are located in the root zone of the gear teeth.

22. If gray spots are present, replace the affected parts.

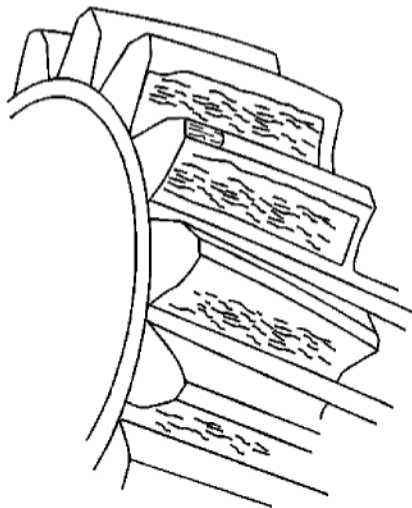
Gray spots are caused by the following conditions:

- Material fatigue
- Contact pressure
- Sliding movement
- Composite friction



23. Inspect the gear teeth for slight pittings.

Slight pittings are identified as pore-like areas of individual pittings on the flank caused by material fatigue. Usually, slight pittings are only present in the root zone of the flank. Slight pittings may cease after run-in. A change in operating conditions may also stop continued development of slight pitting.



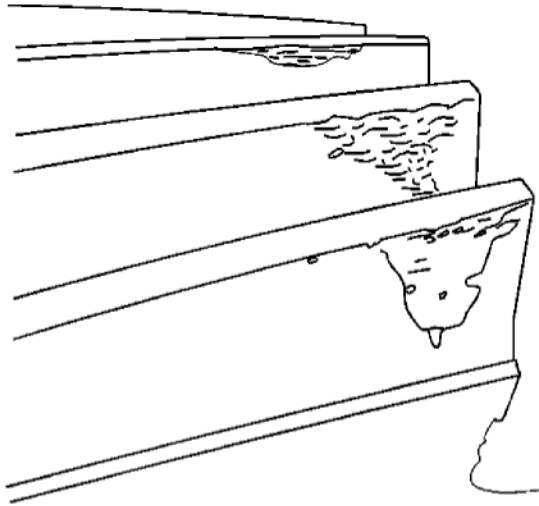
24. Inspect the gear teeth for pittings.

Pittings are material fatigue on the flank. The total pitting surface may become so large that smooth running is considerably impaired, or the remaining flank face still bearing the load will soon be destroyed by wear.

25. If pittings are present, replace the affected parts.

Pitting is caused by the following conditions:

- Exceeding the sliding and rolling stresses for the material
- Incorrect oil viscosity
- Excessive operating temperature



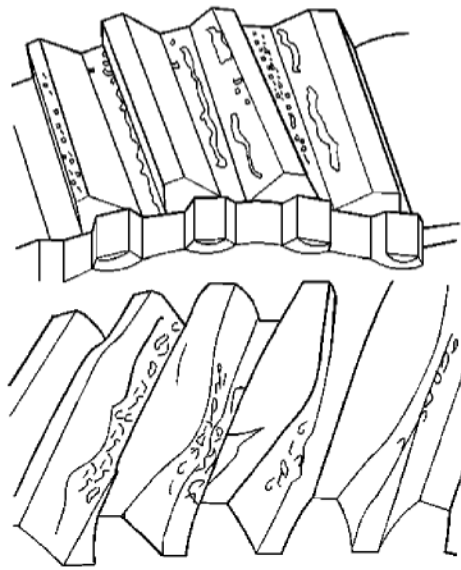
26. Inspect the gears for spalling.

Spalling is extensive triangular pits on the flank, spreading from a zone of gray spots or a fine line of pits at the root. The depth of the exposed surface is relatively constant throughout. Further cracks may extend from the pits at an angle. In some cases, the damage may even progress into the tip zone, causing tip damage.

27. If spalling is present, replace the affected parts.

Spalling is caused by the following conditions:

- Exceeding the sliding and rolling stresses for the material
- Incorrect oil viscosity
- Excessive operating temperature



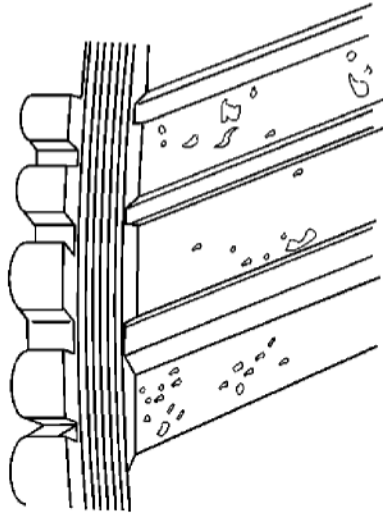
28. Inspect the gears for damage from overheating.

Overheating damage is identified by grayish to bluish black discoloration of the gear, burnt oil, and reduced hardness. Due to the reduction in hardness, there is scored or grooved flank wear in the direction of sliding, particularly in the tip and root zones. If there is extreme overheating, the material softens, causing distortion of the gear teeth, bending the teeth from thermal distortion.

29. If damage from overheating is present, replace or repair the affected parts.

Overheating is caused by the following conditions:

- Temporary or complete lack of lubrication - low oil level
- Very high peripheral speeds
- Insufficient tooth clearance



30. Inspect the gears for corrosion.

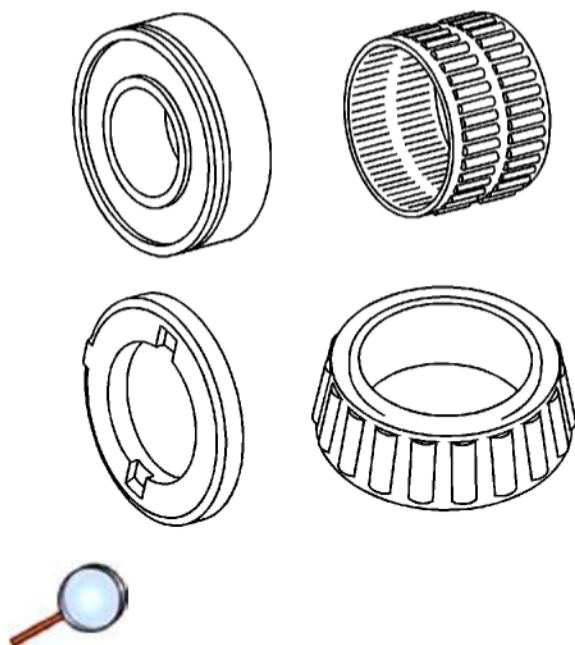
Corrosion is brownish red to black spots, sometimes with local material loss on the flank. If corrosion has not caused material loss to the flank, the sliding and rolling action of the flank can help to remove some of the corrosion.

31. If corrosion is severe, replace the affected parts.

Corrosion is caused by the following conditions:

- Water or salt water entering the transmission
- Condensation forming under unfavorable operating conditions
- Oil aging and the decomposition of corrosion inhibitors

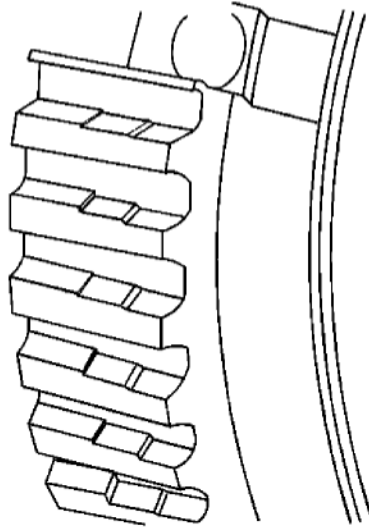
Bearings and Spacers Cleaning and Inspection



Caution: Do not allow the bearings to spin. Turn them slowly by hand. Spinning the bearings may damage the race and the rollers.

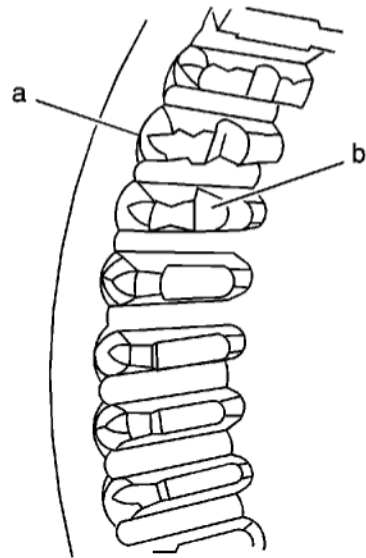
1. Mark or tag the bearings in order to ensure they are properly installed in the correct location.
2. Clean all of the roller bearings, needle bearings, and ball bearings in a suitable solvent and air dry all the parts.
3. Inspect the bearings and races for the following conditions:
 - Roughness
 - Brinelling
 - Pitting
4. Inspect the cage bearings for being bent or for having damaged cages.
5. Replace the bearings with any of the above conditions.
6. Replace mated bearing parts when only one part is damaged.
7. Inspect the thrust washers for scoring or wear.
8. Replace any faulty thrust washers.
9. Do not file surfaces which have been hardened and precision ground.

Synchronizers Cleaning and Inspection

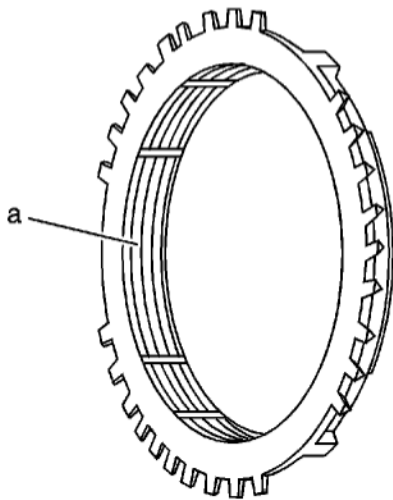


Important: When you service the synchronizers, retain them in the order that they are removed. Mark the parts to ensure the correct position for inspection and assembly.

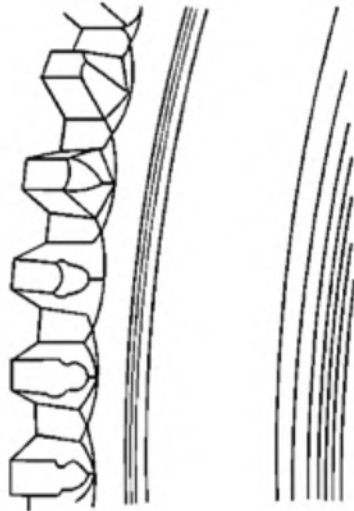
1. Clean all the synchronizer parts in a suitable cleaning solvent and air dry all the parts.
2. Inspect the 1st/2nd gear and the 3rd/4th gear synchronizer hubs for a force fit on the output shaft.
3. Replace synchronizer hubs that do not require a force fit.
4. Inspect the synchronizer hub for wear on the external splines. A stepped effect on the teeth, due to wear, may cause shift concerns.
5. Replace a worn hub.
6. Correct the cause, such as, but not limited to the following conditions:
 - Engine related vibrations
 - Driving at a low speed in a high gear
 - Defective vibration damper or crankshaft



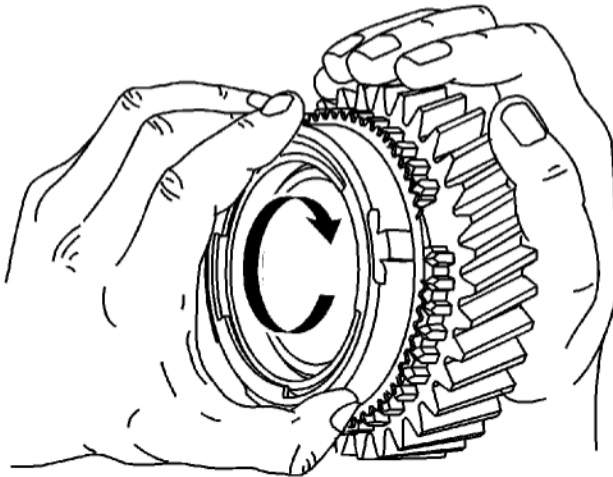
7. Inspect the synchronizer sleeve teeth (a) for the following conditions, which may cause shift concerns:
 - Grated teeth
 - Chipped off teeth
 - Blunted teeth
8. Inspect the synchronizer sleeve detent stops (b) for wear or for being chipped off.
9. Replace the synchronizer assembly if the teeth or stops show the above conditions.



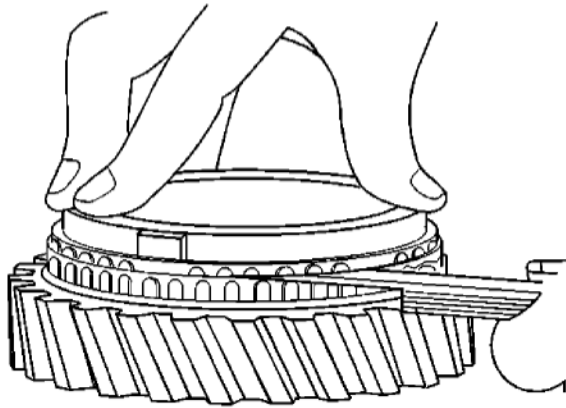
10. Inspect the synchronizer blocker rings for worn away grooves (a).
11. Replace the blocker ring assembly if the blocker ring grooves are worn.



12. Inspect the synchronizer blocker rings for worn shift teeth.
13. Inspect the internal ring for being warped or damaged.
14. Inspect the outer ring for worn grooves.
15. Replace the synchronizer assembly for any of the above conditions.



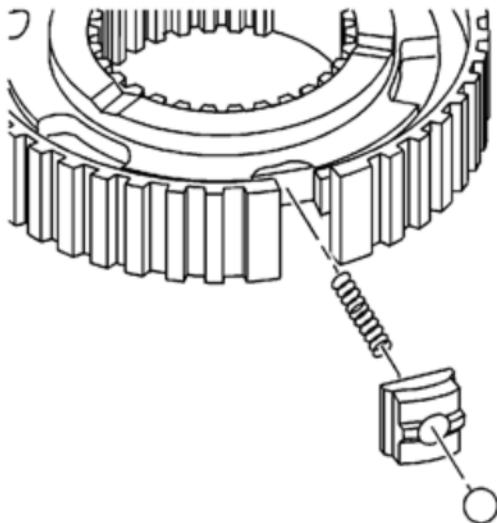
16. Install the synchronizer blocking rings to the correct speed gear.
17. Inspect the braking effect of the blocking ring. Turn the blocking ring in one direction while pushing to the gear cone. Ensure the ring locks.
18. If the ring does not lock, replace the synchronizer assembly.



19. Except for 5th gear, measure the blocker ring to gear clearance.
 - 19.1. Assemble the correct blocker ring to the correct gear.
 - 19.2. Apply pressure to the blocker ring to fully seat the ring.
 - 19.3. Using a feeler gage, measure between the blocker ring teeth and the teeth on the gear.

