

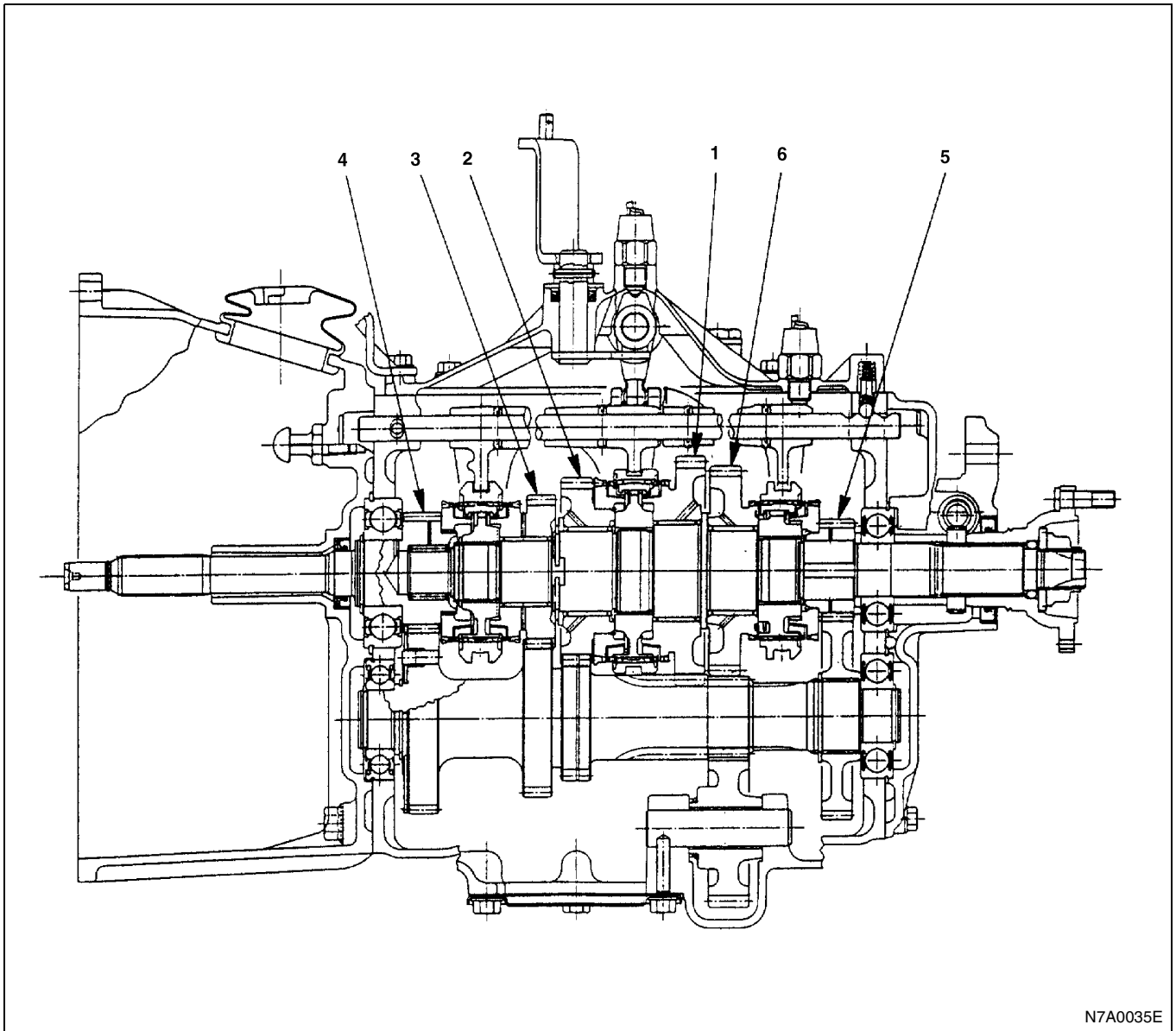
MANUAL TRANSMISSION AND CLUTCH MSB SERIES

SECTION 7B MANUAL TRANSMISSION (MSB)

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GENERAL DESCRIPTION



Legend

- | | |
|--------|---------|
| 1. 1st | 4. 4th |
| 2. 2nd | 5. 5th |
| 3. 3rd | 6. Rev. |

For MSB model transmission, a forward 5-shift all synchromesh type and a backward 1-shift constant mesh type transmission are employed.

The transmission case is made of a high rigidity cast iron, and the front cover integral with the clutch housing is made of aluminum die-cast. An aluminum die-cast control box containing a gear shift and gear select mechanism is installed on the right side of the transmission case. A window for power take-off is also provided on the left side.

For all the gears, helical gears are employed to reduce noises.

The synchromesh mechanism that employs balking rings use block rings of special brass to obtain improved synchromesh performance.

With the main shaft screwed up at the rear, ball bearings are employed for the bearings on both sides of the main shaft and the counter shaft, and needle roller bearings employed for the bearings at the tip end of the main shaft and also for those of the 1st gear, 2nd gear, 3rd gear and reverse gear to secure improved durability and reduced noises.

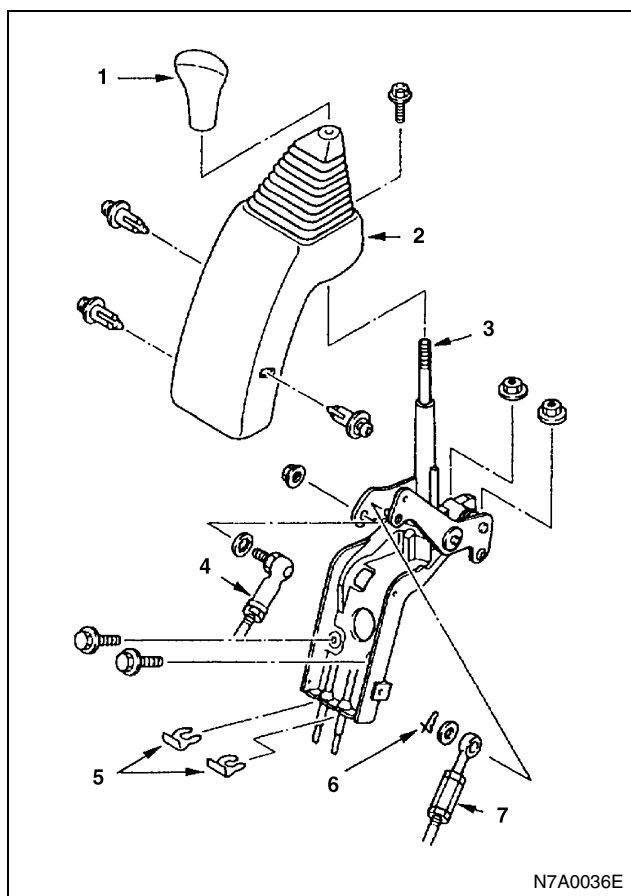
Furthermore, with the anti-lash mechanism employed for the engagement of the top gear with the counter gear, fine-pitch gears are also employed for the 4th gear and the 5th gear to reduce noises.

ON-VEHICLE SERVICE

Change Lever Assembly Replacement

Removal

1. Change Lever Knob
2. Cover Assembly
 - Remove the fixing screw and three clips.
3. Shift Cable and Select Cable
 - Disconnect the cables from the change lever.
 - Remove the clips and disconnect the cables from bracket.
4. Change Lever Assembly



Legend

1. Knob
2. Cover assembly
3. Change lever
4. Shift cable
5. Clip
6. Snap pin
7. Select cable

Installation

1. Change Lever Assembly
2. Shift Cable and Select Cable

When connecting the shift cable and the select cable to the change lever, adjust the cable.

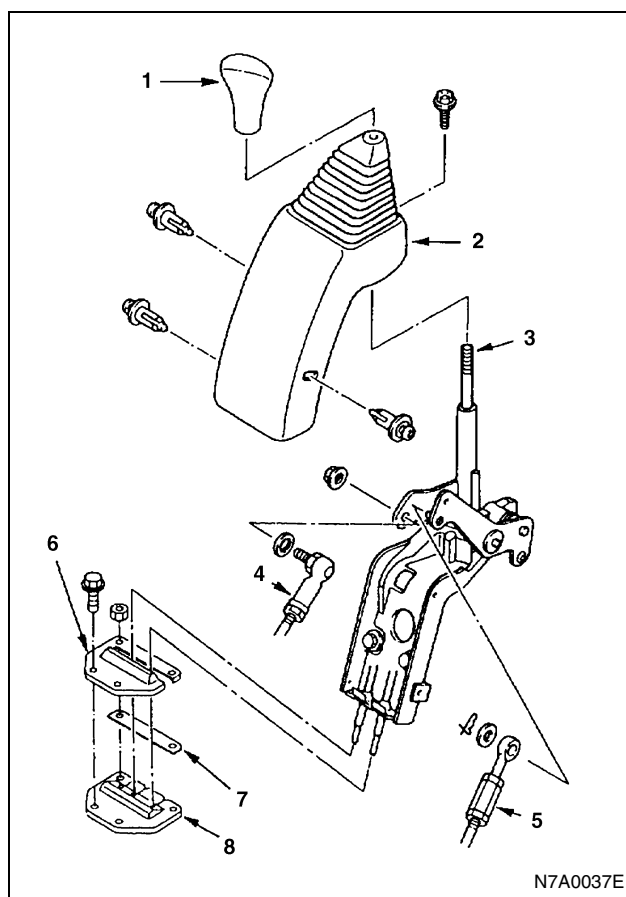
Refer to "SERVICING: GEAR CONTROL CABLE ADJUSTMENT" given previously in this section.

3. Cover Assembly
4. Change Lever Knob

Gear Control Cable Replacement

Removal

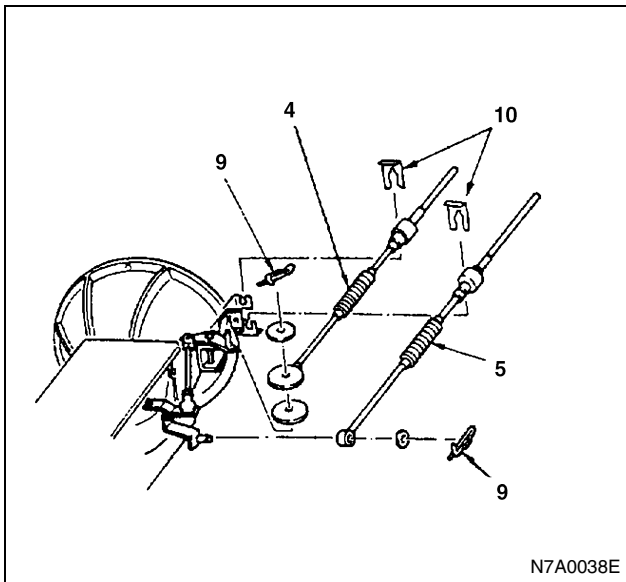
1. Change Lever Knob
2. Cover Assembly
3. Shift Cable and Select Cable
 - 1) Disconnect the shift and select cables from change lever.
 - 2) Remove the clips and disconnect the cables from change lever bracket.
 - 3) Remove the grommet retainer, grommet seal and grommet.
 - 4) Tilt the cab.



Legend

1. Knob
2. Cover assembly
3. Change lever
4. Shift cable
5. Select cable
6. Grommet retainer
7. Grommet seal
8. Grommet

- 5) Disconnect the shift cable and the select cable on the transmission side.
- 6) Remove the clips and disconnect the shift cable and the select cable from the bracket.
- 7) Remove the clips that fix the cables to the frames.
- 8) Remove the shift and select cable assemblies.



Legend

4. Shift cable
5. Select cable
9. Snap pin
10. Clip

Inspection and Repair

Check the cables for any deformation, damage or rust, and also check the sliding portion for any abnormal condition.

When there is any abnormal condition, replace it with a new one.

Installation

1. Shift Cable and Select Cable

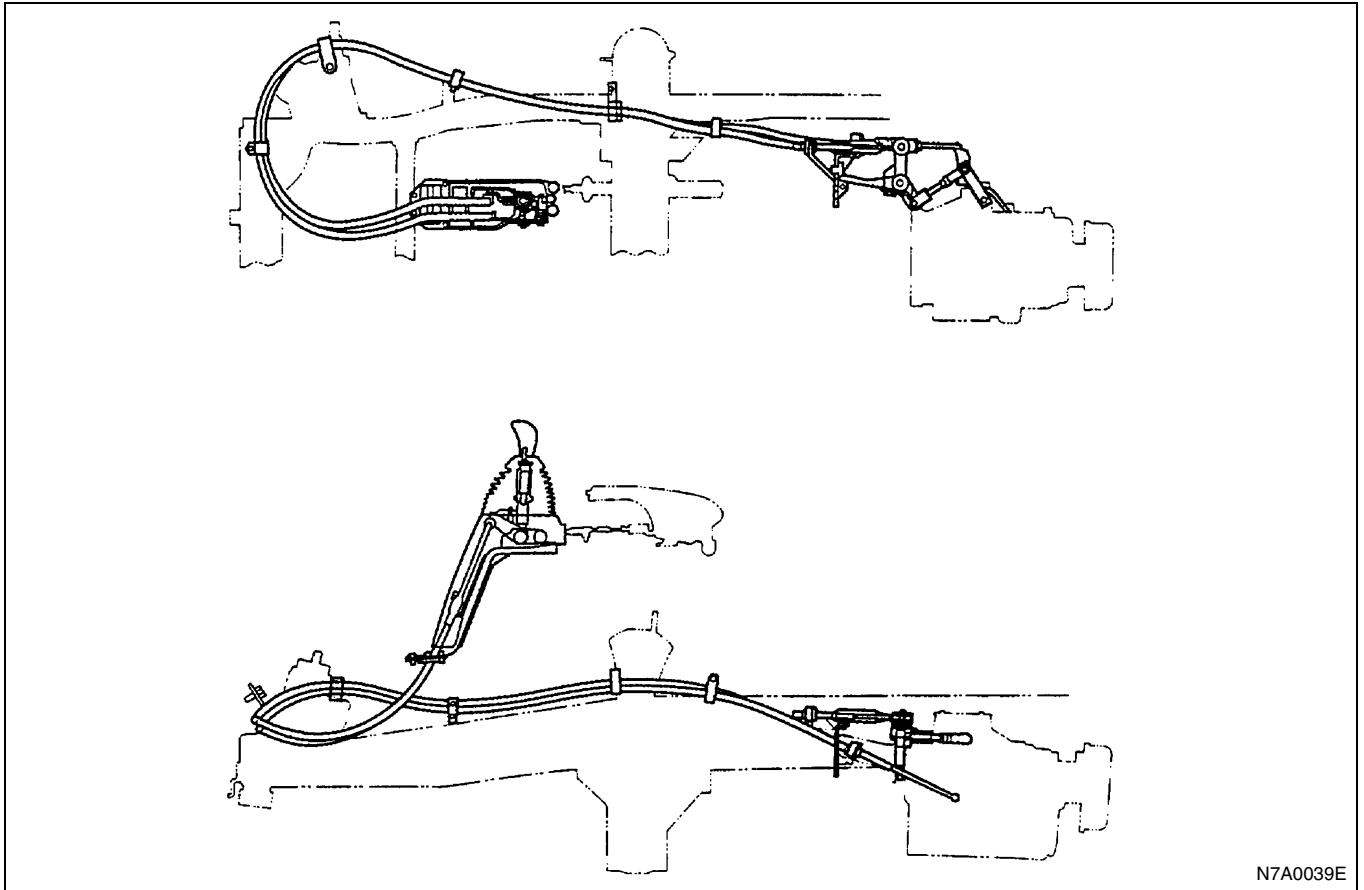
- 1) Install the shift cable and the select cable temporarily.

Caution:

Never bend the cables to radius less than 450 mm (18 in) unless it is necessary to do so for wiring purposes. And never bend the cables to radius less than 180 mm (7 in) even during wiring. Install the cables carefully without unnecessary twisting the cable boots.

- 2) Connect the shift cable and the select cable to the transmission.
- 3) Fasten the cables with clips to the brackets on the transmission side.
- 4) Fasten the cables with clips to the change lever bracket.
- 5) Fasten the cables with clips to the frames. At this time, take care that the select cable comes above the shift cable.
- 6) Install the grommet, grommet seal and grommet retainer.
- 7) When connecting the shift cable and the select cable to the change lever, adjust the cables. Refer to "SERVICING: GEAR CONTROL CABLE ADJUSTMENT" given previously in this section.

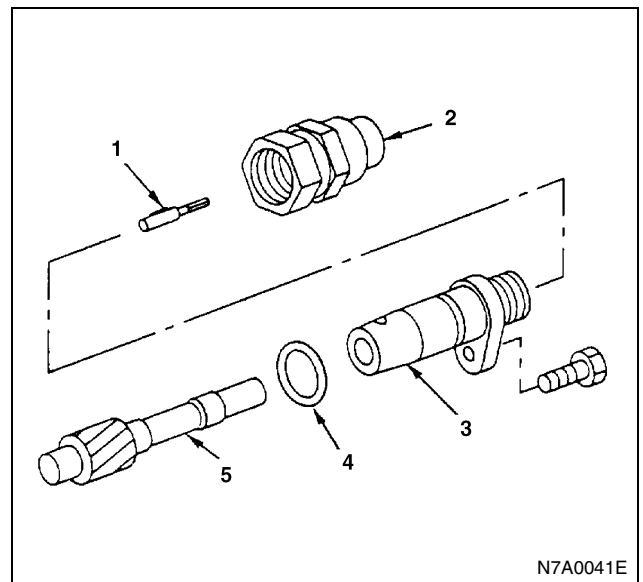
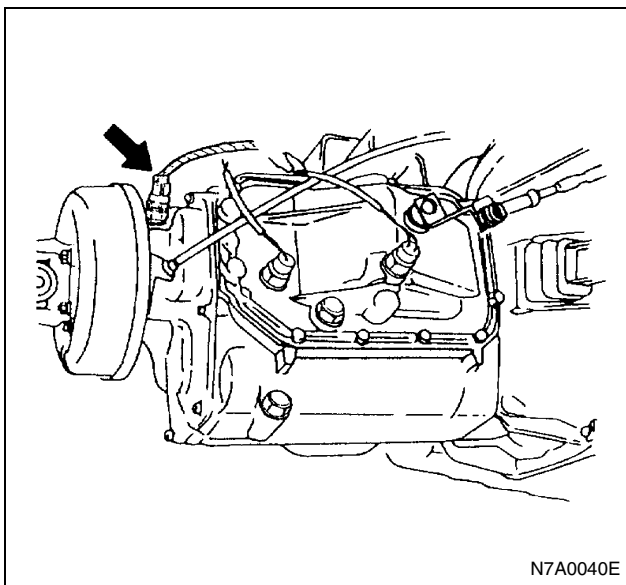
2. Cover Assembly
3. Change Lever Knob



Vehicle Speed Sensor Driven Gear Replacement

Removal

1. Wiring Connector



Legend

1. Key rod
2. Vehicle speed sensor
3. Bushing
4. O-ring
5. Driven gear

2. Vehicle Speed Sensor with Key Rod
3. Vehicle Speed Sensor Driven Gear Assembly
 - Remove the fixing bolt.
 - Remove the driven gear assembly.

Installation

1. Vehicle Speed Sensor Driven Gear Assembly

Tighten:

Fixing bolt to 15 N·m (1.5 kg·m / 11 lb·ft)

2. Vehicle Speed Sensor with Key Rod

Tighten:

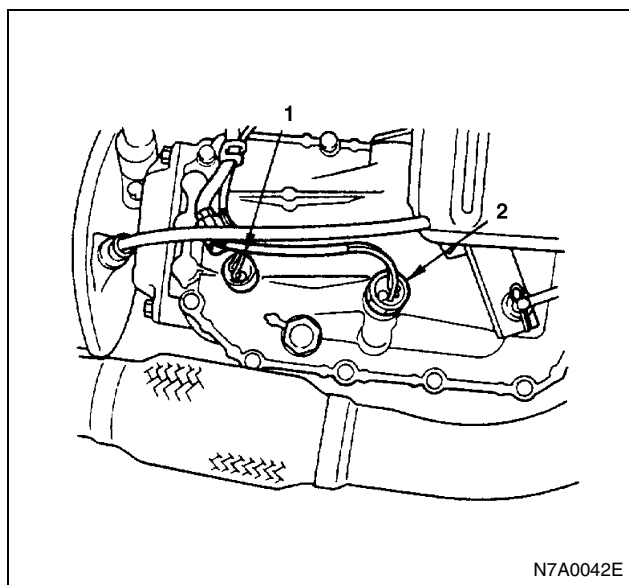
Fixing bolt to 25 N·m (2.5 kg·m / 18 lb·ft)

3. Wiring Connector

Back-up Light Switch and Neutral Switch Replacement

Removal

1. Wiring Connector
2. Switch



N7A0042E

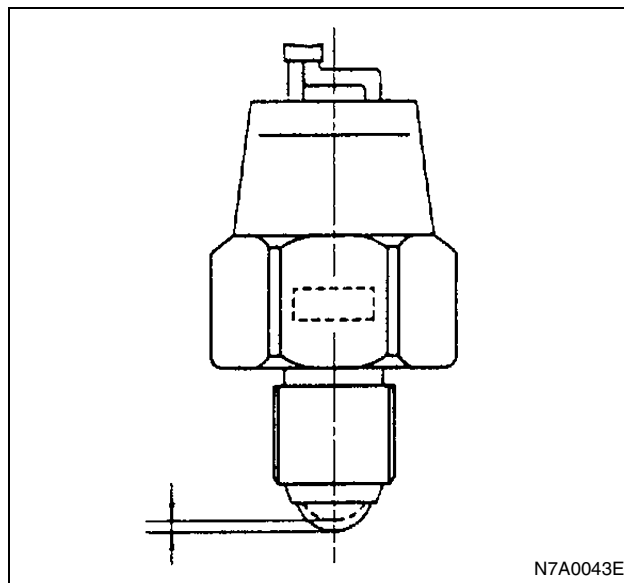
Legend

1. Back-up light switch
2. Neutral switch

Inspection and Repair

- When there is continuity between the terminals in the condition as it is, and when the continuity between the terminals is turned off by pressing the ball of the switch, the switch is normal.

Switch Operating Stroke	mm (in)
0.93 (0.037)	



N7A0043E

Installation

1. Switch

- Apply liquid gasket (Three Bond 1141 or equivalent) to the switch's threaded portion to prevent oil leakage, and install the switch to the control box.
- Color of connector
Back-up Light Switch: Brown
Neutral Switch: Gray

Tighten:

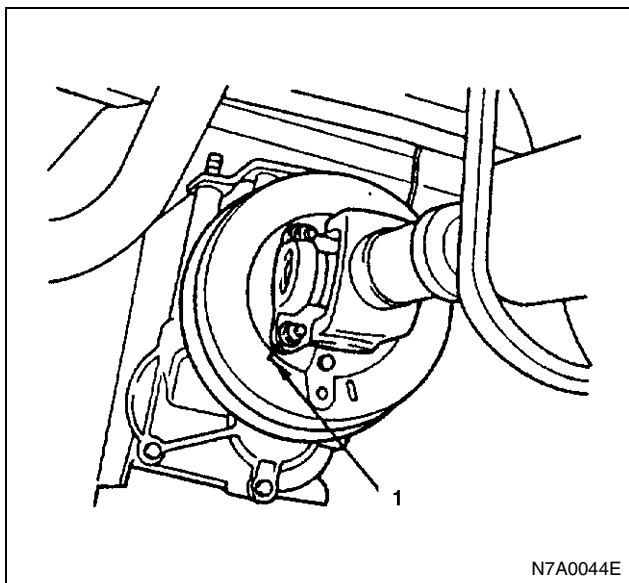
Switch to 34 N·m (3.5 kg·m / 25 lb·ft)

2. Wiring Connector

Rear Oil Seal Replacement

Removal

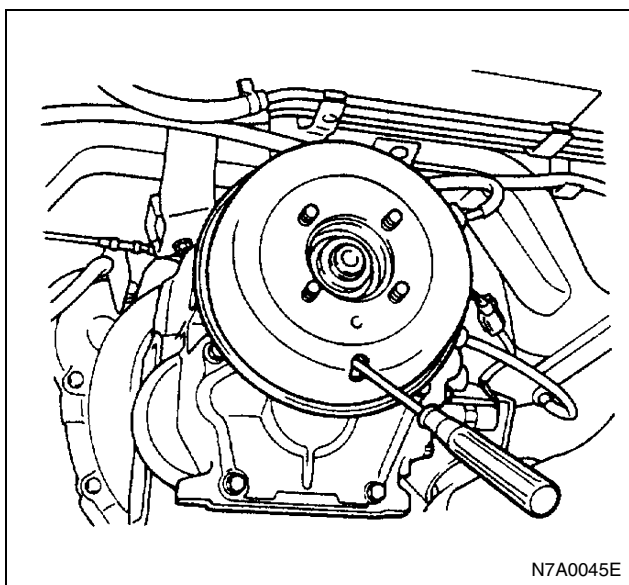
- Raise vehicle and support with suitable safety stands.
1. Propeller Shaft
 - Put a reference mark (1) on the flange yoke and the parking brake drum.



- Disconnect the propeller shaft at flange yoke.
- Put aside the propeller shaft and tie it to the frame so it does not interfere with servicing work.