Specification

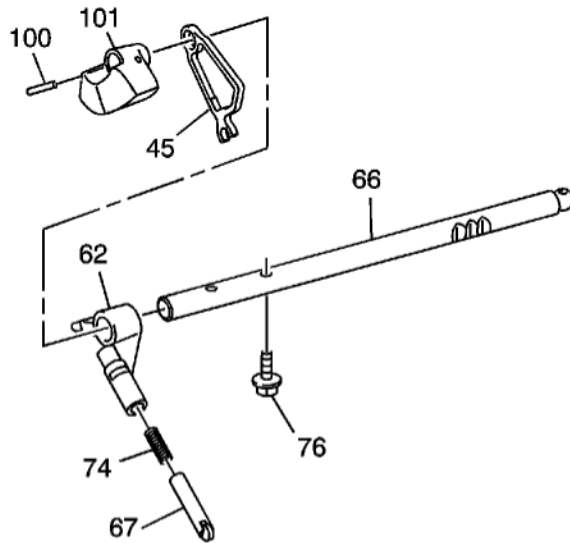
- Minimum Clearance 4th Gear: 0.8 mm (0.031 in)
 - Minimum Clearance 3rd Gear: 0.8 mm (0.031 in)
 - Minimum Clearance 2nd Gear: 0.8 mm (0.031 in)
 - Minimum Clearance 1st Gear: 0.8 mm (0.031 in)
20. If using a NEW blocker ring and the standard clearance can not be obtained, replace the gear.



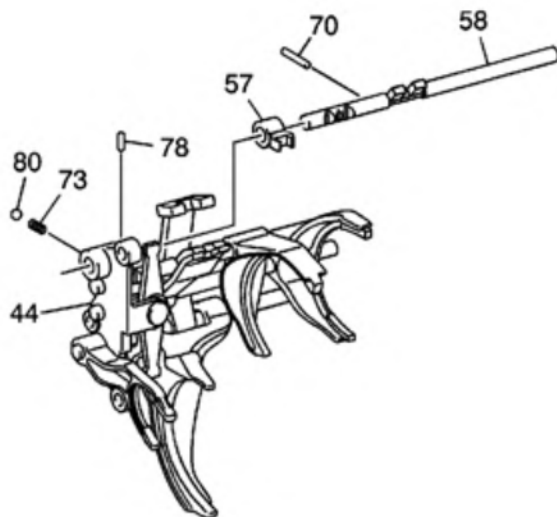


21. Inspect the pressure pieces for wear or damage.
22. Inspect the springs for distortion.
23. Replace the worn pressure pieces or faulty springs.

Shift Shaft and Shift Fork Cleaning and Inspection



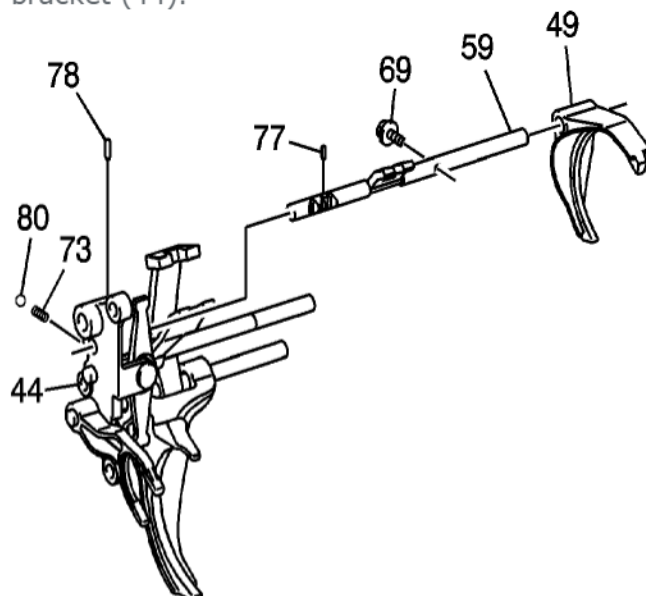
1. Using a suitable punch and hammer, remove the pin (100) from the dynamic damper weight (101).
2. Remove the shift shaft detent cam (45) and the weight (101) from the shift control shaft (66).
3. Remove the shift shaft detent (67) and the shift shaft detent spring (74).
4. Remove the bolt (76) from the shift shaft detent lever (62).
5. Remove the shift shaft detent lever (62) from the shift control shaft (66).





Important: The shift detent ball (80) and spring (73) will come out of the shift control lever when the 1st/2nd shift shaft (58) is removed.

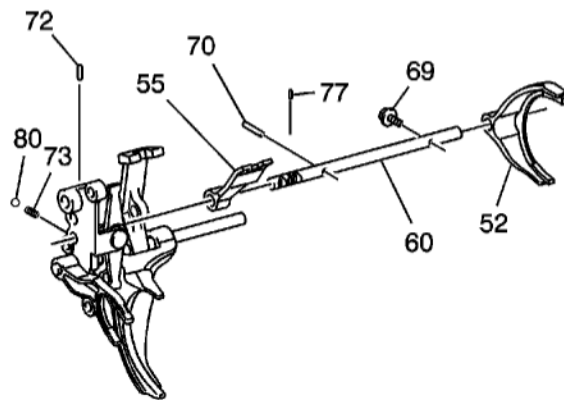
6. Remove the 1st/2nd shift fork pin (70).
7. Remove the 1st/2nd shift shaft (58).
8. Remove the slotted pin (70) from the select control lever assembly (57). Slide the select control lever assembly (57) from the 1st/2nd shift shaft (58).
9. Using a suitable punch and hammer, remove the pin (78) from the shift control lever bracket (44).



Important: The shift detent ball (80) and spring (73) will come out of the shift control lever bracket (44) when the 3rd/4th shift shaft (59) is removed.

Important: Please note the proper orientation of the 3rd/4th shift fork (49) prior to removal.

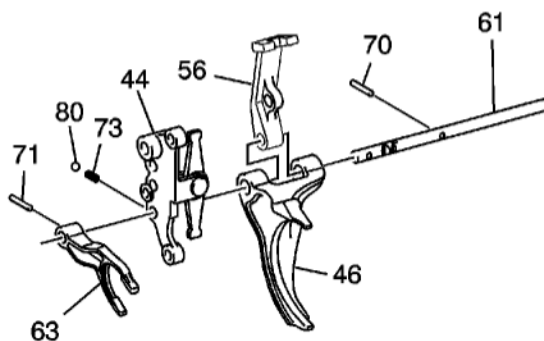
10. Remove the bolt (69) from the 3rd/4th shift fork (49).
11. Remove the 3rd/4th shift shaft (59).
12. Remove the shift fork (49).
13. Use a magnet to remove pins (77 and 78).



Important: The shift detent ball (80) and spring (73) will come out of the shift control lever bracket (44) when the 5th/6th shift shaft (60) is removed.

Important: Please note the proper orientation of the 5th/6th shift fork (52) prior to removal.

14. Remove the bolt (69) from the 5th/6th shift fork (52). Slide the 5th/6th shift fork (52) from the 5th/6th shift shaft (60).
15. Remove the 5th/6th shift shaft (60).
16. Using a suitable punch and hammer, remove the pin (70) from the shift lever assembly (55). Slide the shift lever assembly (55) from the 5th/6th shift shaft (60).
17. Using a suitable punch and hammer, remove pins (77 and 72).

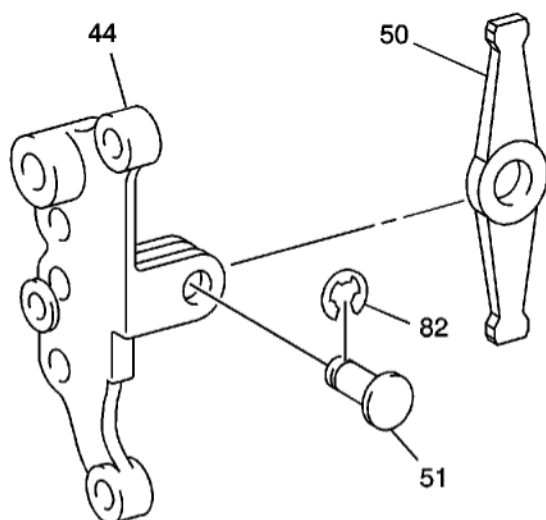


Important: The shift detent ball (80) and spring (73) will come out of the shift control lever bracket (44) when the reverse shift shaft (61) is removed.

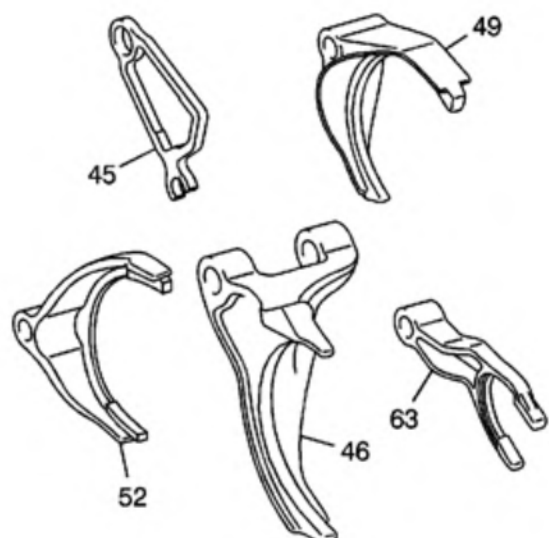
18. Using a suitable punch and hammer, remove the slotted pin (71) from the reverse shift fork (63). Slide the reverse shift fork (63) off the reverse shift shaft (61).
19. Remove the reverse shift shaft assembly.

Important: Please note the proper orientation of the 1st/2nd shift fork (46) prior to removal.

20. Using a suitable punch and hammer, remove the long, slotted pin (70) from the internal shift control lever (56). Slide the internal shift control lever (56) and 1st/2nd shift fork assembly (46) from the reverse shift shaft (61).

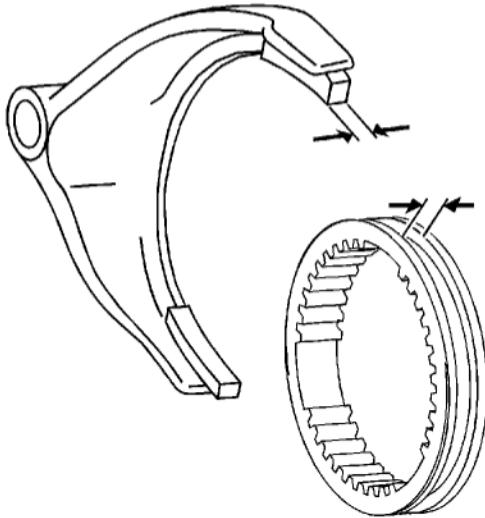


21. Remove the selector control lever pin retainer (82) and pull the control select arm pin (51) from the shift control lever bracket (44).
22. Remove the control select arm (50) from the shift control lever bracket (44).

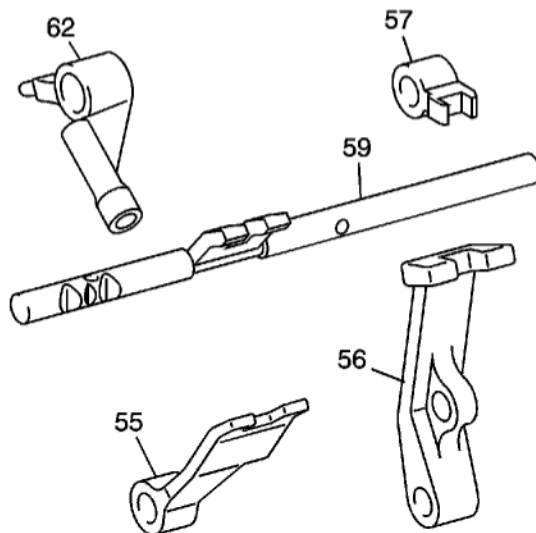




23. Inspect the cam (45), shift forks (49), (52), (63) and assembly (46) for:
- Bent fork
 - Hole for wear
 - Cracks



24. Measure the fork width and sleeve groove width for wear. If synchronizer sleeve to shift fork width clearance exceeds the maximum, replace the synchronizer sleeve and/or shift fork. Refer to [Transmission Clearance Specifications](#) and see Synchronizer Sleeve to Shift Fork Clearance - Maximum Clearance table.

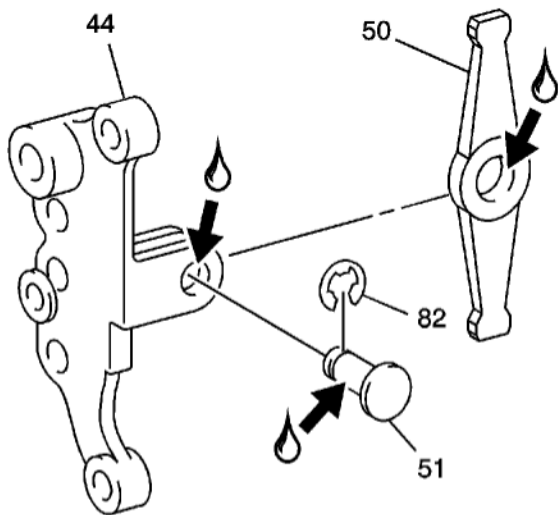


25. Inspect the detent lever (62), assembly (56 and 57), shift shaft (59) and control lever (56)

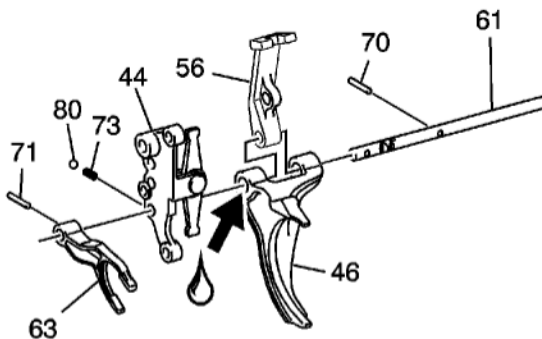
for:

- Bent fork
- Hole for wear
- Cracks

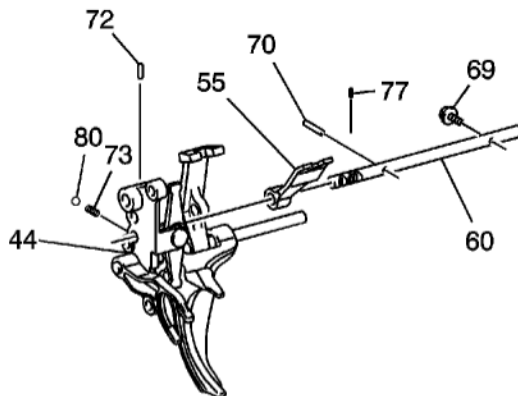
Shift Shaft and Shift Forks Assemble



1. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 and install the control select arm (50) into the shift control lever bracket (44).
2. Apply lubricant and install the control select arm pin (51).
3. Install the selector control lever pin retainer (82).



4. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 and slide the internal shift control lever (56) and 1st/2nd shift fork assembly (46) onto the reverse shift shaft (61). Install the slotted pin (70) into the lever (56).
5. Install the shift control lever bracket (44) onto the reverse shift shaft (61).
6. Slide the reverse shift fork (63) onto the reverse shift shaft (61). Install the long, slotted pin (71) into the reverse shift fork (63).
7. Install the spring (73) and shift detent ball (80) into the bracket (44).

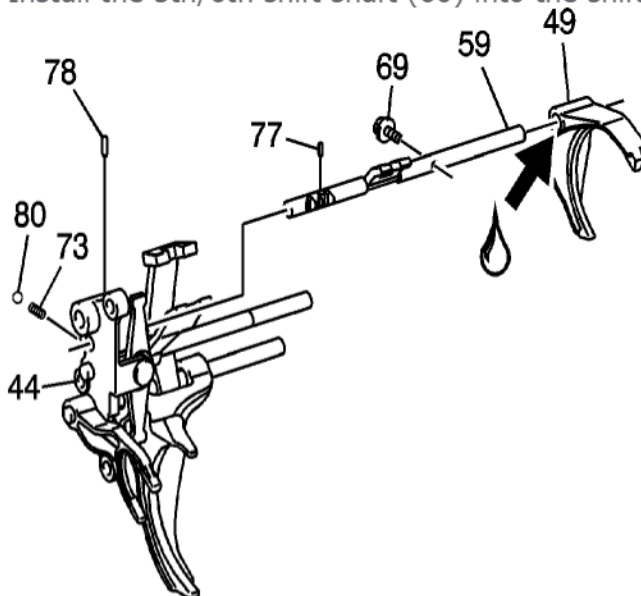


8. Install the pin (72) into the shift control lever bracket (44).
9. Install the pin (77) into the 5th/6th shift shaft (60).
10. Install the 5th/6th shaft (60) into the hole in the shift lever assembly (55).
11. Install a new bolt (69) into the shift lever assembly (55).

Tighten

Tighten the bolt to 19.5 N·m (14 lb ft).

12. Install the 5th/6th shift shaft (60) into the shift control lever bracket (44).



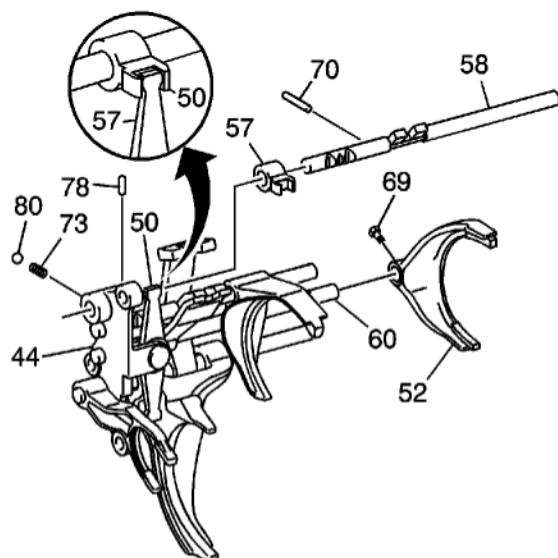


13. Apply lubricant and slide the 3rd/4th shift fork (49) onto the 3rd/4th shift shaft (59). Install a new bolt (69) into the 3rd/4th shift fork (49).

Tighten

Tighten the bolt to 19.5 N·m (14 lb ft).

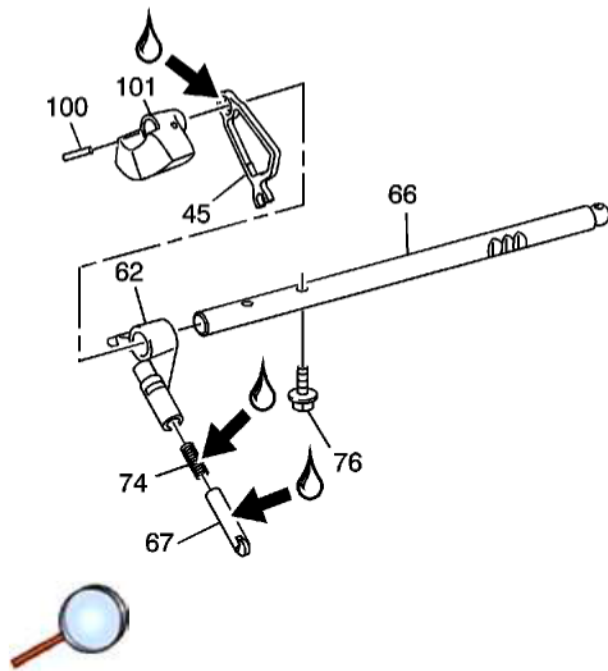
14. Insert the spring (73) and the shift detent ball (80) into the shift control lever bracket (44).
15. Install the pin (77) into the 3rd/4th shift shaft (59).
16. Install pin (78) into the shift control lever bracket (44).
17. Install the 3rd/4th shift shaft (59) into the shift control lever (44).



18. Install the spring (73) and detent ball (80) into the shift control lever bracket (44).
19. Install the pin (78) into the shift control lever bracket (44).
20. Install the groove of select control lever assembly (57) into the projection of the control select arm (50).
21. Slide the 1st/2nd shift shaft (58) into the shift control lever (57), and the shift control lever bracket (44).
22. Install pin (70) into the 1st/2nd shift shaft (58).
23. Install the 5th/6th shift fork (52) onto the 5th/6th shift shaft (60) and retain with a new bolt (69).

Tighten

Tighten the bolt to 19.5 N·m (14 lb ft).



24. Slide the shift shaft detent lever (62) onto the shift control shaft (66).
25. Install a new bolt (76) into the shift shaft detent lever (62).

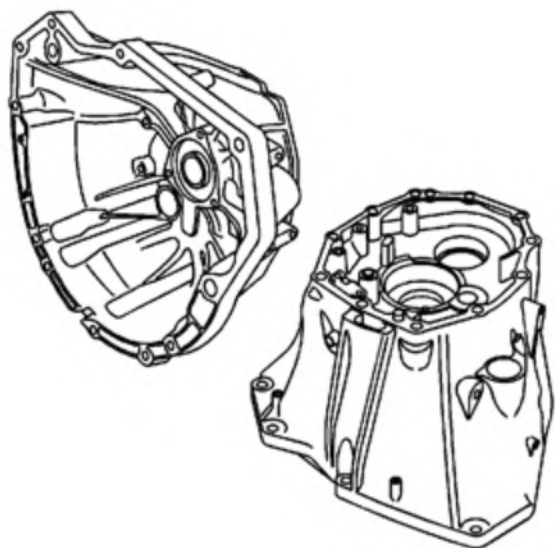
Tighten

Tighten the bolt to 38 N·m (28 lb ft).

26. Apply lubricant and insert the shift shaft detent spring (74) and the shift shaft detent (67) into the lever (62).
27. Apply lubricant and slide the shift shaft detent cam (45) onto the shift control shaft (66).
28. Insert the assembled shift shaft detent lever (62, 74, 67) into the opening in the shift shaft detent cam (45).
29. Install the dynamic damper weight (101) onto the shift control shaft (66).
30. Insert the pin (100) into the dynamic damper weight (101).
31. Check the function of assembled components. The shift shaft detent (67) should slide on the shift shaft detent cam (45).

Transmission Case Cleaning and Inspection

Clutch Housing

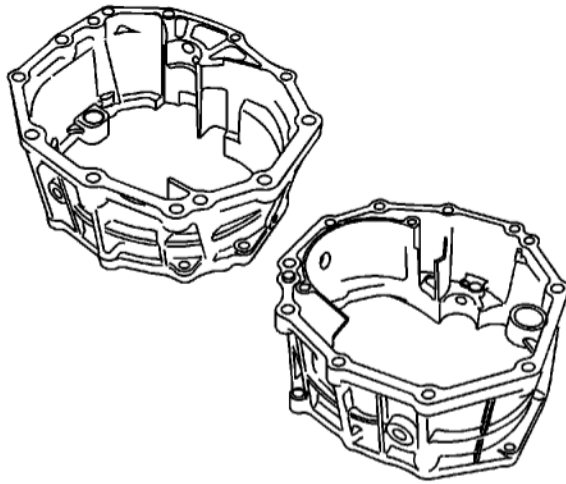


1. Clean the clutch housing in a suitable cleaning solvent and air dry.
2. Inspect the clutch housing for the following conditions:
 - Cracks
 - Damaged mounting flanges
 - Damaged bolt holes

Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.

3. Remove the sealer from the case sealing surfaces.
4. Inspect the case for being broken or cracked.
5. Inspect the bearing bore for the following conditions:
 - A spun bearing
 - Cracks
6. Replace the case assembly if any of the above conditions are found.
7. Inspect the sealing surfaces for damage.
8. Repair small scratches or nicks with a soft stone.
9. Inspect the case threaded bolt holes for damage.
10. Repair any damaged threads.
11. Inspect the location pins for being loose or missing.
12. Repair or replace any damaged location pins.

Middle Case

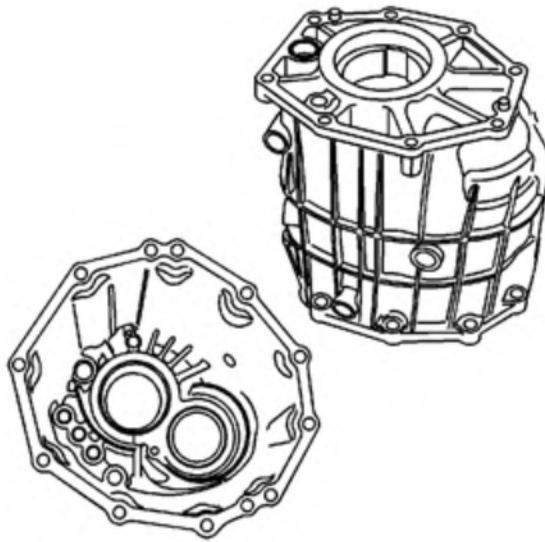


1. Clean the middle case in a suitable cleaning solvent and air dry.

Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.

2. Remove the sealer from the case sealing surfaces.
3. Inspect the case for being broken or cracked.
4. Inspect the input shaft bearing bore for the following conditions:
 - A spun bearing
 - Cracks
5. Inspect the countershaft front bearing bore for the following conditions:
 - A spun bearing
 - Cracks
6. Replace the case assembly if any of the above conditions are found.
7. Inspect the sealing surfaces for damage.
8. Repair small scratches or nicks with a soft stone.
9. Inspect the case threaded bolt holes for damage.
10. Repair any damaged threads.
11. Inspect the location pins for being loose or missing.
12. Repair or replace any damaged location pins.

Rear Case

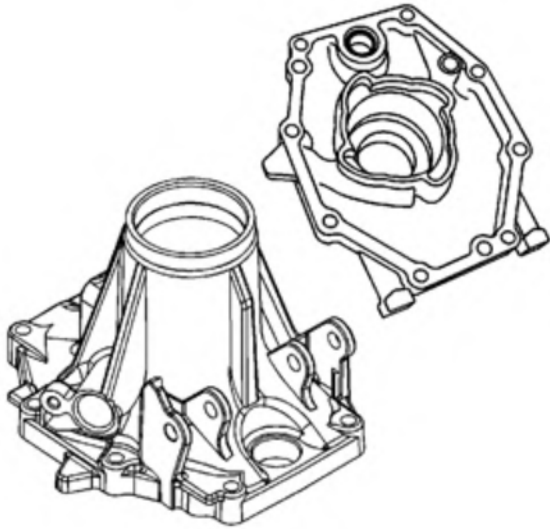


1. Clean the rear case in a suitable cleaning solvent and air dry.

Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.

2. Remove the sealer from the case sealing surfaces.
3. Inspect the sealing surfaces for damage.
4. Inspect the case threaded bolt holes for damage.
5. Repair any damaged threads.
6. Inspect the location pins for being loose or missing.
7. Repair or replace any damaged location pins.
8. Inspect the shift shaft bushings for excessive wear.
9. Inspect the bearing bore.
10. Replace the case assembly if the shift shaft bushings are faulty.

Extension Housing



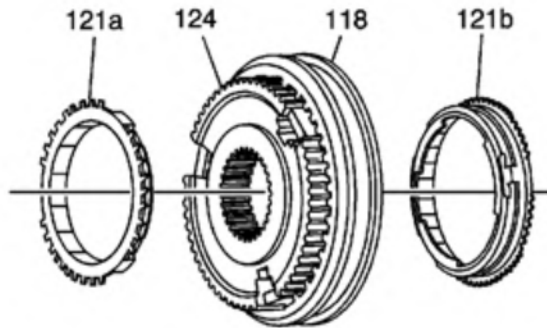
1. Clean the extension housing in a suitable cleaning solvent and air dry.

Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.

2. Remove the sealer from the extension sealing surfaces.
3. Inspect the sealing surfaces for damage.
4. Inspect the extension for being broken or cracked.
5. Inspect the oil seal for wear or damage. The oil seal is serviced only with the extension housing.
6. Inspect the bearing bore.
7. Replace the extension if any of the above conditions are found.
8. Inspect the case threaded bolt holes for damage.
9. Repair any damaged threads.
10. Repair or replace any damaged location pins.

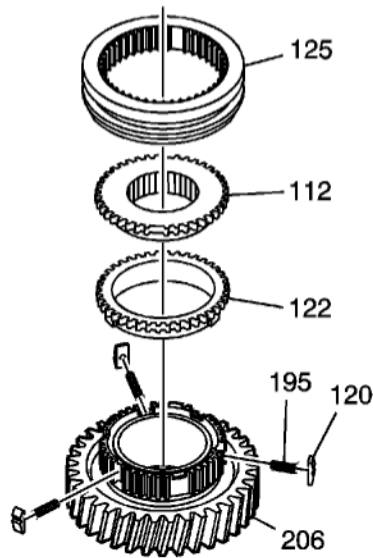
Synchronizers Assemble

5th / 6th Gear Synchronizer



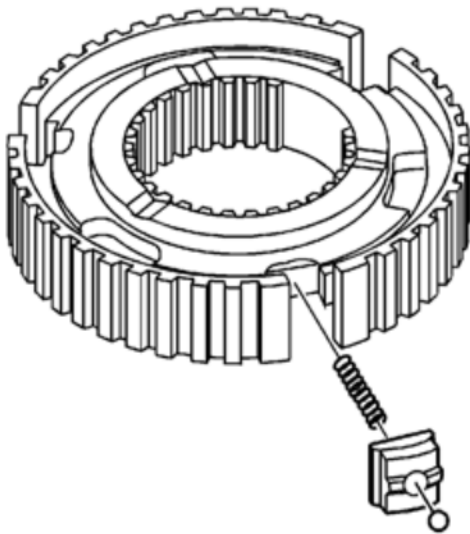
Important: Ensure that the hub slides easily.

1. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 as shown in illustration. Install the following components into the 5th/6th synchronizer hub (124/118):
 - The 5th gear blocking ring (121b)
 - The 6th gear blocking ring (121a)

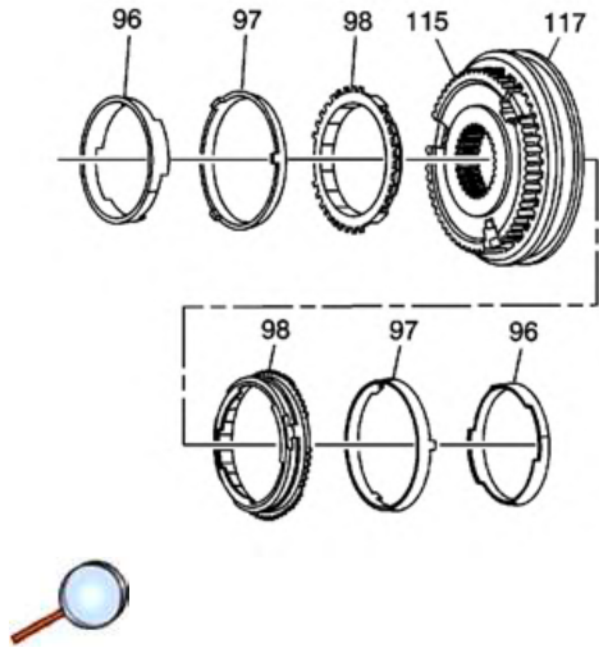


2. Apply lubricant to the blocking ring, driven gear and sleeve. Install the following components into the reverse gear (206):
- The reverse gear insert (120) and the spring (195)
 - The reverse gear blocking ring (122)
 - The reverse driven gear (112)
 - The synchronizer sleeve (125)

1st / 2nd, 3rd / 4th Gear Synchronizer

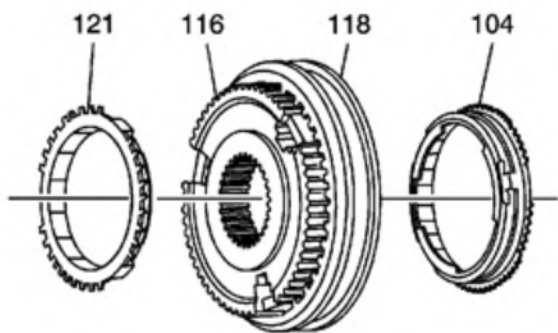


1. Install the synchronizer insert and spring into the synchronizer hub. Press the spring and slide the insert in.



Important: When you service the synchronizers, retain them in the same order that they are removed. Keep the synchronizer components together and mark them to identify correct location.

2. Apply lubricant to the cones and blocking rings. Align and install the following components into the 1st/2nd gear synchronizer hub (115/117):
 - The 1st gear synchronizer inner cone (96)
 - The 1st gear synchronizer outer cone (97)
 - The 1st gear outer blocking ring (98)
 - The 2nd gear outer blocking ring (98)
 - The 2nd gear synchronizer outer cone (97)
 - The 2nd gear synchronizer inner cone (96)



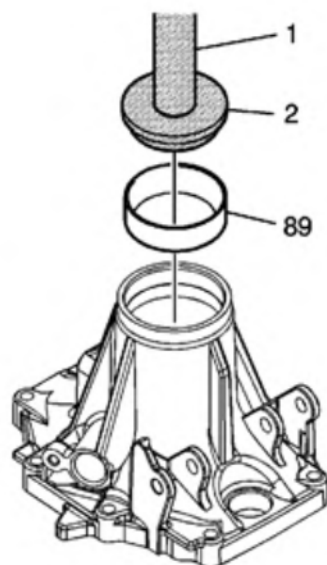


3. Apply lubricant to the blocking rings. Install the following components into the 3rd/4th gear synchronizer hub (116/118):
 - The 3rd gear blocking ring (104)
 - The 4th gear blocking ring (121)

Extension Assemble

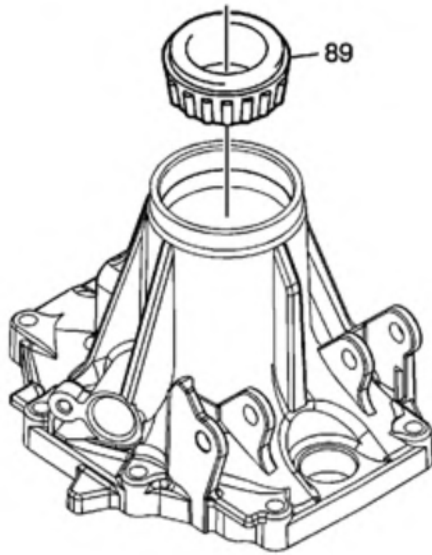
Special Tools

- [DT-47722](#) Shift Rail Bushing Remover and Installer
- [DT-47724](#) Output Shaft Bearing Cup Installer
- [J 36614](#) Inner Pinion Bearing Installer
- [J 44765](#) Seal Installer

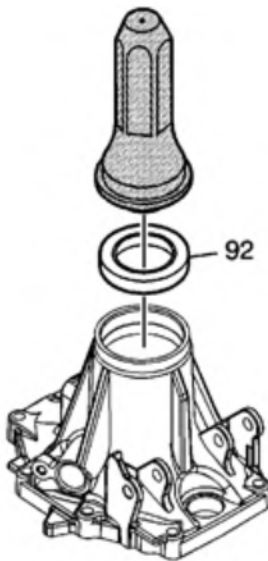


Important: Ensure that the extension housing installation surfaces are clean.

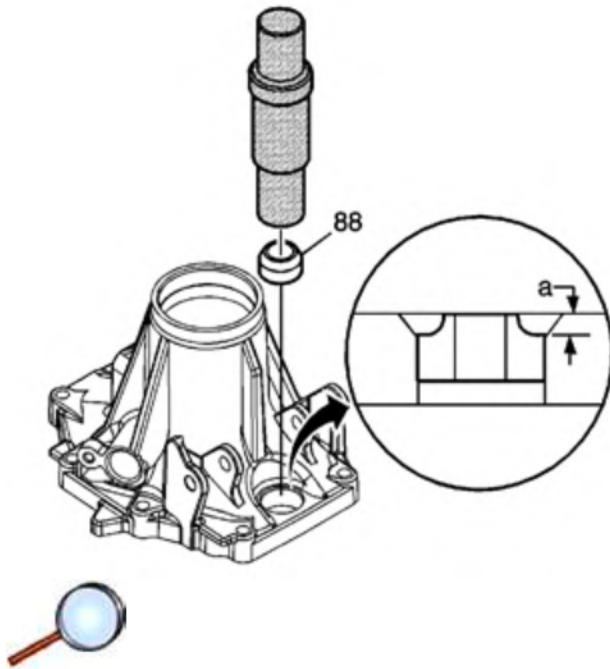
1. Using [DT-47724](#) (2) and [J 36614](#) (1), install the tapered bearing race (89).



2. Apply gear oil and install the tapered roller bearing (89).



3. Using [J 44765](#) , install a NEW rear output shaft oil seal (92).



4. Using [DT-47722](#) , install a NEW shift shaft seal (88) to the specified depth (a).

Depth

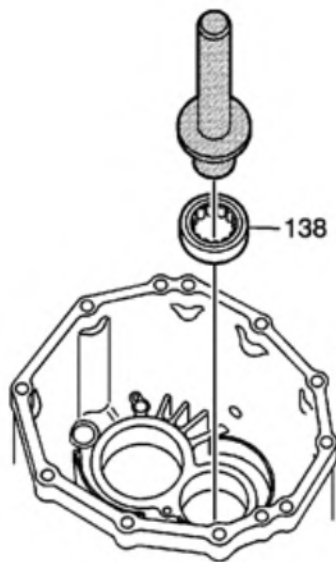
Drive the shift shaft seal to a depth of 4.6-5.4 mm below the surface of the extension housing.

Transmission Case Assemble

Special Tools

- DT-47722 Shift Rail Bushing Remover and Installer
- DT-47725 Extension Housing Bearing Cup Installer
- DT-47726 Countershaft Rear Bearing Installer

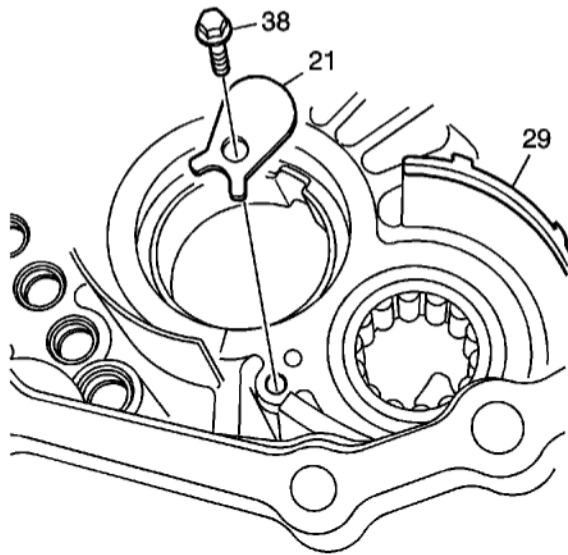
Rear Case Assemble



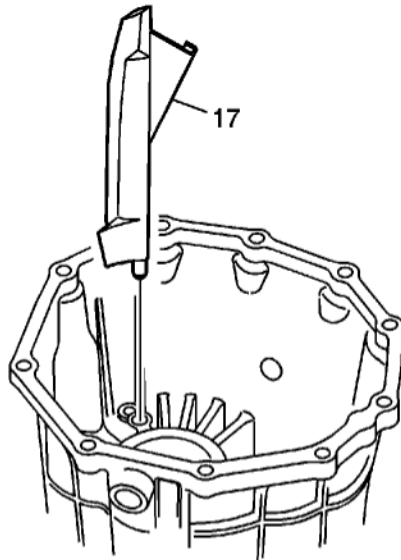
Note: Ensure that the rear case housing installation surfaces are free of dirt and sealant.

1. Apply gear oil to new bearing. Use DT-47726 installer to install new bearing (138).

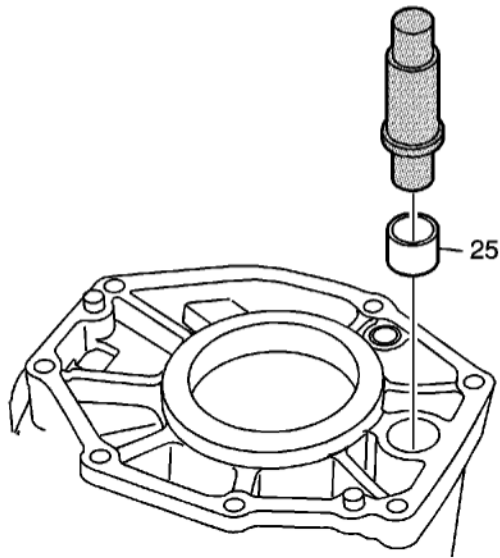
Caution: Refer to [Fastener Caution](#) in the Preface section.



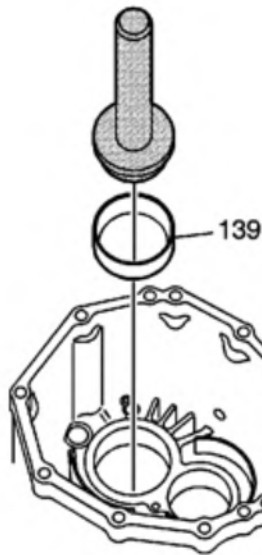
2. Install the bearing retainer (21) and bolt (38) and tighten to **11.3 N·m (100 lb in)**.
3. Install the gasket (29).



4. Install the oil trough (17).

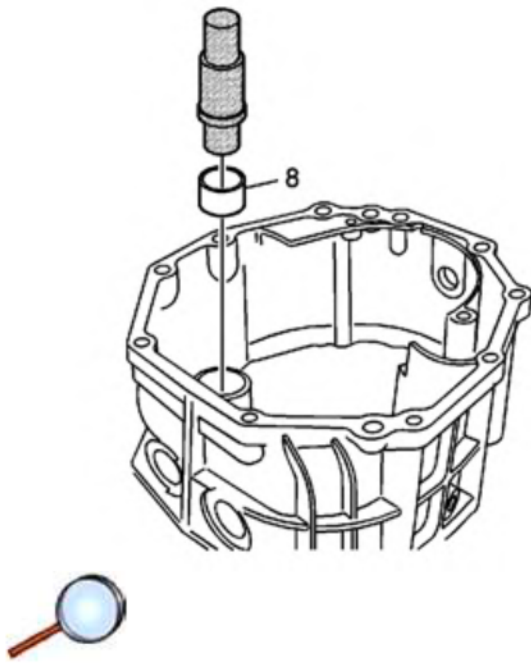


5. Using *DT-47722* remover/installer , install the bearing (25) in the rear case.



6. Using *DT-47725* installer , install the tapered bearing race (139).

Middle Case Assemble

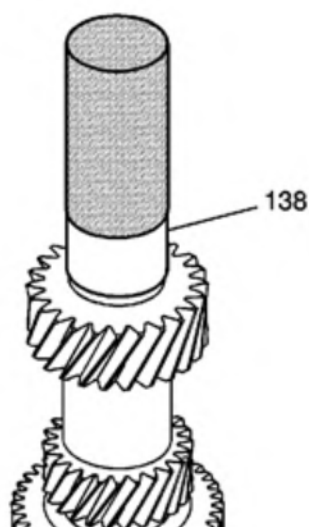


Using *DT-47722* remover/installer , install the bearing (8) in the middle case.

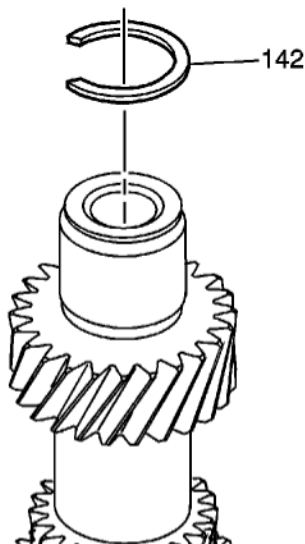
Counter Gear Shaft Assemble

Special Tools

- [DT-47722](#) Shift Rail Bushing Remover and Installer
- [J 5590](#) Bearing and Seal Driver
- [DT-47723](#) Output Shaft Bearing Installer

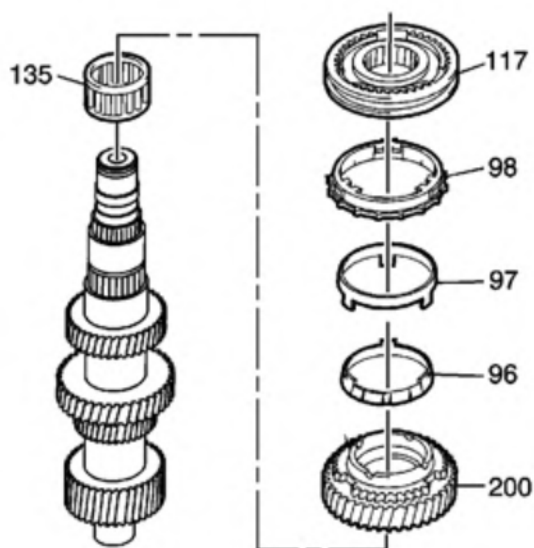


1. Using [J 5590](#) (1) and a press or hammer install the inner race (138).

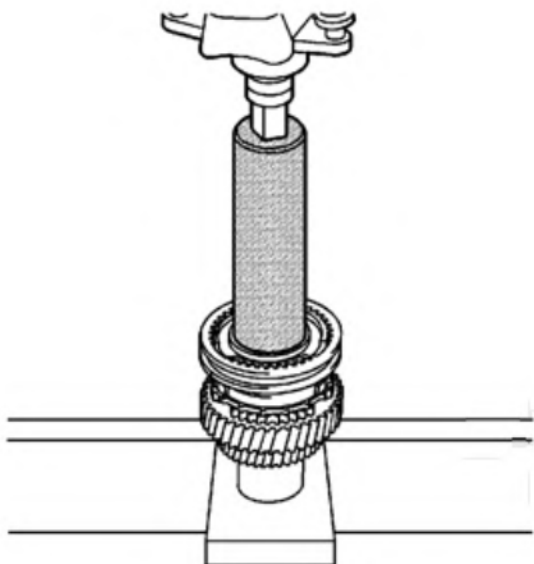




2. Select and install a snap ring (142) with a maximum thickness that can be installed to the counter shaft.

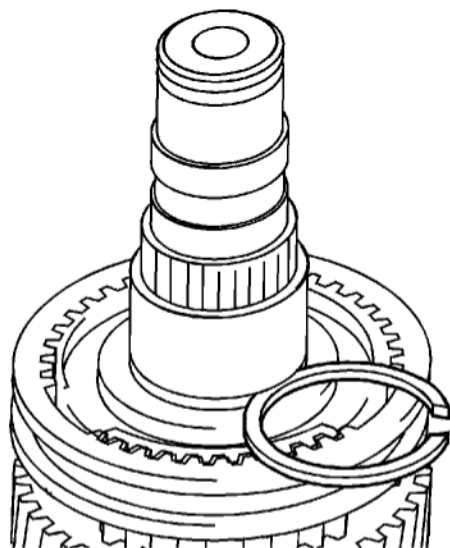


3. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 and install the following components:
 - The 2nd gear bearing (135)
 - The 2nd gear (200)
 - The 2nd gear synchronizer inner cone (96)
 - The 2nd gear synchronizer outer cone (97)
 - The 2nd gear outer blocker ring (98)
 - The 1st/2nd gear synchronizer sleeve (117)