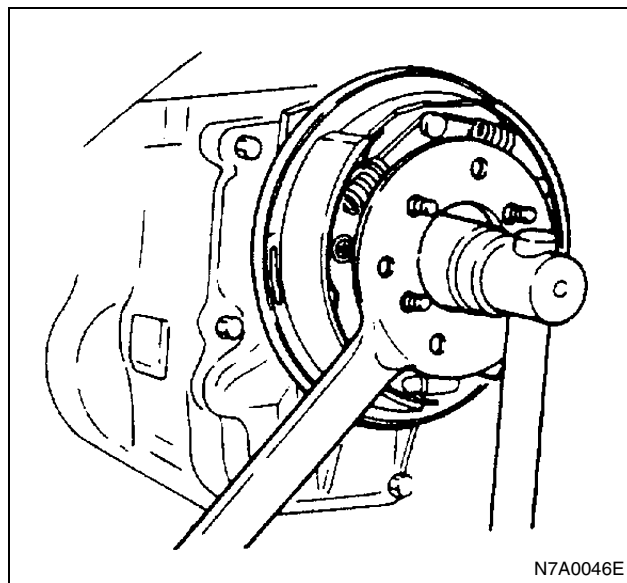
2. Parking Brake Drum

- Remove the screw and the adjust hole cover.
- It may be necessary to back off the shoe adjuster.



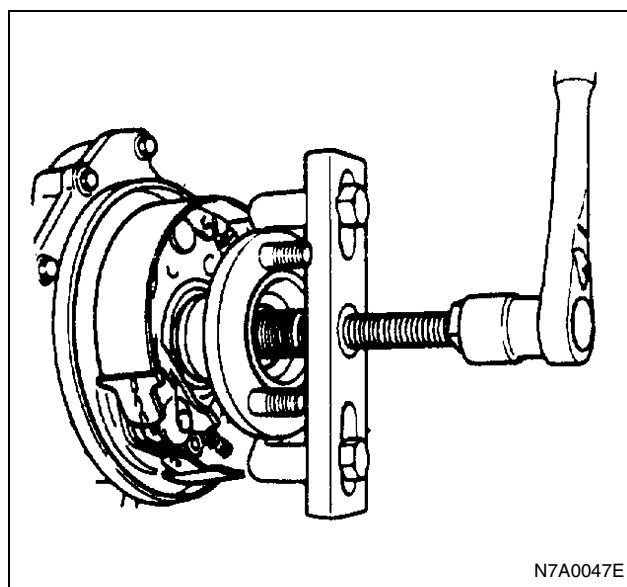
3. Lock Nut

- Make sure to raise the caulking of the coupling driver lock nut, then remove the lock nut.
- Use the handle to remove the lock nut.
Handle: 5-8840-2043-0

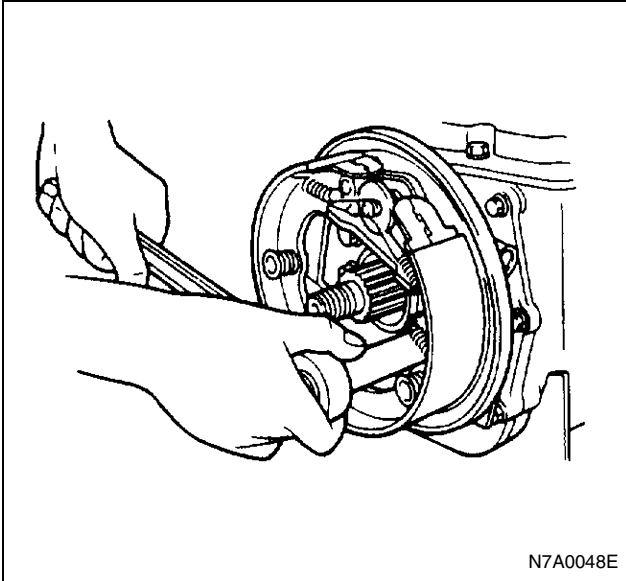


4. Coupling Driver

- Remove the coupling driver using the universal puller.
Universal Puller: 5-8840-2027-0
- Remove the conical washer and the O-ring.



5. Parking Brake Assembly



6. Oil Seal

- Use the screwdriver to remove the oil seal from the rear cover.

Caution:

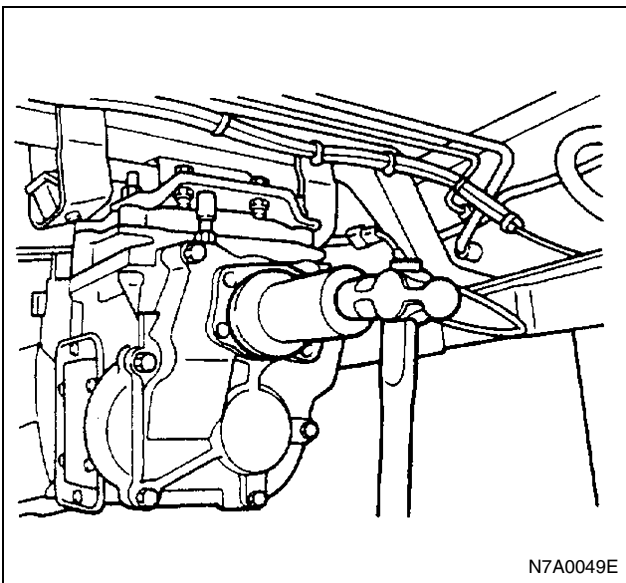
Take care not to damage the sealing seat of the rear cover.

Installation

1. Oil Seal

- Apply engine oil to the new oil seal outer circumference and apply multi-purpose grease to the oil seal lip.
- Use the oil seal installer to install the oil seal to the rear cover.

Oil Seal Installer: 5-8840-2242-0

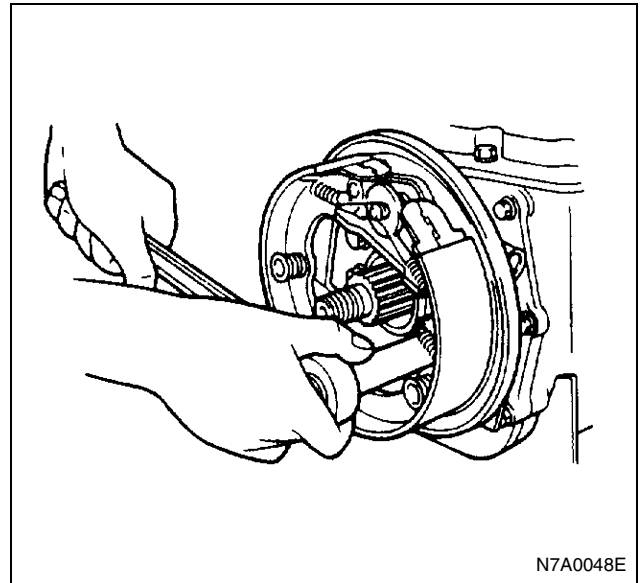


2. Parking Brake Assembly

Tighten:

- Parking brake bolts to 25 N·m (2.5 kg·m / 18 lb·ft)

- Parking brake nut to 113 N·m (11.5 kg·m / 83 lb·ft)



3. Coupling Driver

4. Lock Nut

- Install the O-ring and the conical washer. The conical washer is to be set up with its identification groove to the nut side.

Caution:

Do not reuse the lock nut.

- Apply the engine oil to the setting face of the new lock nut and tighten it up to the specified torque.
Handle: 5-8840-2043-0

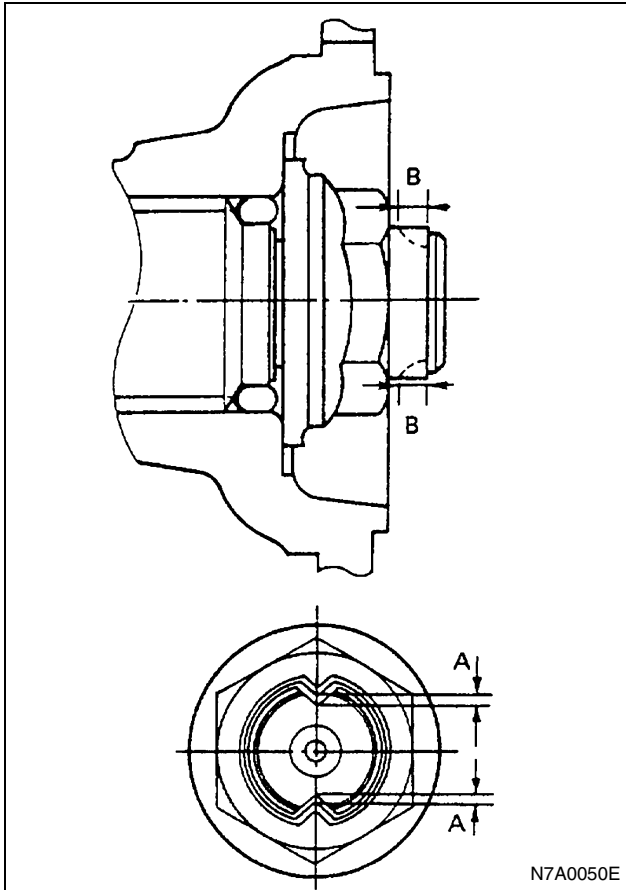
Tighten:

Lock nut to 226 N·m (23.0 kg·m / 166 lb·ft)

- Align the lock nut with the V-shaped groove at the tip of the main shaft, and caulk the nut lip portion by using a chisel. (Round edge approximately 1 mm (0.04 in) × 60°).
- As shown in the illustration, be sure to caulk the nut lip so that the clearance between the V-shaped groove portion at the tip of the main shaft and the caulked up lip (A) is less than 1.5 mm (0.06 in), and the caulking length (B) is 5 mm (0.2 in) or more.

Caution:

Be sure to confirm that there is no crack at the caulked portion of the end nut after caulking.

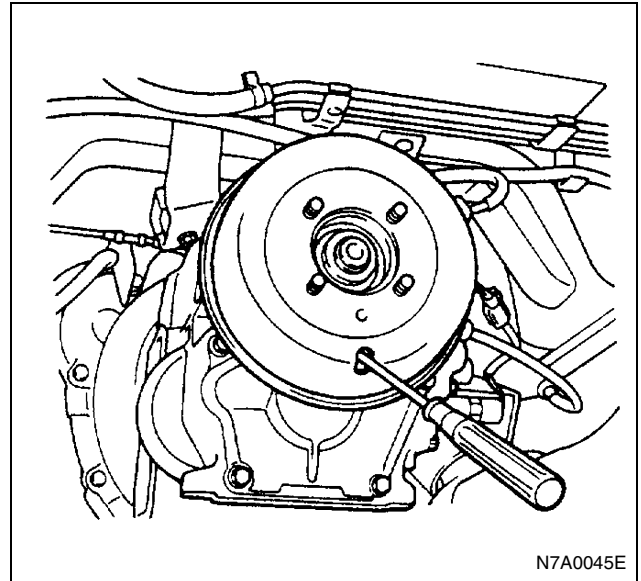


5. Parking Brake Drum

- Adjust the parking brake after installation.
- 1) Rotate the brake drum to align the adjust hole with the adjuster.
- 2) Move the camshaft lever from side to side several times to center the brake shoes.
- 3) Insert a screwdriver into the hole and rotate the adjuster by pushing it upward until the shoes drag on the drum.
- 4) Back off the adjuster 30 notches.
- Install the adjust hole cover.

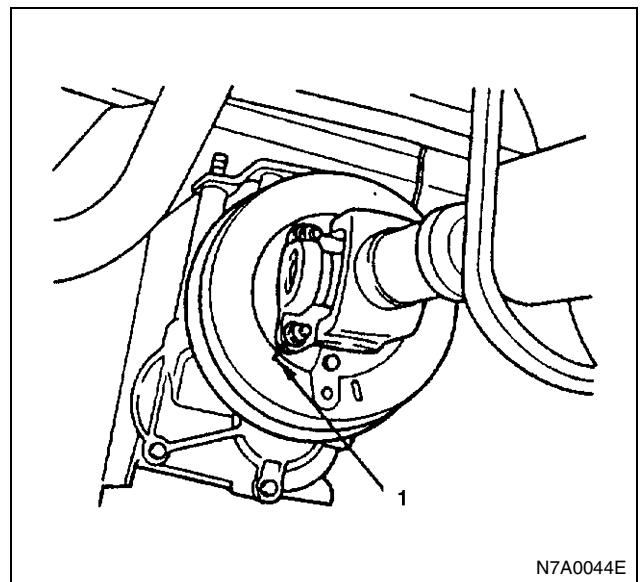
Tighten:

Adjust hole cover bolt to 8 N·m (0.8 kg·m / 69 lb·in)



6. Propeller Shaft

- Line up reference mark (1).



Tighten:

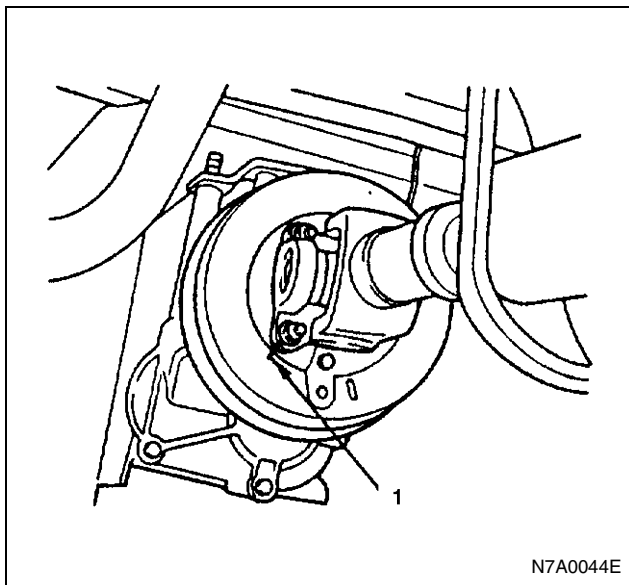
Propeller shaft bolt to 66 N·m (6.7 kg·m / 48 lb·ft)

- Remove the safety stands.