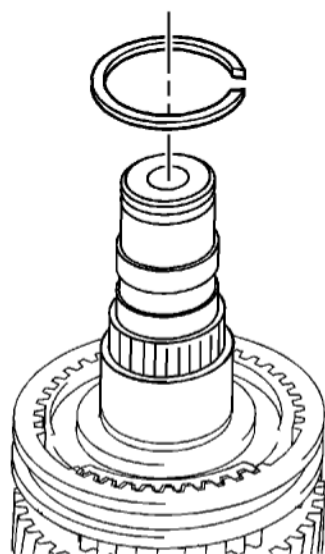


4. Using a hydraulic press and [DT-47723](#) , install the 1st/2nd gear synchronizer sleeve with the boss side facing 2nd gear. The synchronizer ring set and transmission clutch hub are to be aligned when installing the transmission clutch hub assembly.

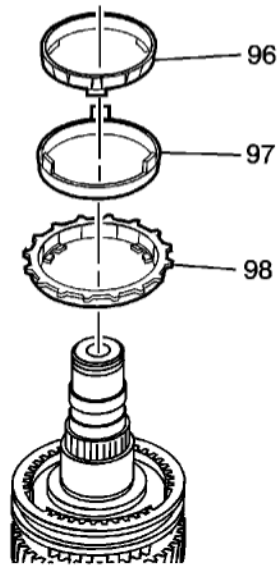


Important: The retaining ring is a selected fit. Always install a NEW retaining ring.

5. Select the maximum thickness retaining ring that will fit in the groove. Refer to [Countershaft Front and Rear Bearing Retaining Ring Specifications](#).

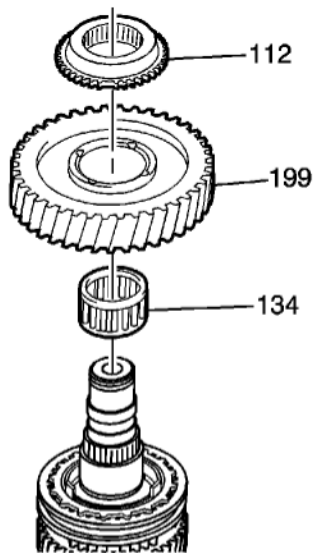


6. Install a NEW snap ring.

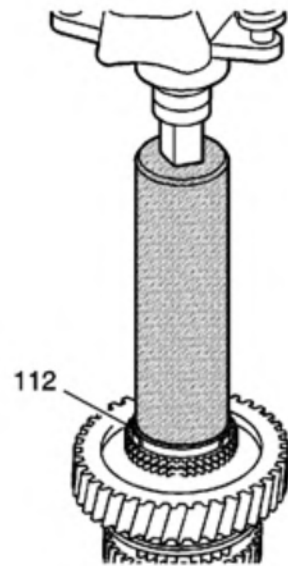


7. Apply lubricant and install the following components:

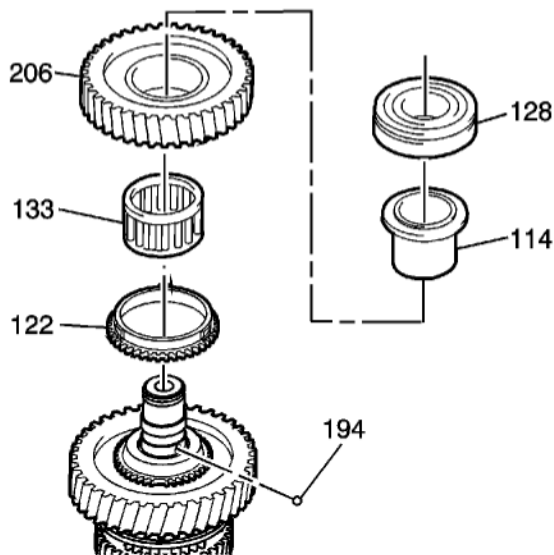
- The 1st gear outer blocking ring (98)
- The 1st gear synchronizer outer cone (97)
- The 1st gear synchronizer inner cone (96)



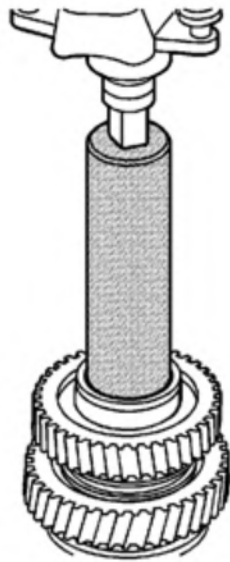
8. Apply lubricant, install and align the 1st gear bearing (134), 1st gear (199) and the reverse gear spline (112).



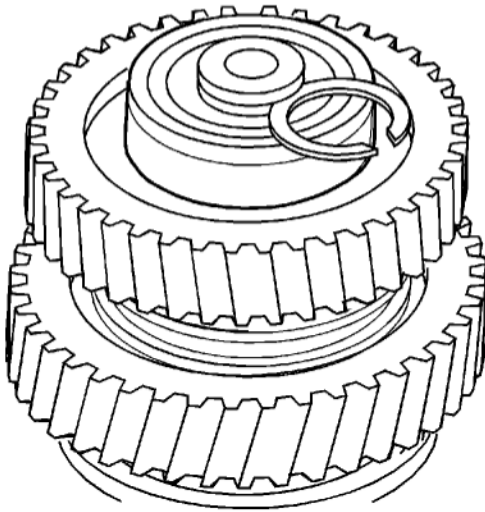
9. Using a hydraulic press and [DT-47723](#) , install the reverse gear spline (112).



10. Apply lubricant and install the reverse gear blocking ring (122).
11. Install the ball (194) to the countershaft.
12. Apply lubricant and install the reverse gear bushing bearing (133).
13. Apply lubricant. Align and install the synchronizer sleeve and reverse gear (206) together.
14. Apply lubricant. Install the reverse gear bushing (114) with ball.
15. Install the counter gear front bearing (128) with groove facing forward.

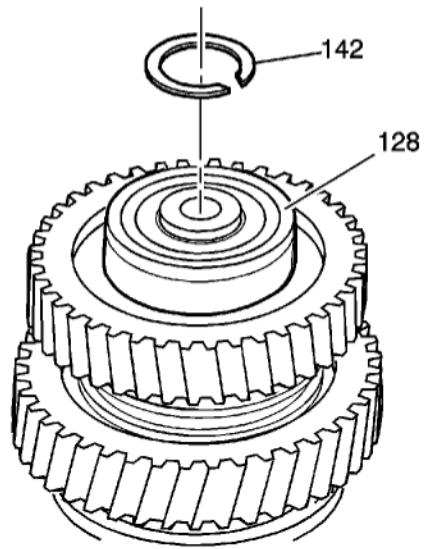


16. Using a hydraulic press and [J 5590](#) , install the counter gear front bearing.



Important: The retaining ring is a selected fit. Always install a NEW retaining ring.

17. Select the maximum thickness retaining ring that will fit in the groove. Refer to [1st and 2nd Gear Synchronizer Retaining Ring Specifications](#).

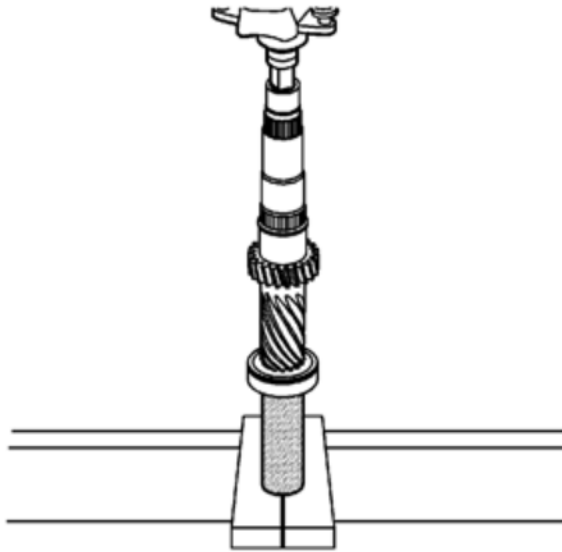


18. Install a NEW snap ring (142).

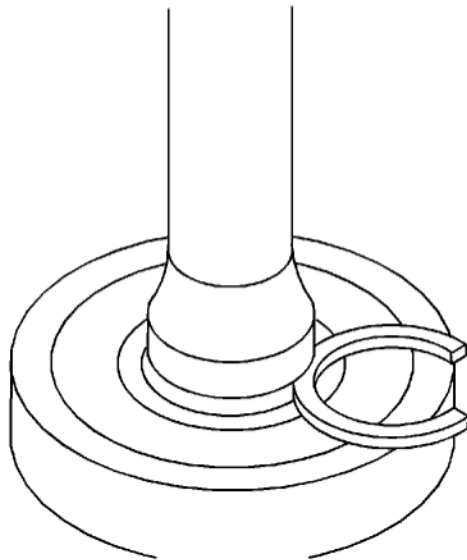
Input Shaft Assembly

Special Tools

- [J 5590](#) Bearing and Seal Driver
- [DT-47723](#) Output Shaft Bearing Installer



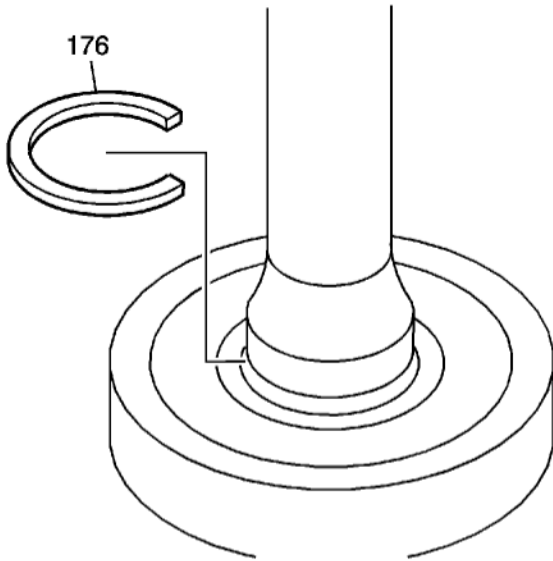
1. Using a hydraulic press and [J 5590](#) , install the counter gear front bearing on the input shaft.



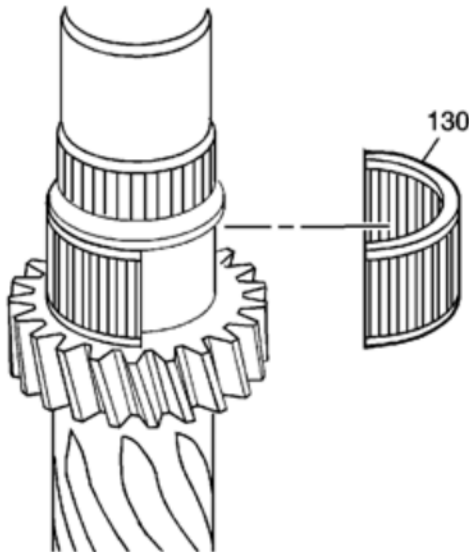


Important: The retaining ring is a selected fit. Always install a NEW retaining ring.

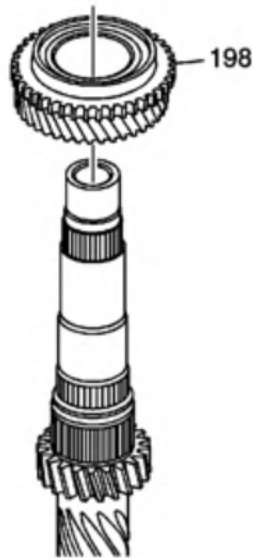
2. Select the maximum thickness retaining ring that will fit in the groove. Refer to [Input Shaft Bearing Retaining Ring Specifications](#).



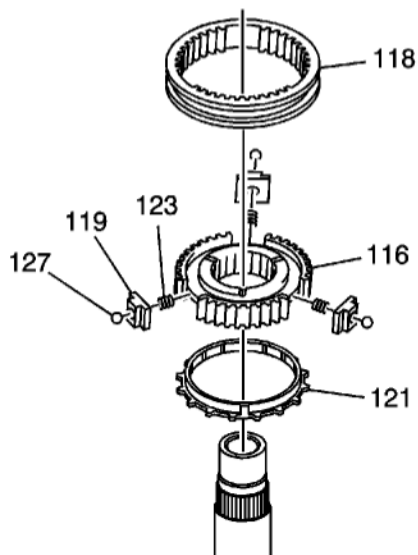
3. Install a NEW snap ring (176) and ensure that the radial bearing rotates smoothly.



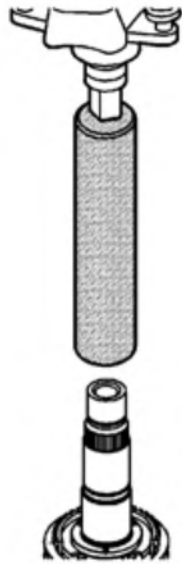
4. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 and install the 4th gear bearing (130).



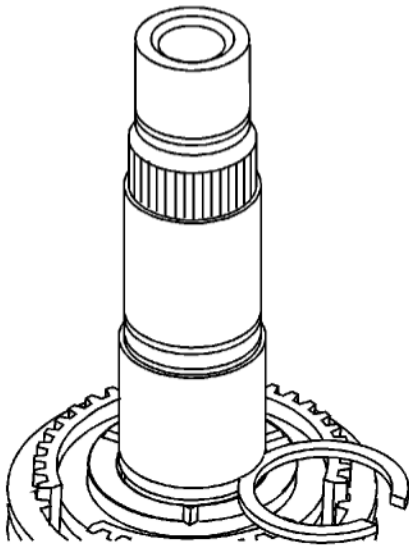
5. Apply lubricant and install the 4th gear (198).



6. Apply lubricant and install the following components:
- The blocking ring (121)
 - The 3rd/4th gear synchronizer hub (116) including the spring (123), detent ball (127) and insert (119)
 - The 3rd/4th gear synchronizer sleeve (118) with the higher boss facing the front

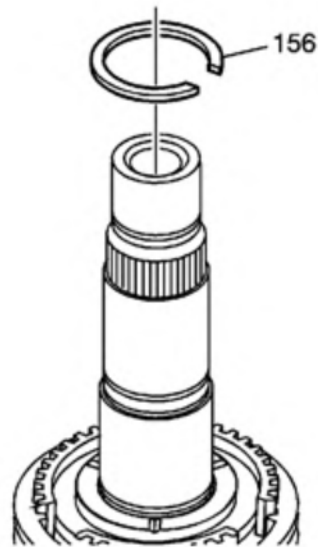


7. Using a hydraulic press and [DT-47723](#) , install the 3rd/4th synchronizer hub assembly. Ensure that the synchronizer ring and 3rd/4th synchronizer hub assembly are aligned when installing.

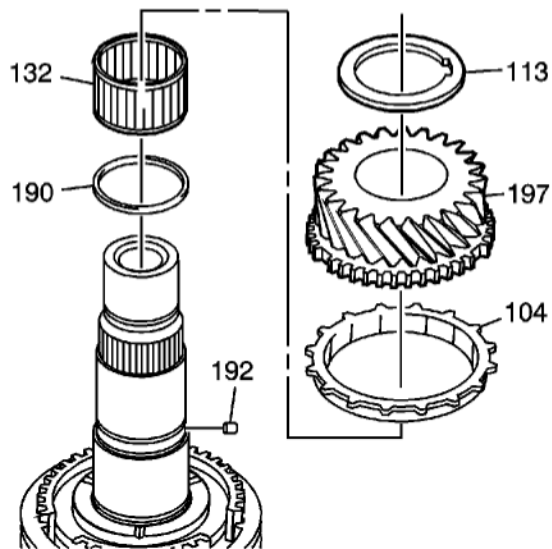


Important: The retaining ring is a selected fit. Always install a NEW retaining ring.

8. Select the maximum thickness retaining ring that will fit in the groove. Refer to [3rd and 4th Gear Synchronizer Retaining Ring Specifications](#).

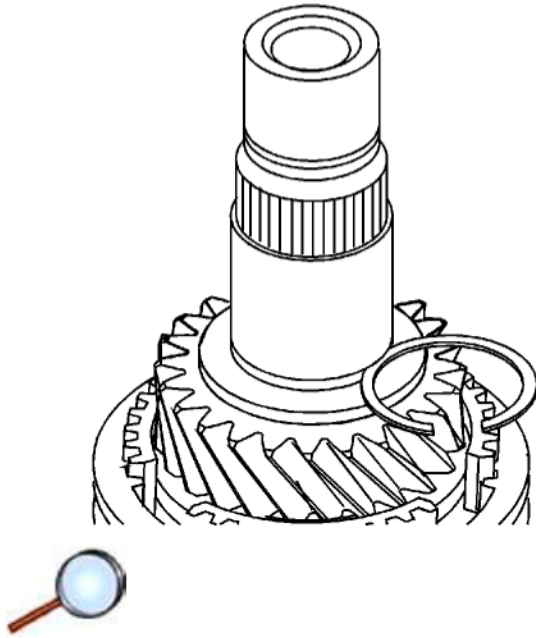


9. Install a NEW snap ring (156).



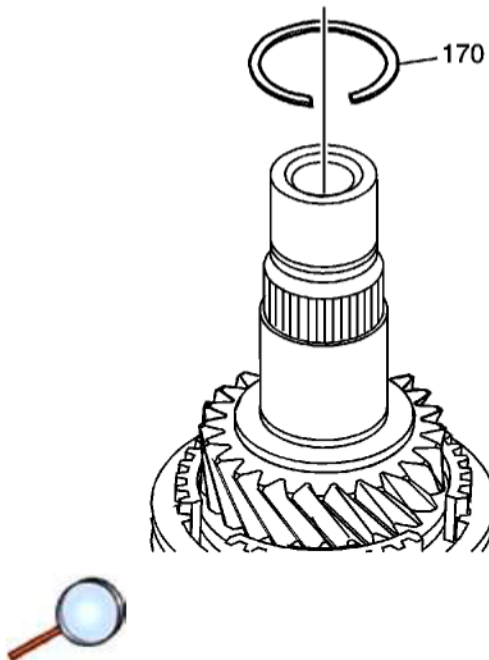
10. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 to components and install the following components:

- 3rd/4th gear spacer (190)
- 3rd gear bearing (132)
- 3rd gear blocking ring (104)
- Install and align the 3rd gear (197).
- Locating pin (192)
- Install and align the 3rd gear thrust washer (113) with the groove facing the front.

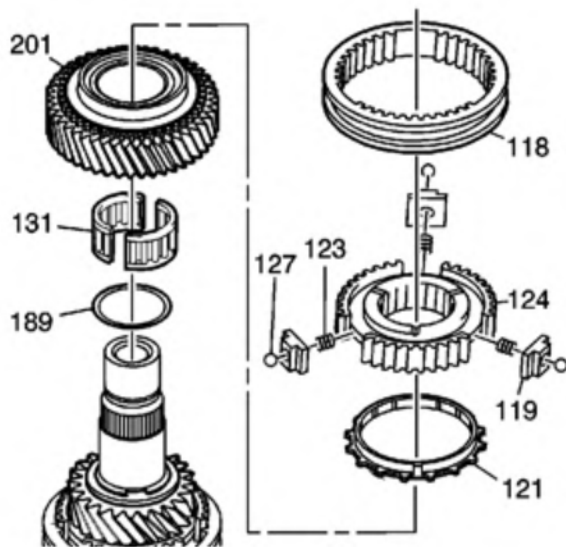


Important: The retaining ring is a selected fit. Always install a NEW retaining ring.

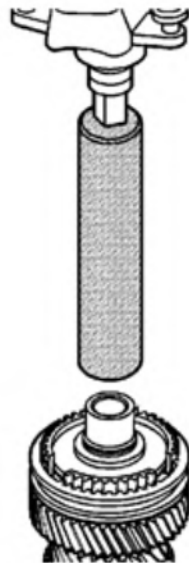
11. Select the maximum thickness retaining ring that will fit in the groove. Refer to [3rd and 4th Gear Synchronizer Retaining Ring Specifications](#).



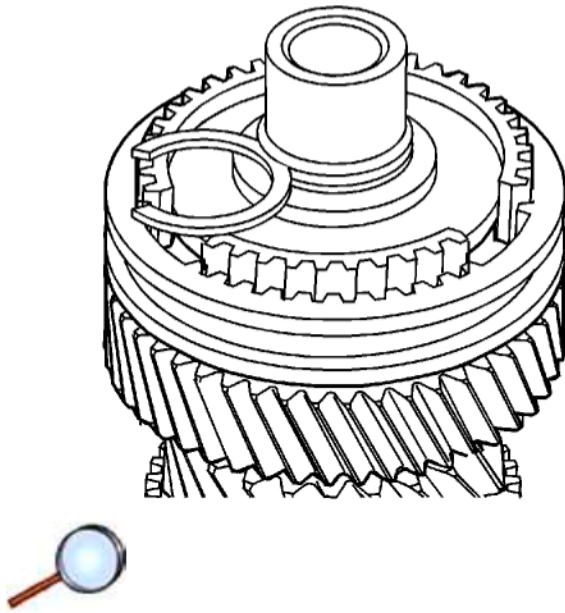
12. Install a NEW snap ring (170).



13. Install the 6th gear bearing spacer (189).
14. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 and install the 6th gear bearing (131).
15. Apply lubricant and install the 6th gear (201).
16. Apply lubricant and install the 6th gear blocking ring (121).
17. Apply lubricant and install the 5th/6th gear synchronizer hub (124) including the spring (123), detent ball (127) and insert (119).
18. Apply lubricant and install the 5th/6th synchronizer sleeve (118) with higher boss of sleeve facing the rear.

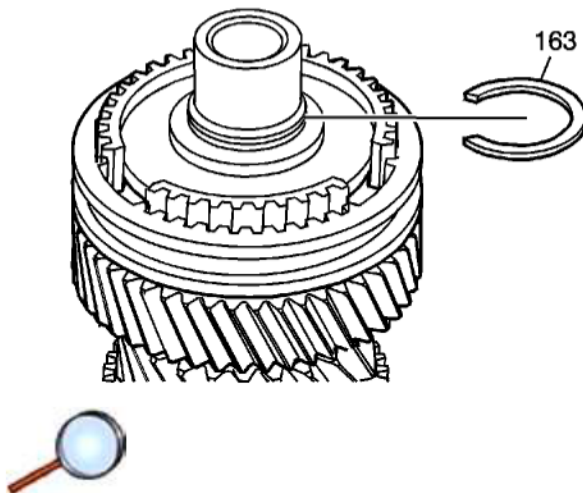


19. Use a hydraulic press and [DT-47723](#) to install the 5th/6th synchronizer hub assembly.



Important: The retaining ring is a selected fit. Always install a NEW retaining ring.

20. Select the maximum thickness retaining ring that will fit in the groove. Refer to [6th Gear Retaining Ring Specifications](#).

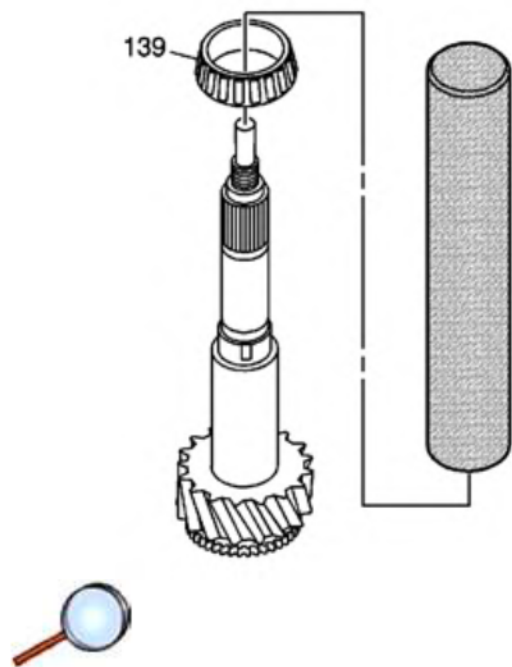


21. Install a NEW snap ring (163).

Output Shaft Assembly

Tools Required

[DT-47723](#) Output Shaft Bearing Installer

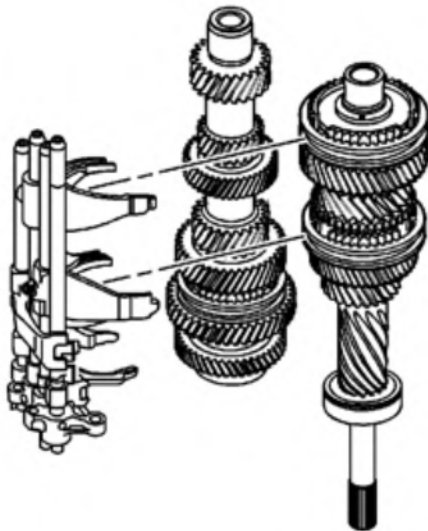


Using [DT-47723](#) , install the output shaft bearing (139).

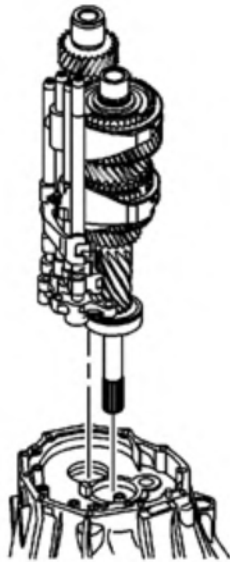
Transmission Assemble

Special Tools

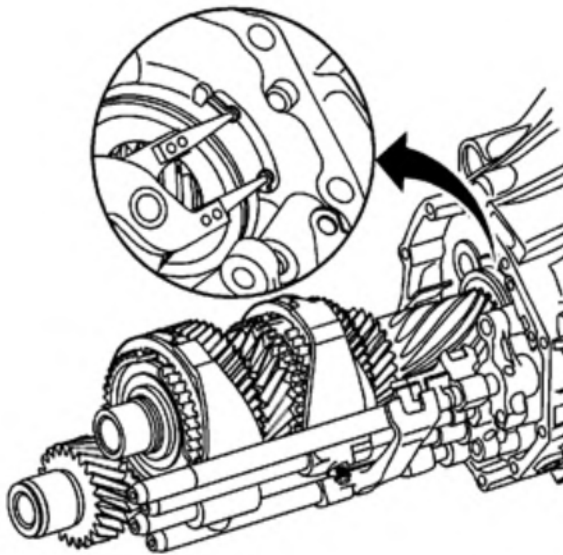
- *DT-47678* Transmission Holding Fixture
- *DT-48636* Flange Holder
- *DT-49027* Coil Pin Remover and Installer
- *J 35467* One-Way Clutch Tester
- *J 44731* Input Shaft Seal Installer
- *J 3289-20* Holding Fixture



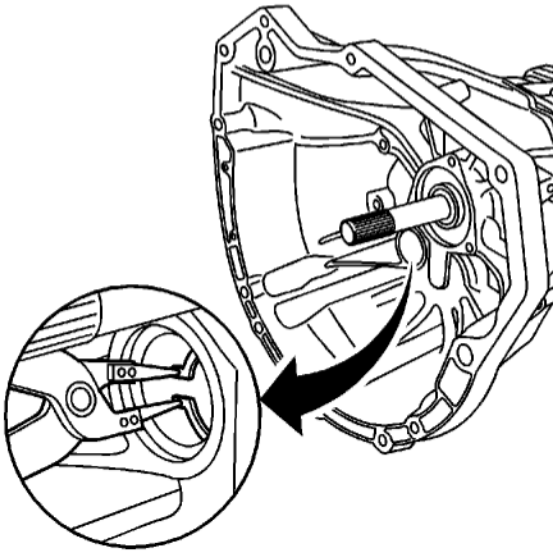
1. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476) to each gear shift fork and gear shift head. Join the shift rail assembly to the input shaft and countershaft assembly.



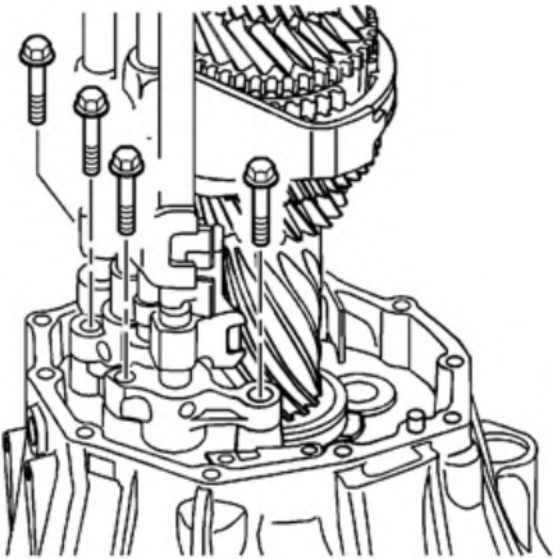
2. Install the input shaft, countershaft and shift rails as an assembly in the clutch housing.