Transmission Assembly Replacement

Removal

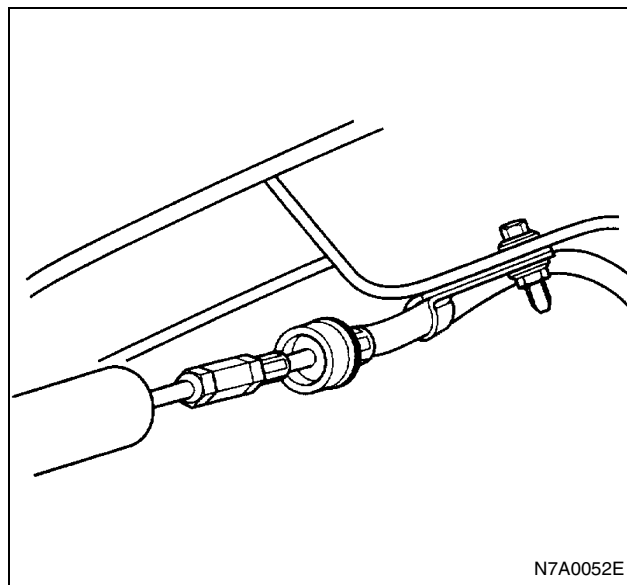
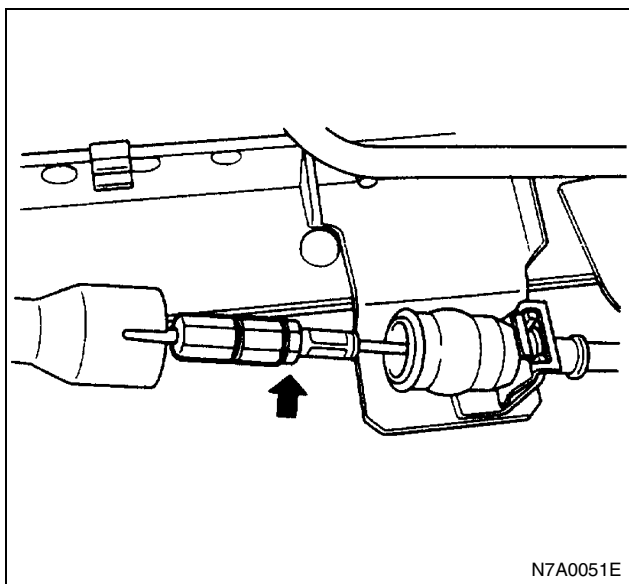
- Raise vehicle and support with suitable safety stands.
- 1. Propeller Shaft
 - Put a reference mark (1) on the flange yoke and the parking brake drum.



- Disconnect the propeller shaft at flange yoke.
- Put aside the propeller shaft and tie it to the frame so that it does not interfere with servicing work.

2. Parking Brake Cable

- Move the joint cover.
- Disconnect the joint bolt.
- Remove the clip, and then disconnect the cable from the bracket.

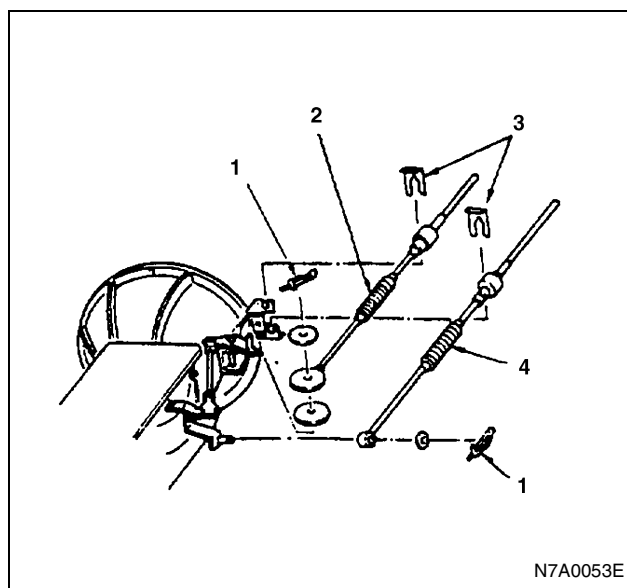


3. Wiring Connector

- Disconnect the wiring connectors from the vehicle speed sensor, the neutral switch and the back-up light switch.

4. Shift Cable and Select Cable

- Disconnect the shift cable and select cable on the transmission side.

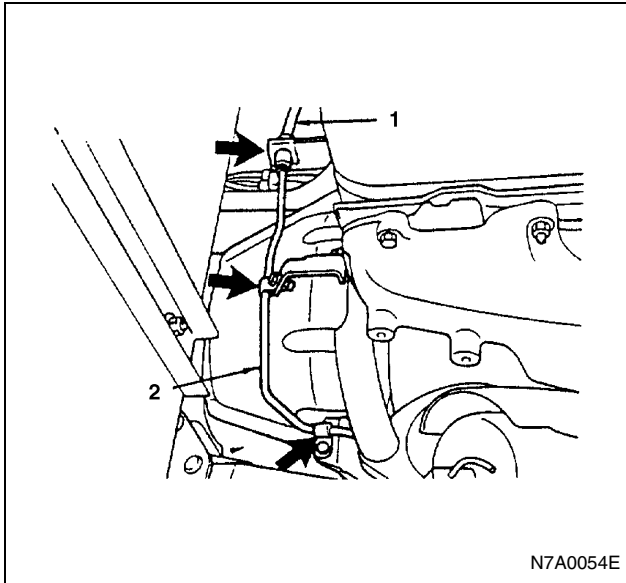


Legend

1. Snap pin
2. Shift cable
3. Clip
4. Select cable

5. Clutch Slave Cylinder

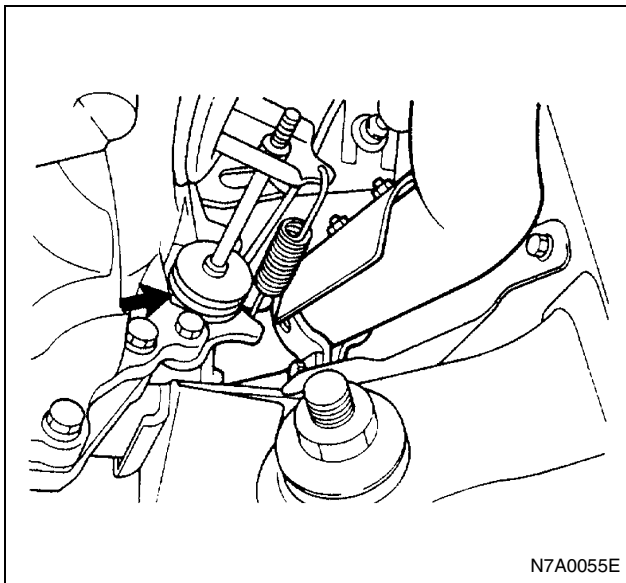
- Remove the clutch pipe fixing clips and the clip bracket (Right hand drive models only).



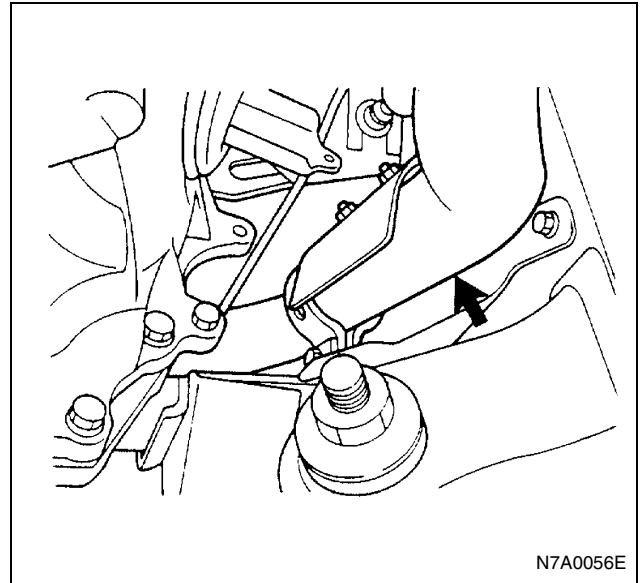
Legend

1. Flexible hose
2. Shift cable

- Remove the slave cylinder assembly with the flexible hose attached, and then tie it to the frame so that it does not interfere with servicing work.



6. Exhaust Brake Assembly
7. Front Exhaust Pipe



8. Transmission Assembly

Notice:

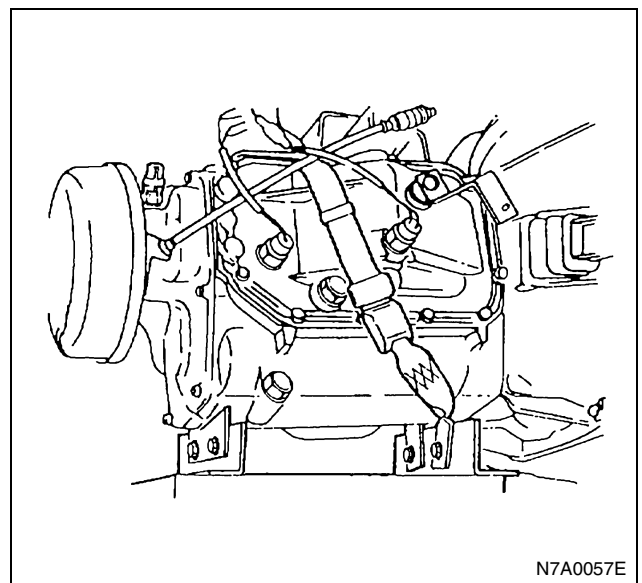
The exhaust pipe bracket, the gear control bracket and the clips are sometimes installed in the wrong position or direction confusedly. To prevent incorrect installation of these parts, put a correct installation mark on them.

- Support the transmission with mission jack.

Caution:

To prevent the falling of the transmission, tie it firmly to the jack with a chain or belt.

Do not allow transmission to hang unsupported from clutch. Damage to the clutch assembly will result.



- Remove the nuts of the transmission mounting bracket on the crossmember side.
- Engine and transmission angles may need to be adjusted for removal.
- Hold the rear section of the engine by the jack or hoist.

7B-12 MANUAL TRANSMISSION (MSB)

Caution:

When lifting the engine by the jack, use wood blocks to prevent any possible damage to the oil pan.

- Remove transmission fastening bolts.
- Pull out the transmission assembly rearward.

9. Mounting Bracket

Installation

1. Mounting Bracket

Tighten:

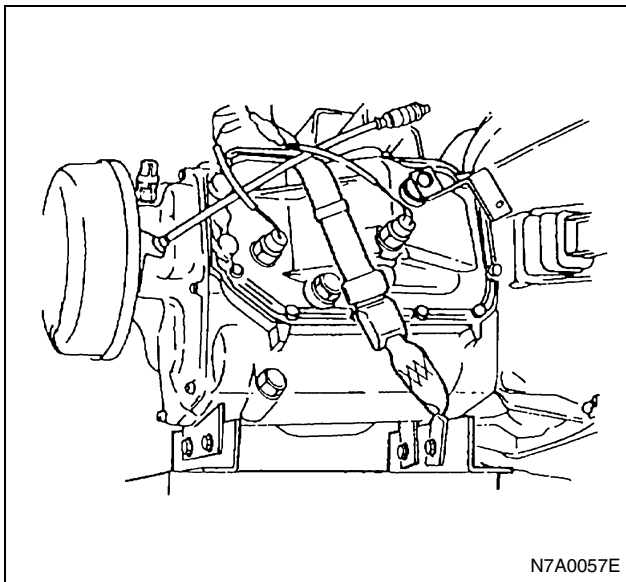
Mounting bracket nuts to 69 N·m (7.0 kg·m / 51 lb·ft)

2. Transmission Assembly

- Support the transmission with mission jack.

Caution:

To prevent the falling of the transmission, tie it securely to the jack with a chain or belt.



- Shift transmission into high gear.
- Align transmission with engine slope.
- Turn output parking brake drum to aid clutch spline engagement.

Tighten:

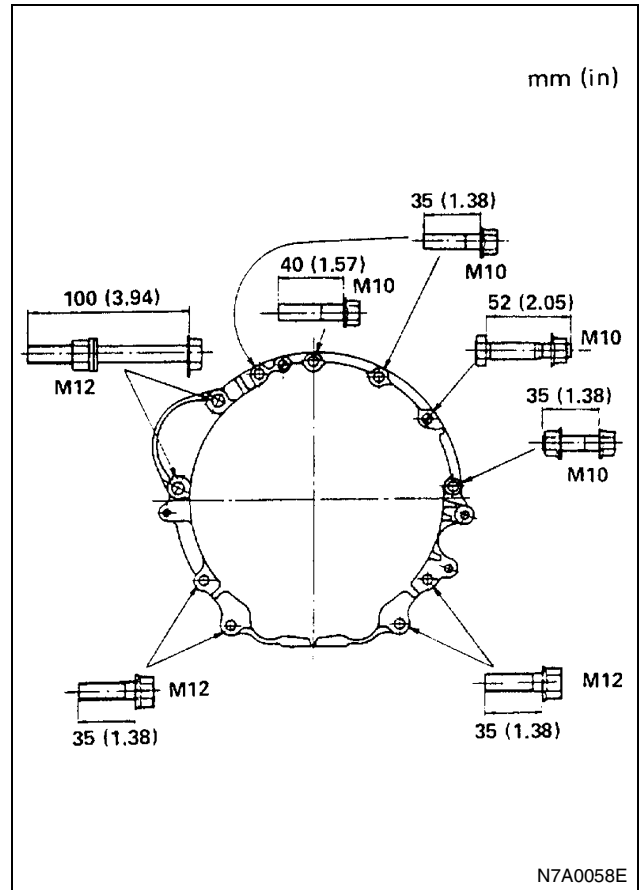
Clutch housing to flywheel housing bolts to

- M10: 46 N·m (4.7 kg·m / 34 lb·ft)
- M12: 91 N·m (9.3 kg·m / 67 lb·ft)
- Raise engine and transmission up into rear transmission mount.

Tighten:

Engine rear mounting nuts and bolts to

- M10: 40 N·m (4.1 kg·m / 30 lb·ft)
- M12: 69 N·m (7.0 kg·m / 51 lb·ft)



3. Front Exhaust Pipe

Tighten:

Front exhaust pipe bolts to 37 N·m (3.8 kg·m / 27 lb·ft)

4. Exhaust Brake Assembly

Tighten:

Exhaust brake bolts to 17 N·m (1.8 kg·m / 12 lb·ft)

5. Clutch Slave Cylinder

Tighten:

Slave cylinder bolts to 19 N·m (1.9 kg·m / 14 lb·ft)

- Perform slave cylinder adjustment before installation of the return spring.
- 1) Loosen the lock nut of the push rod.
- 2) Turn the adjust nut until it reaches the shift fork.
- 3) Back off the adjust nut 1.5 turns. (shift fork free play Approximately 2 mm/0.1 in).
- 4) Tighten the lock nut.

Tighten:

Push rod lock nut to 16 N·m (1.6 kg·m / 12 lb·ft)

6. Shift Cable and Select Cable

7. Wiring Connector

- Color of Connector
Back-up Light Switch: Brown
Neutral Switch: Gray

8. Parking Brake Cable

9. Propeller Shaft

- Line up reference mark.

Tighten:

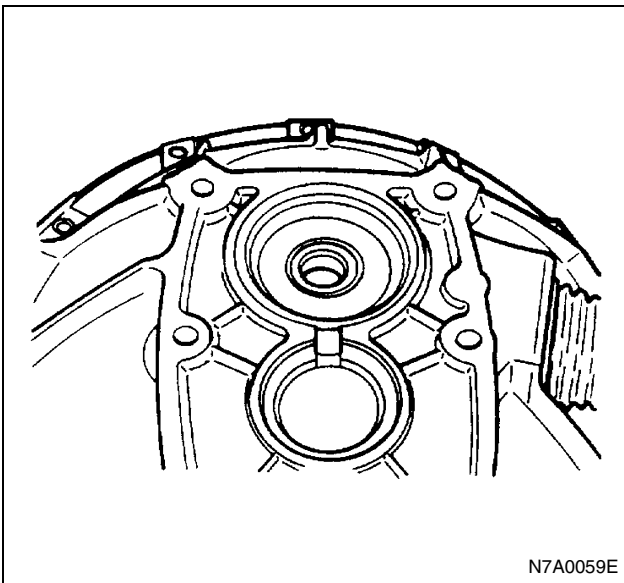
Propeller shaft nuts to 66 N·m (6.7 kg·m / 48 lb·ft)

Front Oil Seal Replacement**Removal**

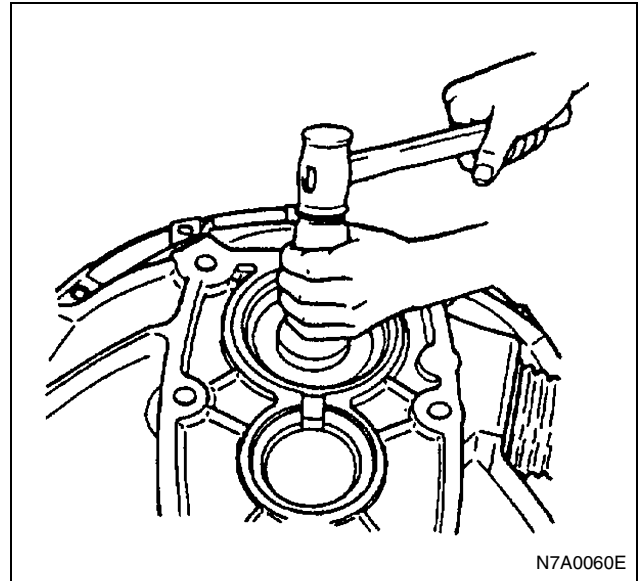
1. Transmission Assembly
Refer to "ON-VEHICLE SERVICE: TRANSMISSION ASSEMBLY REPLACEMENT" previously in this section.
2. Clutch Housing
3. Oil Seal
 - Use the screwdriver to remove the oil seal from the clutch housing.

Caution:

Take care not to damage the sealing seat of the clutch housing.

**Installation**

1. Oil Seal
 - Apply engine oil to the new oil seal outer circumference and apply multi-purpose grease to the oil seal lip.
 - Use the oil seal installer to install the oil seal to the clutch housing.
- Oil Seal Installer: 5-8840-2064-0

**2. Clutch Housing**

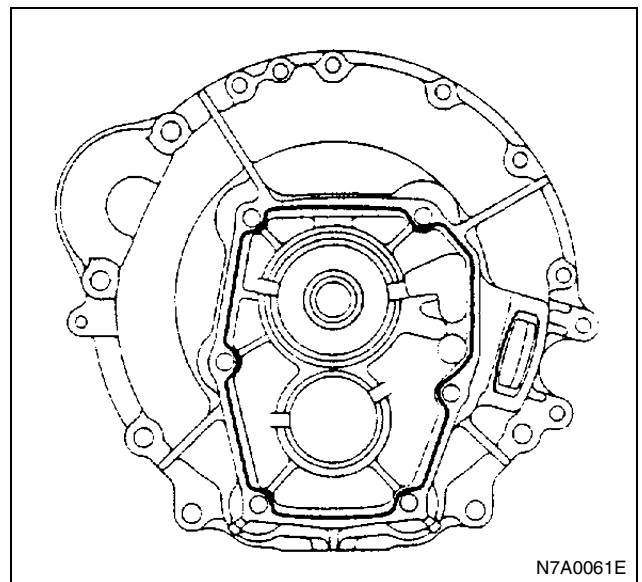
- Remove water and oil on the mating face before applying the liquid gasket.
- Apply $\phi 2$ mm (0.1 in) bead of the liquid gasket (Three Bond 1215 or equivalent) to the clutch housing surface shown in the illustration.

Notice:

Install the clutch housing on the transmission case within 30 minutes after liquid gasket application.

Tighten:

Clutch housing to transmission case bolts to 81 N·m (8.3 kg·m / 60 lb·ft)

**3. Transmission Assembly**

Refer to "ON-VEHICLE SERVICE: TRANSMISSION ASSEMBLY REPLACEMENT" previously in this section.

7B-14 MANUAL TRANSMISSION (MSB)

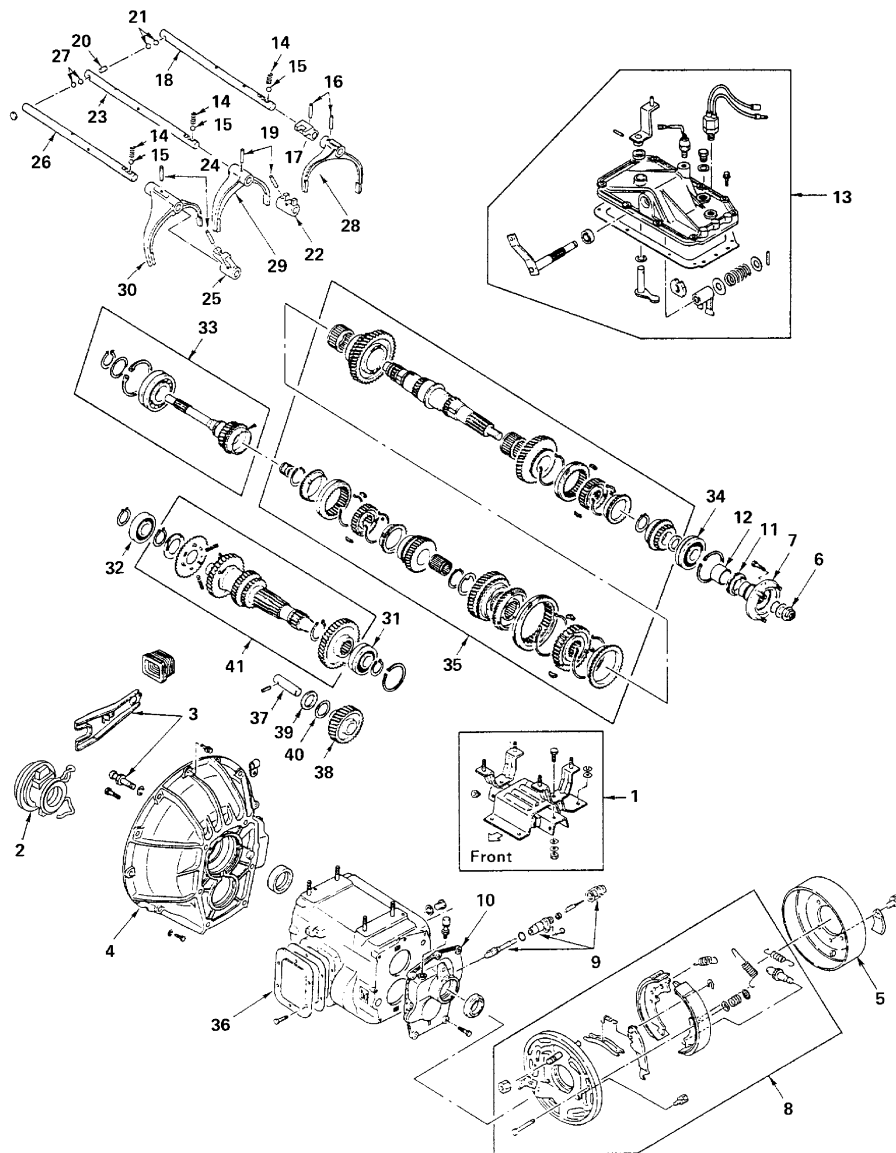
Tighten:

Clutch housing to flywheel housing bolts to

- M10: 46 N·m (4.7 kg·m / 34 lb·ft)
- M12: 91 N·m (9.3 kg·m / 67 lb·ft)

UNIT REPAIR

Major Components



N7A0062E

Legend

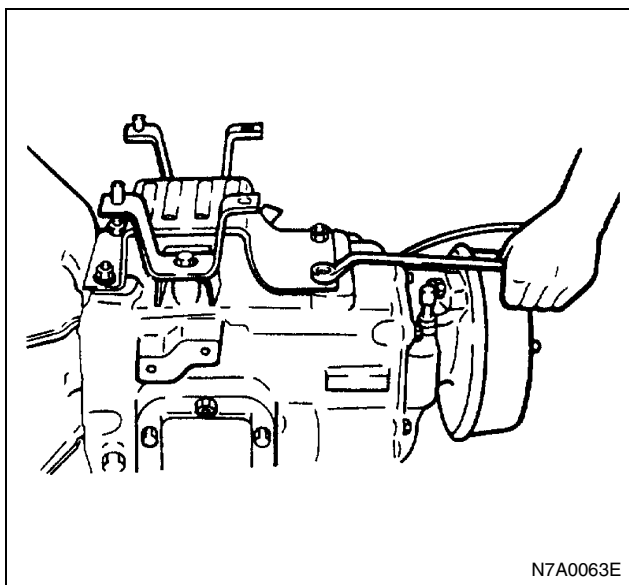
- | | |
|--|---------------------------------|
| 1. Mission mounting assembly | 22. 3rd/4th shift block |
| 2. Release bearing assembly | 23. 3rd/4th shift rod |
| 3. Shift fork and support bolt | 24. Spring pin |
| 4. Clutch housing | 25. 1st/2nd shift block |
| 5. Parking brake drum | 26. 1st/2nd shift rod |
| 6. Lock nut | 27. Interlock ball |
| 7. Coupling driver | 28. 5th/Reverse shift arm |
| 8. Parking brake assembly | 29. 3rd/4th shift arm |
| 9. Vehicle speed sensor driven gear assembly | 30. 1st/2nd shift arm |
| 10. Rear cover | 31. Counter shaft rear bearing |
| 11. Vehicle speed sensor drive gear | 32. Counter shaft front bearing |
| 12. Spacer | 33. Top gear shaft assembly |
| 13. Control box assembly | 34. Main shaft rear bearing |
| 14. Detent spring | 35. Main shaft assembly |
| 15. Detent ball | 36. Side cover |