3. Install the snap ring into the groove of the input shaft radial ball bearing.



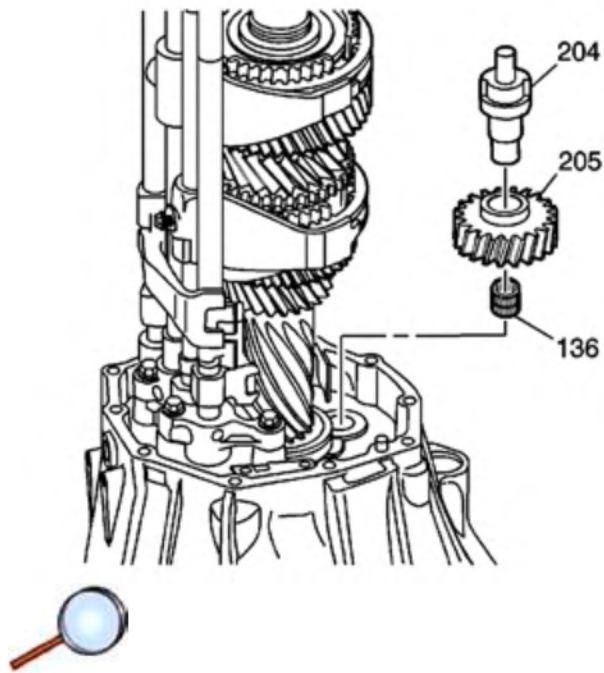
4. Install the snap ring into the groove of the countershaft radial ball bearing.



5. Apply threadlocker GM P/N 12345382 (Canadian P/N 10953489) or equivalent to the shift rail bolts.

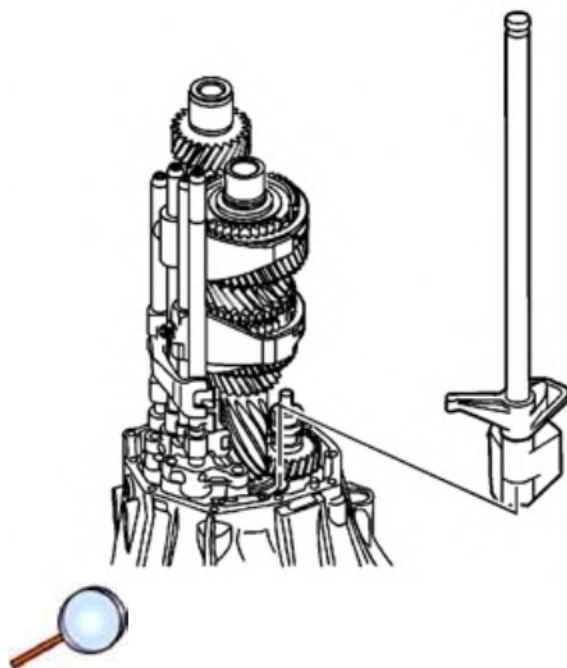
Caution: Refer to [Fastener Caution](#) in the Preface section.

6. Install the 4 shift rail bolts and tighten to **21 N·m (15 lb ft)**.



Note: During alignment, ensure that the thread hole of the reverse idler gear shaft (204) aligns with the thread hole of the middle case.

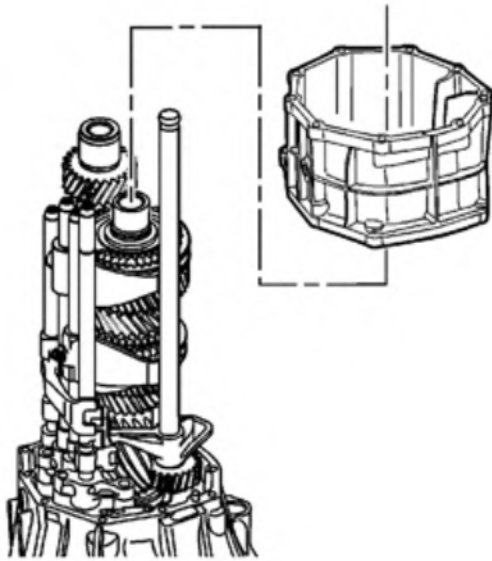
7. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476) and install the following components:
 - The reverse idler gear bearing (136)
 - The reverse idler gear (205) with the higher boss facing the rear
 - The reverse idler gear shaft (204) with its hole facing outward



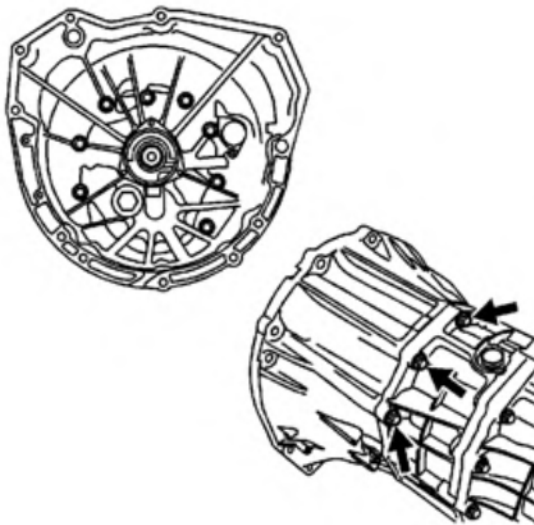
8. Apply sealer GM P/N 89020326 (Canadian P/N 89021188) or equivalent to the interface of either case.

9. Install the shift shaft selector lever.

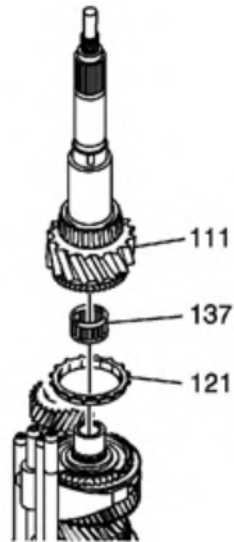
Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.



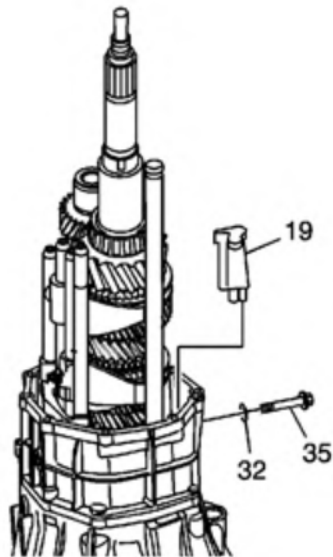
10. Apply sealer GM P/N 89020326 (Canadian P/N 89021188) or equivalent to the interface of either case.
11. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476 to the shift and select lever shaft bearing.
12. Install the intermediate case housing.



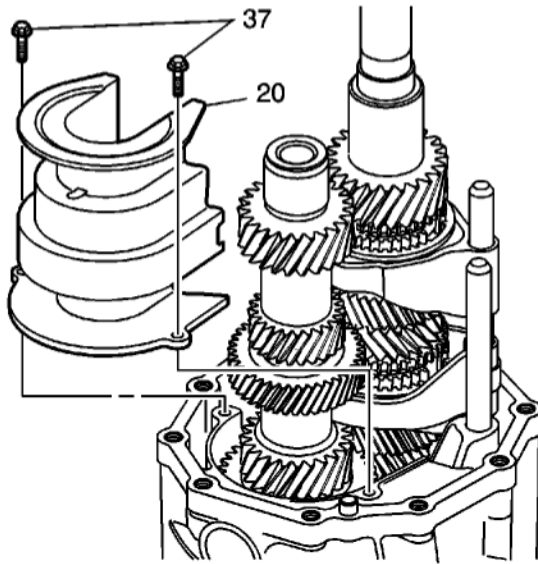
13. Install the 8 bolts from the clutch housing and the 3 bolts from the middle case. Tighten the bolts to 40 N·m (29 lb ft).



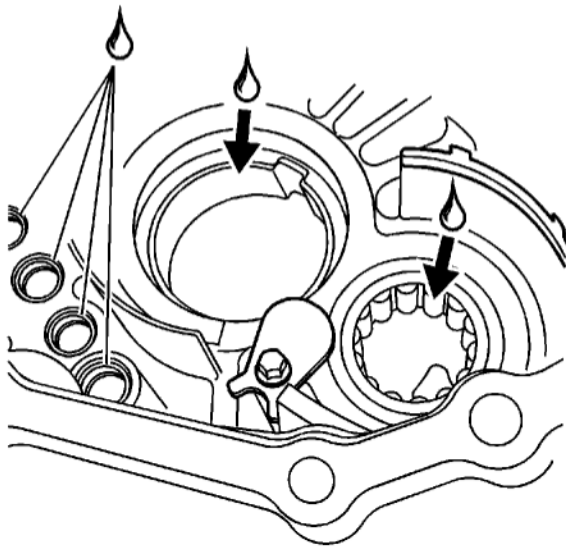
14. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476) and install the input shaft bearing (137), blocking ring (121) and the rear output shaft (111).



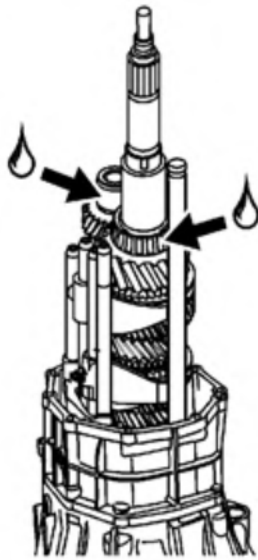
15. Install the oil trough pipe (19).
16. Install a NEW gasket (32) and the bolt (35) to secure the reverse idler shaft. Tighten the bolt to 40 N·m (30 lb ft).



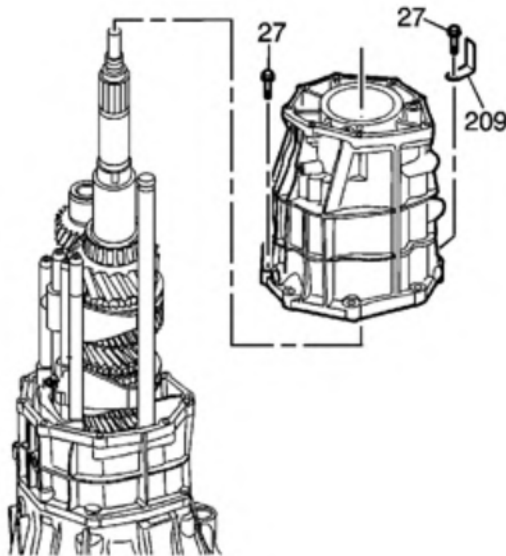
17. Install the oil trough (20) and the 2 oil trough bolts (37) and tighten to **8.5 N·m (75 lb in)**.



18. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476) to the following components:
- The tapered roller bearing outer race
 - The cylindrical roller bearing
 - The control sub-assembly holes



19. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476) to the following components:
- The tapered roller bearing of the output shaft
 - The cylindrical roller bearing inner race of counter gear



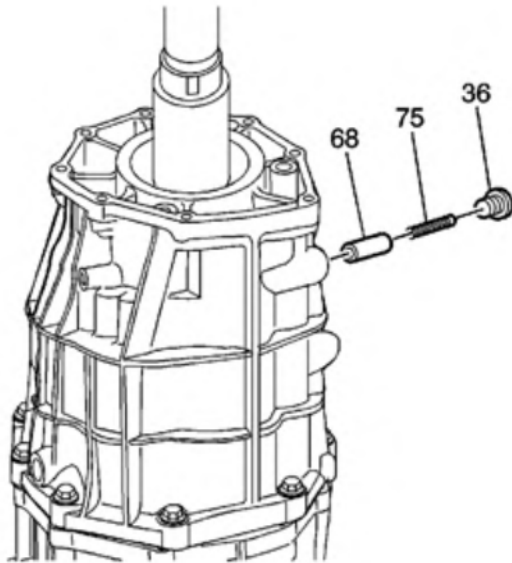
20. Apply sealer GM P/N 89020326 (Canadian P/N 89021188) or equivalent to the clean interface of either case.

Caution: Refer to [Machined Surface Damage Caution](#) in the Preface section.

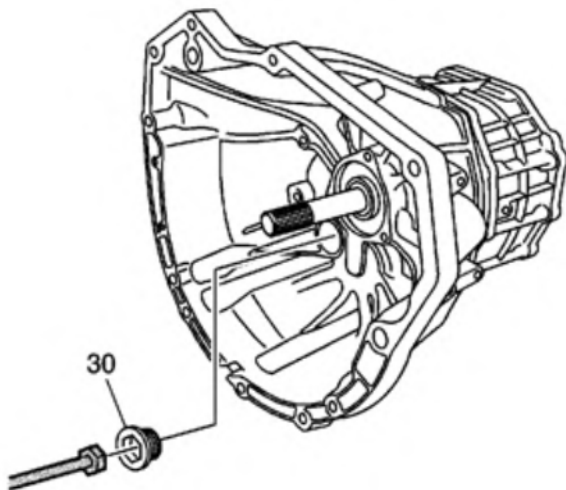
Note: Use care when installing the rear case housing so that the oil receiver is not damaged.

21. Install the rear case housing.

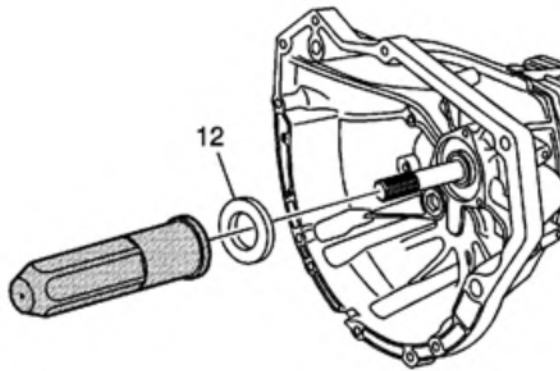
22. Install the 10 bolts (27) and retainer (209) to the rear case housing. Tighten the bolts to **40 N·m (29 lb ft)**.



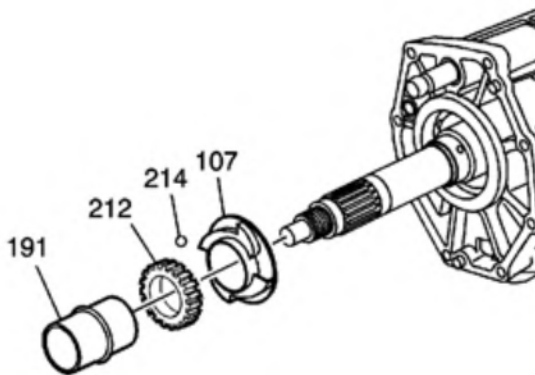
23. Apply lubricant GM P/N 88862475 (Canadian P/N 88862476) and install the lock ball pin (68).
24. Install the spring (75) and a NEW plug (36). Tighten the plug to **24.5 N·m (18 lb ft)**.