7B-16 MANUAL TRANSMISSION (MSB)

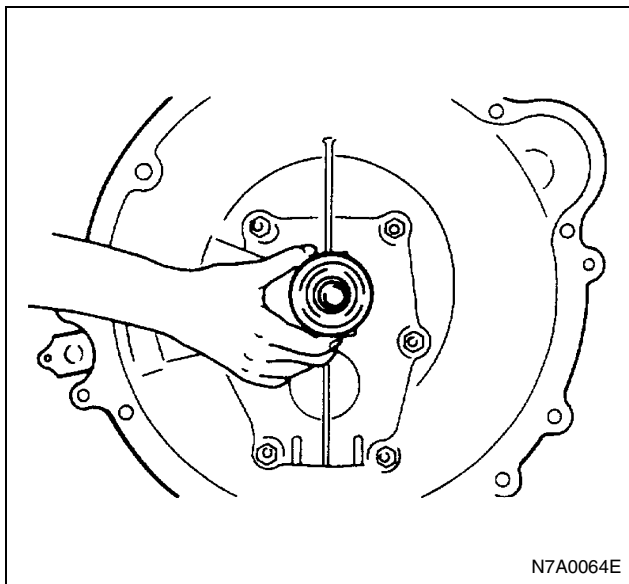
- | | |
|-----------------------------|-----------------------------|
| 16. Spring pin | 37. Reverse idle gear shaft |
| 17. 5th/Reverse shift block | 38. Reverse idle gear |
| 18. 5th/Reverse shift rod | 39. Thrust washer |
| 19. Spring pin | 40. Conical washer |
| 20. Interlock pin | 41. Counter shaft assembly |
| 21. Interlock ball | |

Disassembly

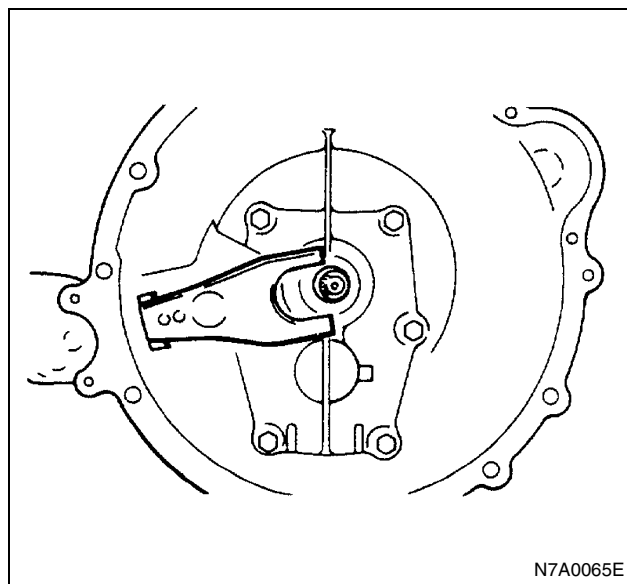
1. Mission Mounting Assembly



2. Release Bearing Assembly



3. Shift Fork and Support Bolt

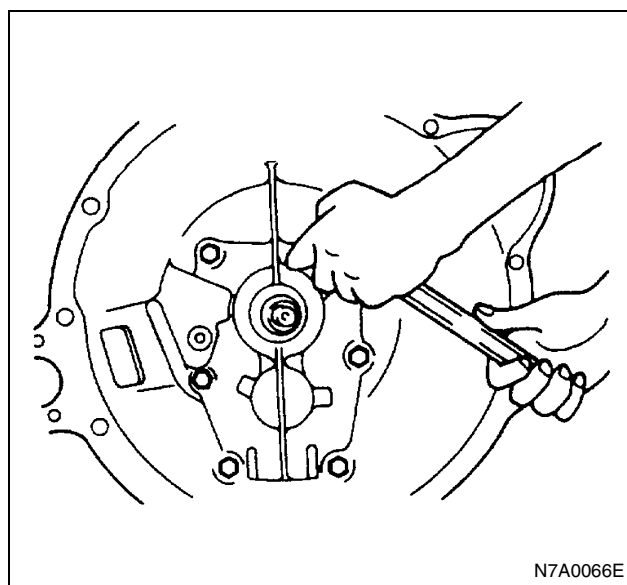


4. Clutch Housing

- Remove the clutch housing from the transmission case.
- Use the screwdriver to remove the oil seal from the clutch housing.

Caution:

Take care not to damage the sealing seat of the clutch housing.

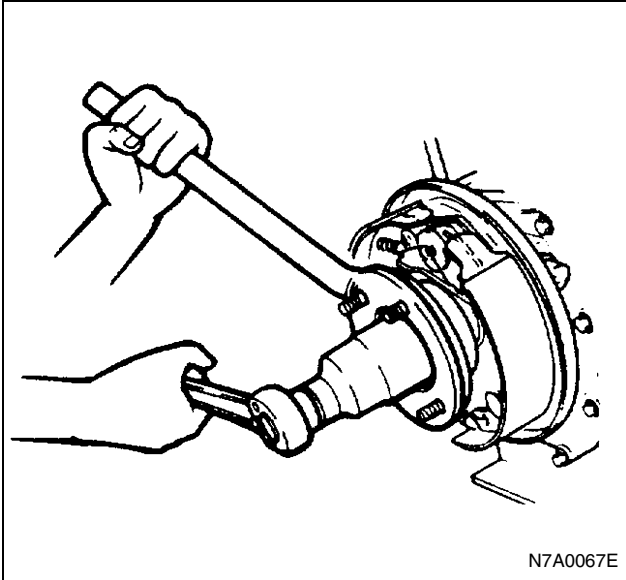


5. Parking Brake Drum

- Remove the screw and the adjust hole cover.
- It may be necessary to back off the shoe adjuster.

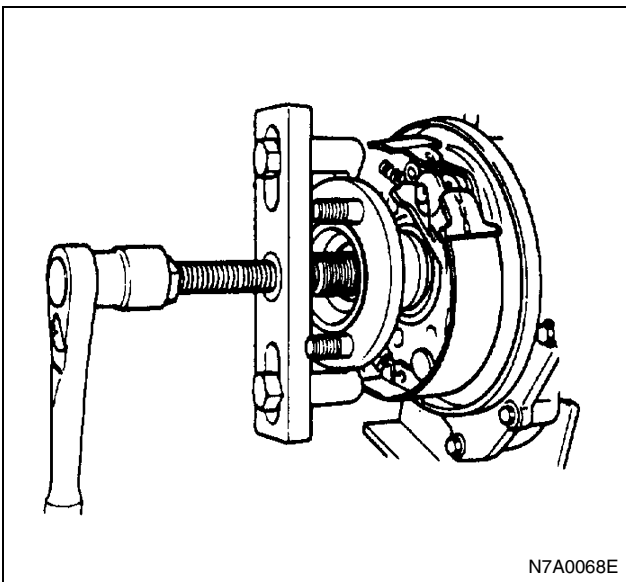
6. Lock Nut

- Make sure to raise the caulking of the coupling driver lock nut.
- Use the handle to remove the lock nut.
Handle: 5-8840-2043-0

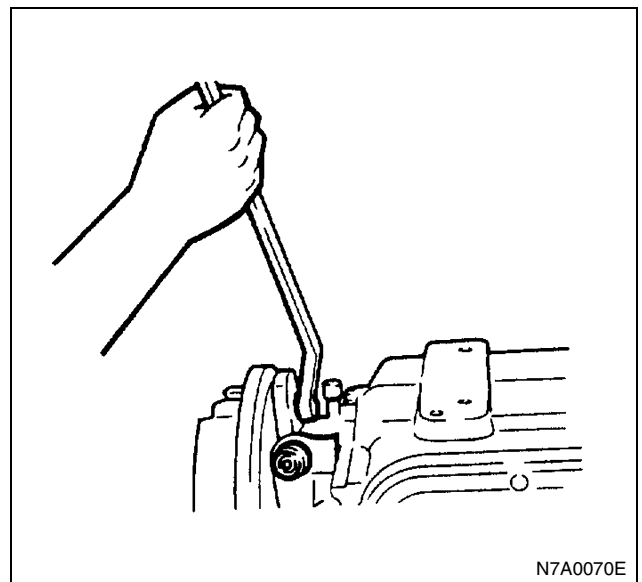
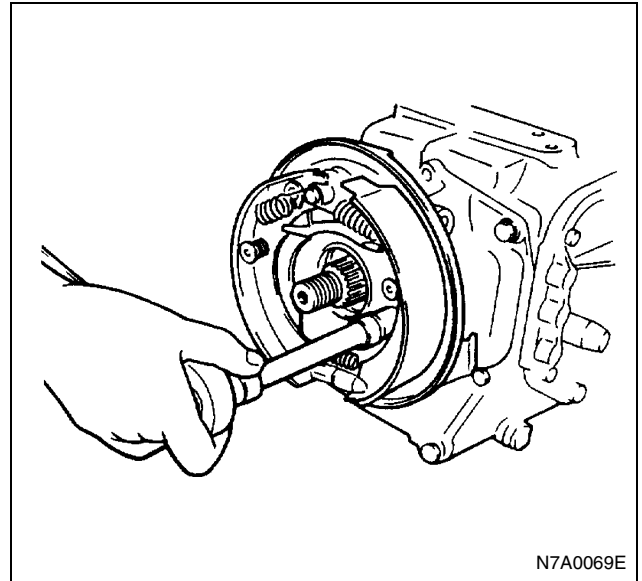


7. Coupling Driver

- Remove coupling driver using the universal puller.
Universal Puller: 5-8840-2027-0
- Remove the conical washer and the O-ring.

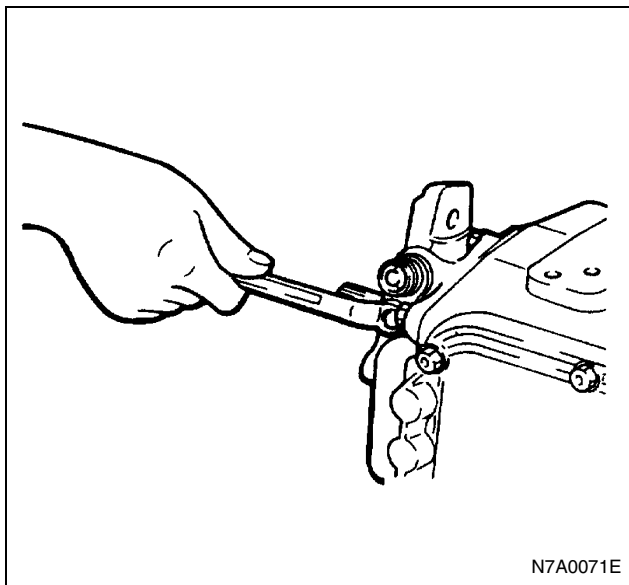


8. Parking Brake Assembly

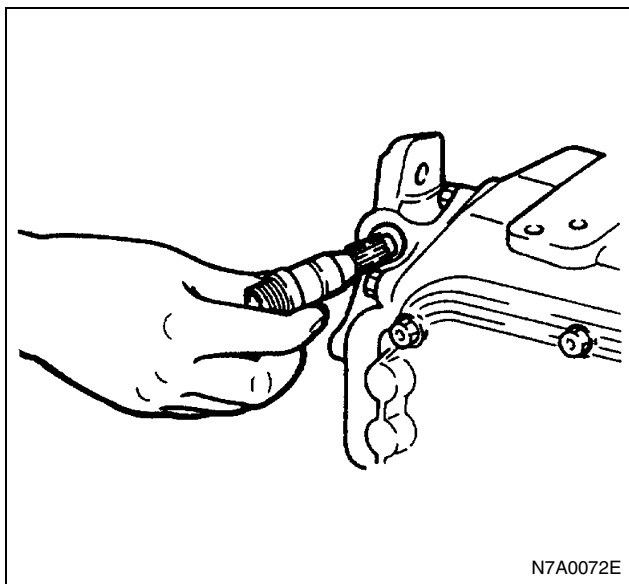
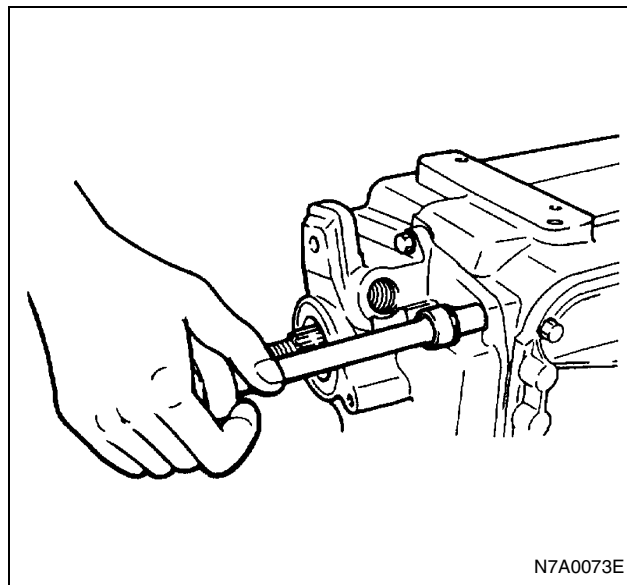


9. Vehicle Speed Sensor Driven Gear Assembly

- Remove the vehicle speed sensor with the key rod.
- Remove the fixing bolt.



- Remove the driven gear assembly.

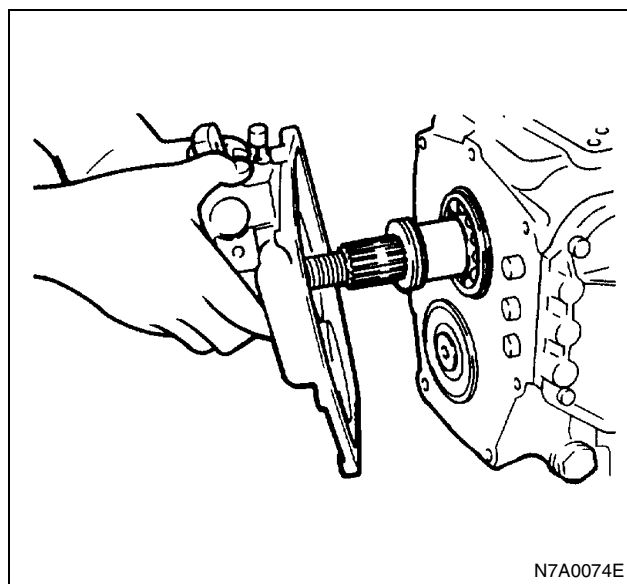


10. Rear Cover

- Remove 7 fixing bolts. Tap the rear cover with a copper or plastic hammer to remove it. The rear cover is provided with lugs for hammering both side.
- Remove the oil seal using the screwdriver.

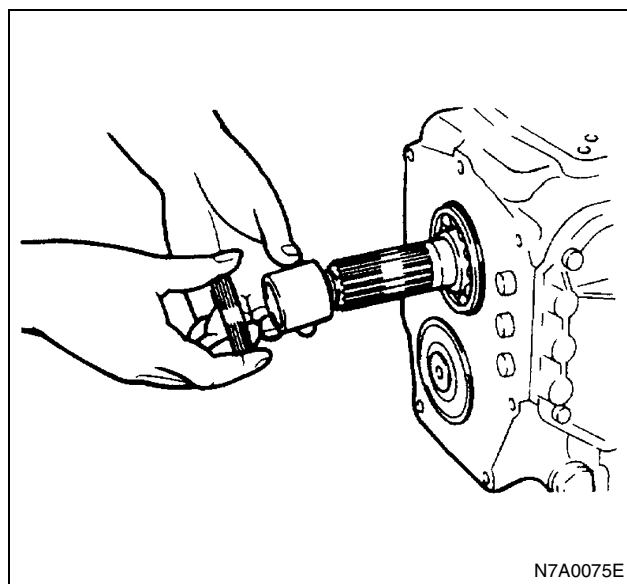
Caution:

Take care not to damage the sealing seat of the rear cover with the screwdriver.



11. Vehicle Speed Sensor Drive Gear

12. Spacer

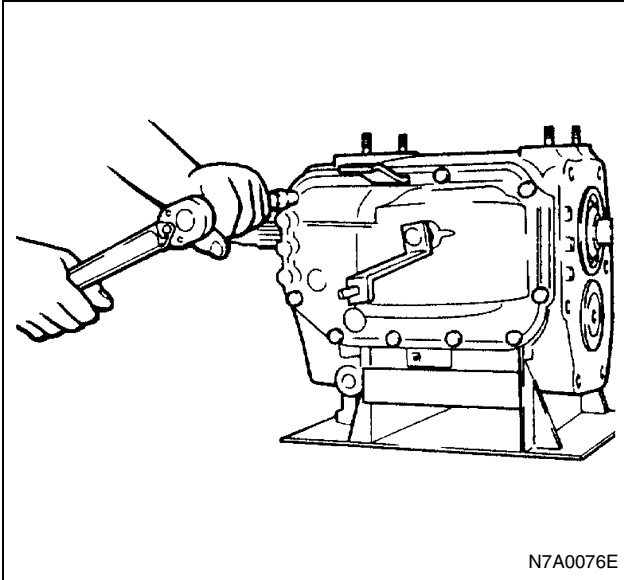


13. Control Box Assembly

- Remove 10 control box fixing bolts, and then prize open the four corners of the control box with a screwdriver to remove the control box assembly.

Notice:

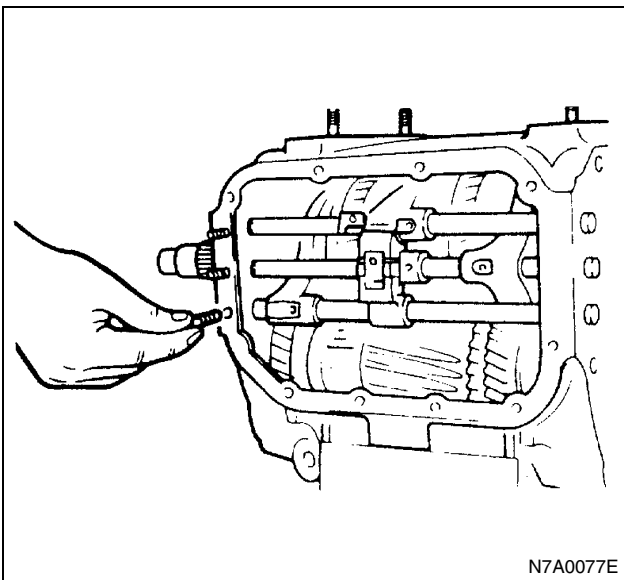
Be careful not to lose the detent springs and balls of the transmission case.



14. Detent Spring

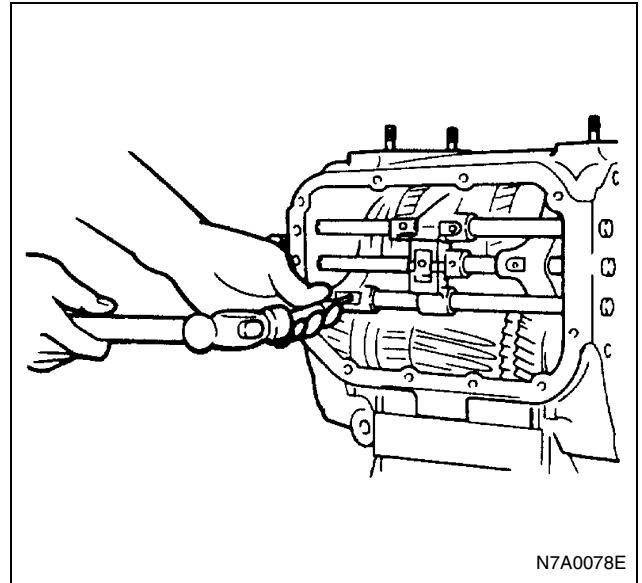
15. Detent Ball

- Take out the three detent springs and the three detent balls from the transmission case.



16. Spring Pin

- Before removal, set all shift rods in neutral position.
Spring Pin Remover: 9-8529-2201-0



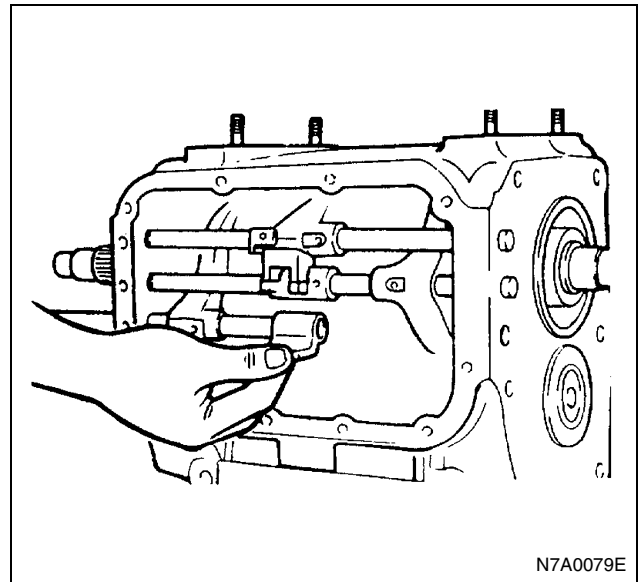
17. 5th/Reverse Shift Block

18. 5th/Reverse Shift Rod

- Move the 5th/reverse shift rod rearward and remove the shift block and shift rod.

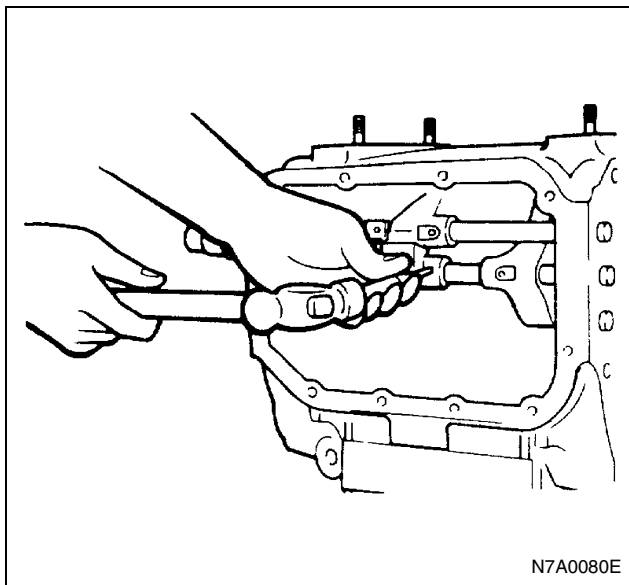
Notice:

When removing the parts, exercise care to prevent the interlock balls and pin fitted to the front part from falling apart.



19. Spring Pin

- Spring Pin Remover: 9-8529-2201-0

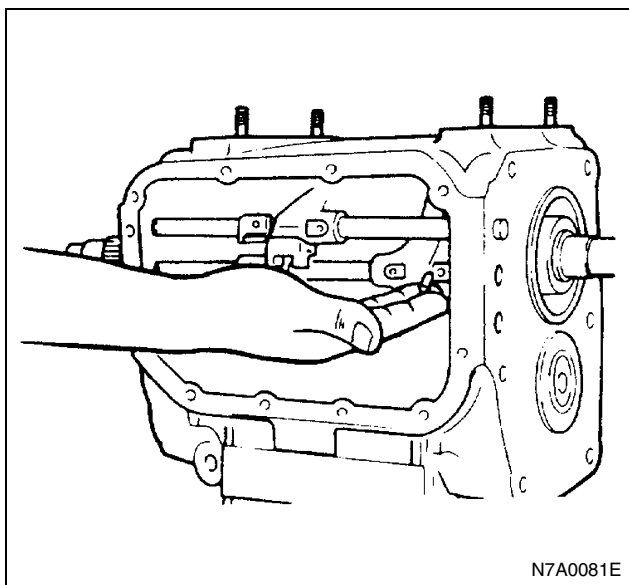


20. Interlock Pin

- Move the 3rd/4th shift rod rearward by pushing its front end.
Then take out the interlock pin from the 3rd/4th shift rod.

21. Interlock Ball

- Take out the 2 interlock balls from the transmission case.



22. 3rd/4th Shift Block

23. 3rd/4th Shift Rod

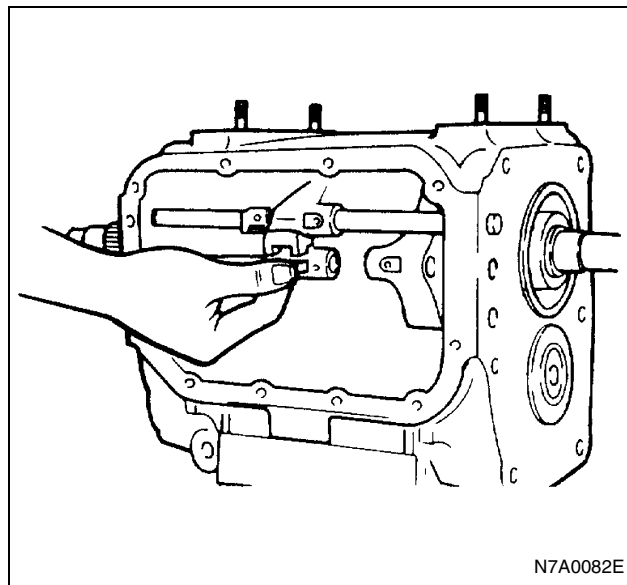
- Move the shift rod rearward and remove the shift block and shift rod.

Notice:

When removing the parts, exercise care to prevent the interlock balls fitted to the front part from falling apart.