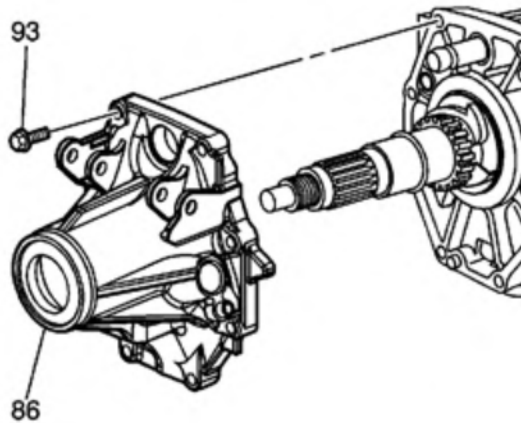
25. Using *J 35467* tester , install a NEW clutch housing hole plug (30) into the clutch housing. Tighten the bolt to **39.3 N·m (29 lb ft)**.



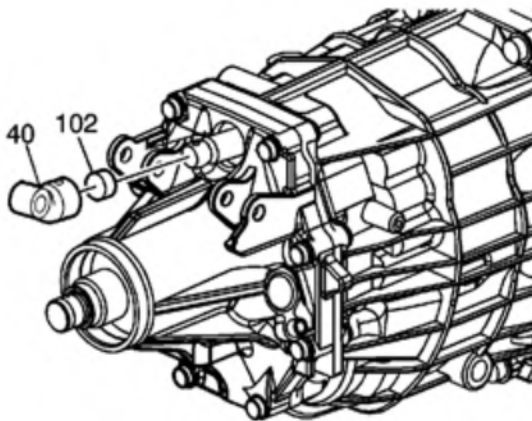
26. Using J 44731 installer , install a NEW input shaft seal (12).



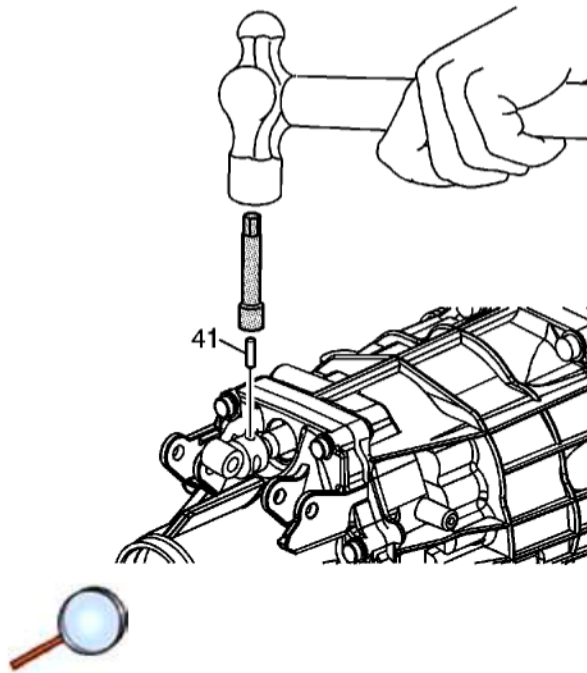
27. Align and install the main shaft bearing oil slinger (107).
28. Grease and install the locking ball (214).
29. Align and install the vehicle speed sensor drive gear (212).
30. Install a NEW rear output shaft rear bearing spacer (191).



31. Apply sealer GM P/N 89020326 (Canadian P/N 89021188) or equivalent to the interface of either case.
32. Install the rear extension housing.
33. Install the 8 bolts (93) into the rear extension housing (86) and tighten to **29 N·m (21 lb ft)**.

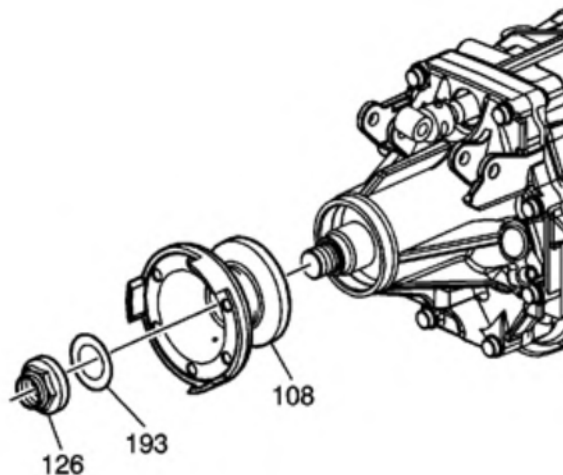


34. Install the dampener (102) and shift lever rod universal joint (40) on the end of the shift control shaft.



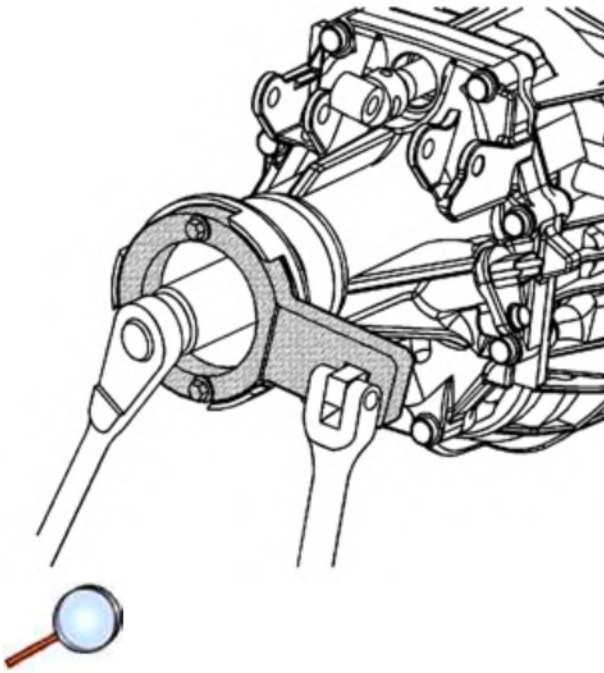
Note: Prior to shift lever pin installation, the shift control shaft must be shifted forward into the transmission.

35. Position and align the shift lever pin (41) with the hole in the shift lever rod universal joint. Use *DT-49027-3* coil pin installer and a mallet to install the pin (41) to the proper depth.

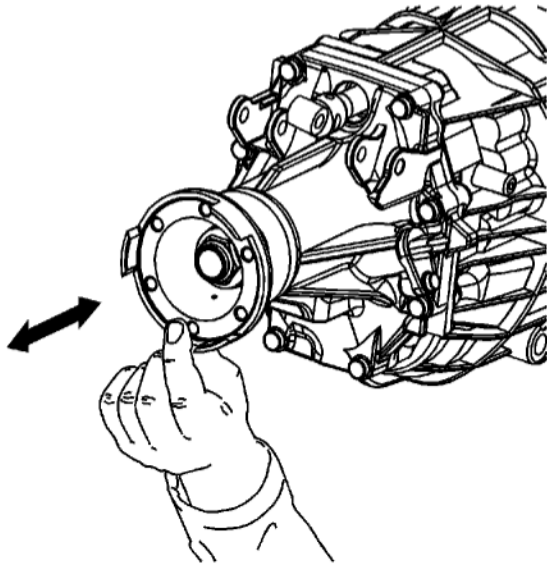


36. Install the propshaft flange (108).
37. Grease and install a NEW propshaft flange fluid seal (193).
38. Install a NEW propshaft flange nut (126).

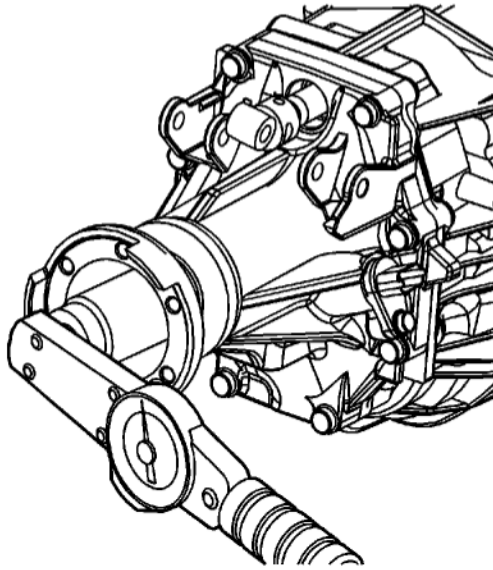
Preload Adjustment Procedure



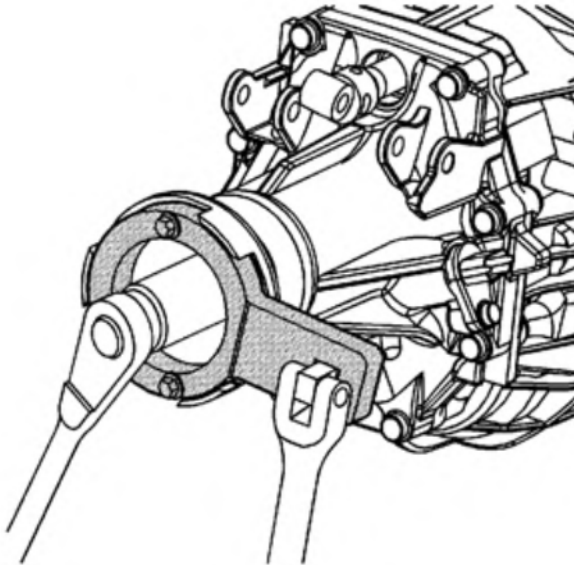
1. Shift the transmission into any gear.
2. Attach *DT-48636* holder to the output flange.
3. Use *DT-48636* holder in order to prevent the output flange from rotating. Install and tighten the output flange nut. Tighten until the looseness is minimum.



4. Verify looseness by shaking the output shaft longitudinally.



5. Remove *DT-48636* holder from the output flange.
6. Shift the transmission into NEUTRAL.
7. Rotate the output flange several times in order to break in the gears, synchronizers and bearings.
8. Measure the rotational torque/drag torque of the output flange by using a suitable tool. Record this initial rotational torque measurement as value A.



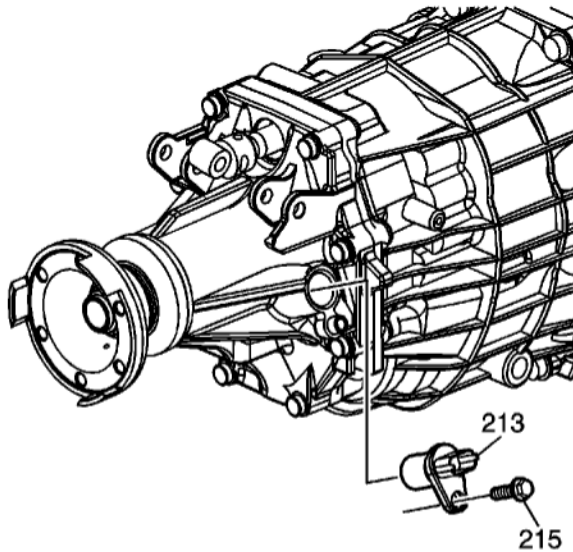
9. Attach *DT-48636* holder to the output flange.
10. Shift the transmission into any gear.
11. Tighten the nut **220-565 N·m (162-417 lb ft)**.
12. Remove the *DT-48636* holder from the output flange.
13. Shift the transmission into NEUTRAL.
14. Rotate the output flange several times in order to seat the bearings.
15. Measure the rotational torque/drag torque of the output flange by using a suitable tool. Record this measurement as value B.

16. Subtract value A from value B. Verify that the resulting measurement is within the specified range.

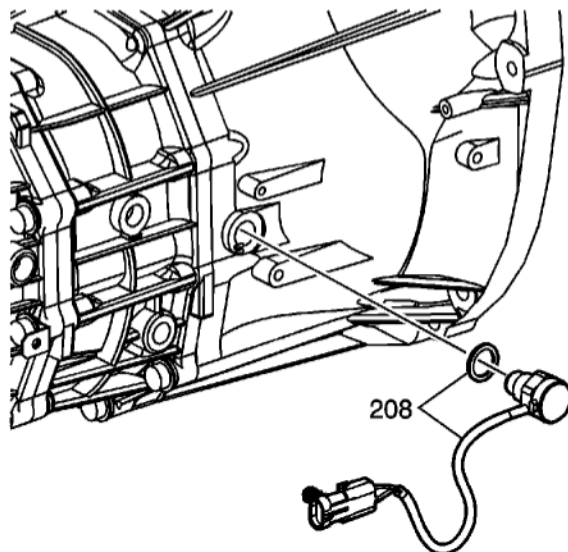
Specification

The rotational torque specification is 0.45-1.35 N·m (4-12 lb in).

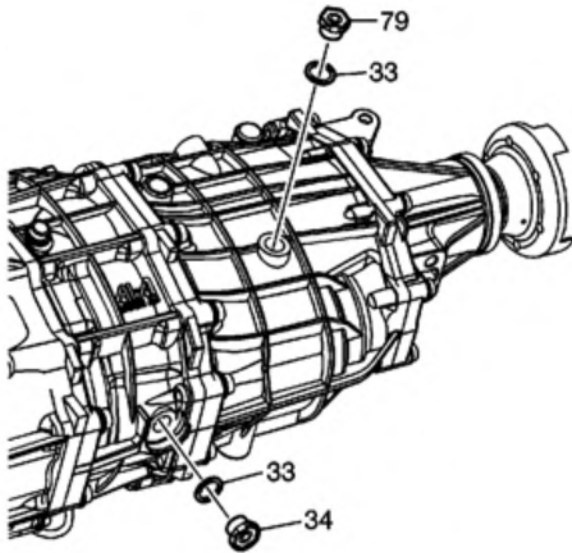
17. Repeat the previous steps until you have confirmed that the rotational torque specification is reached then stake the nut in place. If the rotational torque requirement has been exceeded, replace the spacer (191) and repeat steps 2-16.



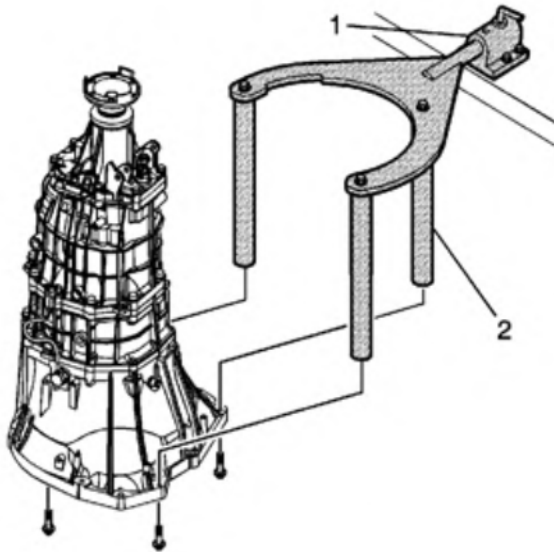
18. Install the output sensor (213) and bolt (215) into the rear extension housing and tighten to 8 N·m (71 lb in).



19. Install a NEW backup lamp washer (208) and switch into the case. Tighten the switch to 44 N·m (32 lb ft).



20. Install the NEW gaskets (33), drain plug (34) and fill plug (79). Tighten both plugs to **37 N·m (27 lb ft)**.
21. Install the clutch release cylinder and the clutch release cylinder bolts. Refer to [Clutch Concentric Actuator Cylinder Replacement](#).



22. Remove the *DT-47678* fixture (2) and *J 3289-20* fixture (1) from the transmission clutch housing.