24. Spring Pin

Spring Pin Remover: 9-8529-2201-0



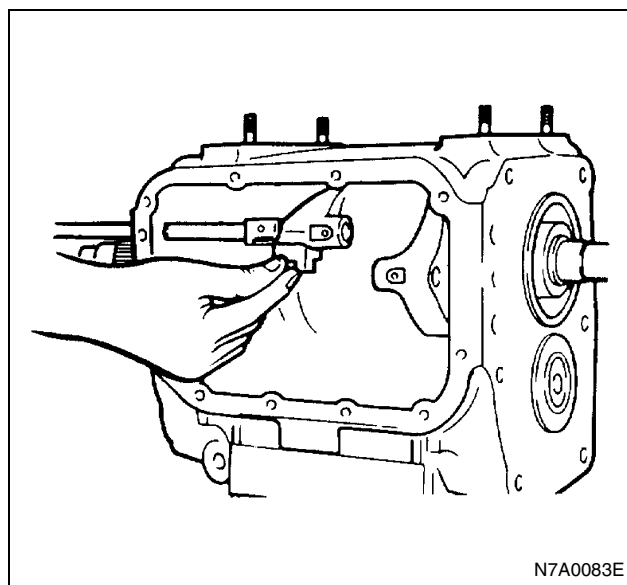
25. 1st/2nd Shift Block

26. 1st/2nd Shift Rod

- Move the shift rod rearward and remove the shift block and shift rod.

27. Interlock Ball

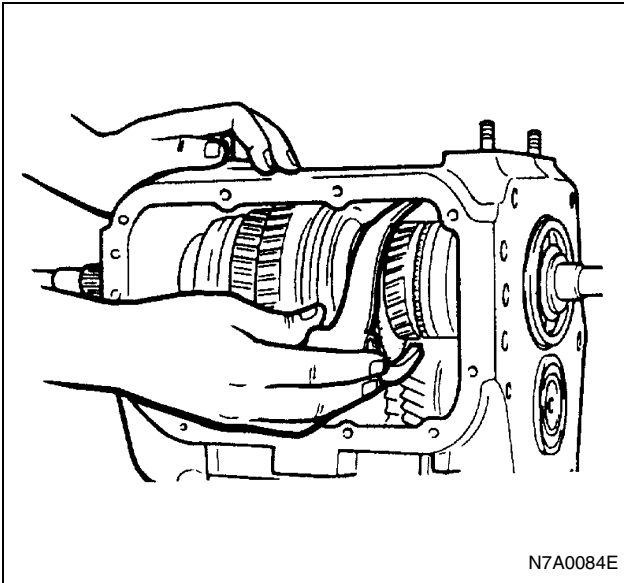
- Take out the 2 interlock balls from the transmission case.



28. 5th/Reverse Shift Arm

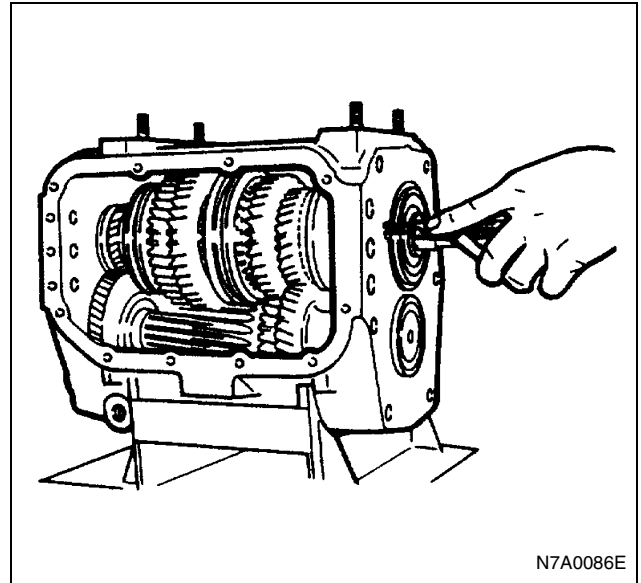
29. 3rd/4th Shift Arm

30. 1st/2nd Shift Arm

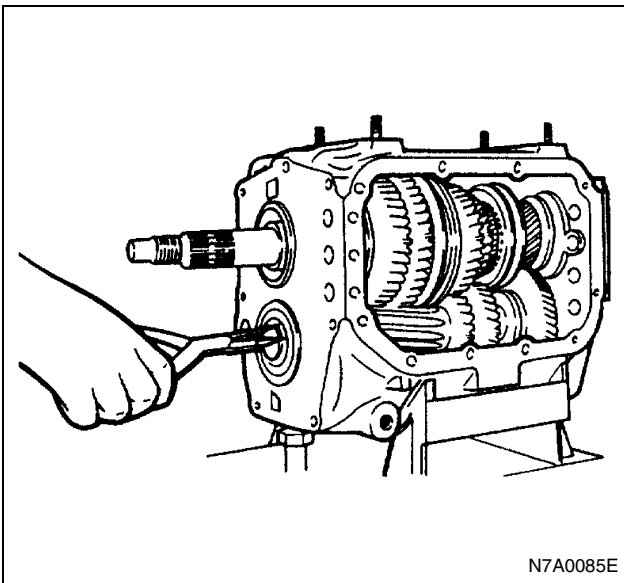


31. Counter Shaft Rear Bearing

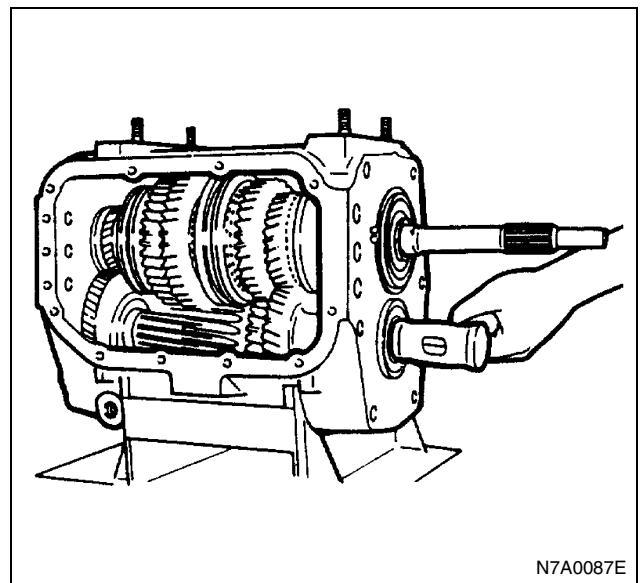
- Remove the snap ring from the counter shaft rear end.



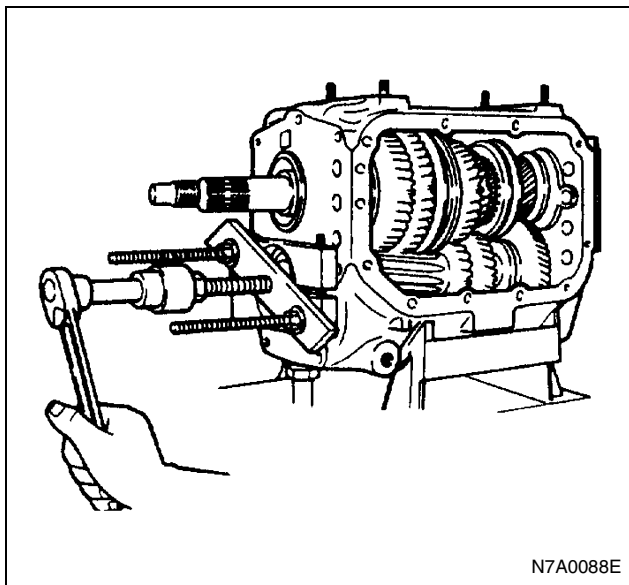
- Move the counter shaft approximately 3 mm (0.1 in) rearward by tapping on its front end with brass or plastic hammer.
- Remove the snap ring from the rear bearing outer circumference.



- Remove the snap ring from the top gear shaft bearing outer circumference.

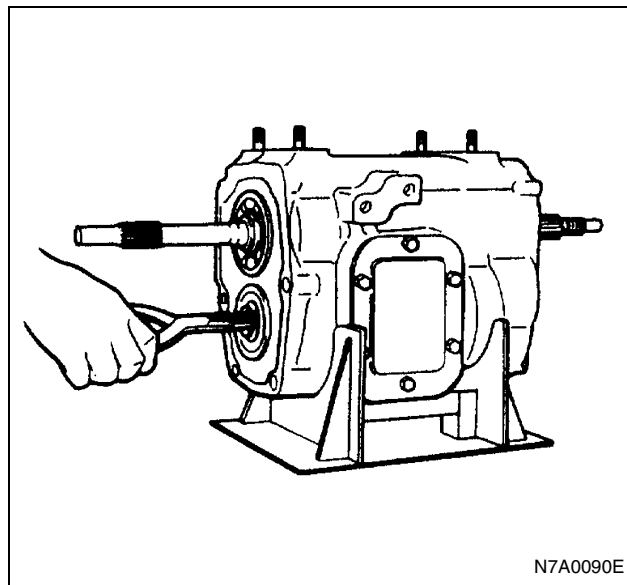


- Set the bearing remover to the snap ring groove to remove the rear bearing.
Bearing Remover: 5-8840-2042-0
Universal Puller: 5-8840-2027-0

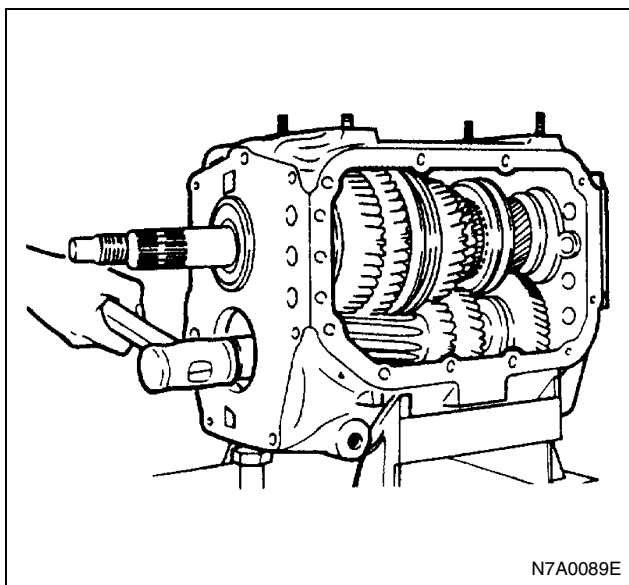


32. Counter Shaft Front Bearing

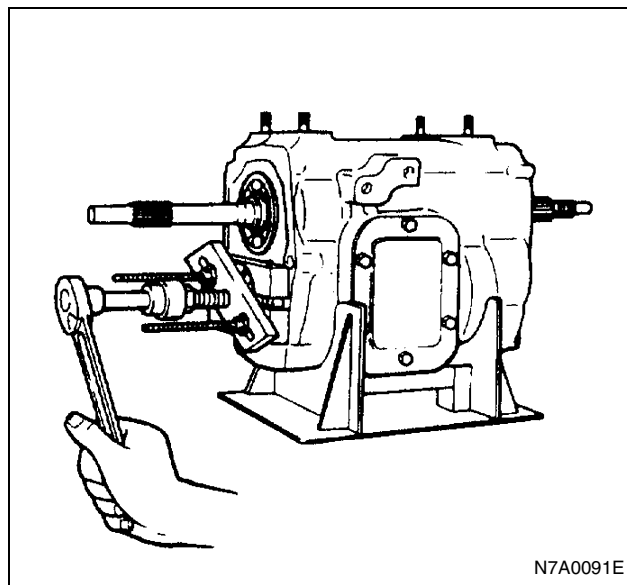
- Move the counter shaft approximately 3 mm (0.1 in) forward by tapping on its rear end with brass or plastic hammer.



- Set the bearing remover to the snap ring groove to remove the front bearing.
Bearing Remover: 5-8840-2078-0
Universal Puller: 5-8840-2027-0

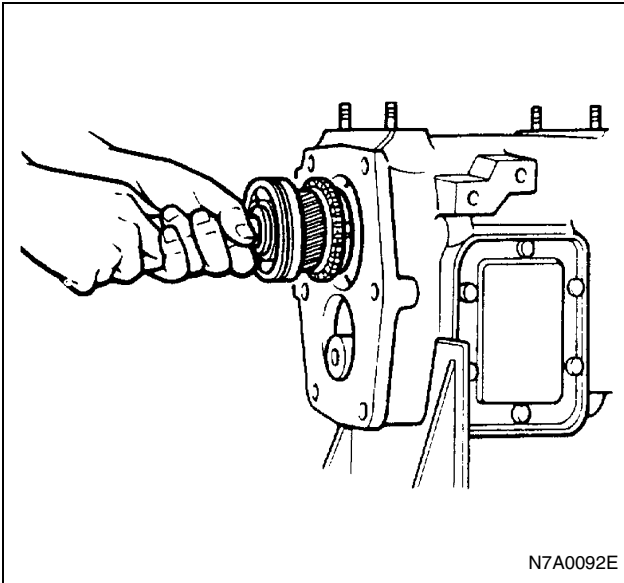


- Remove the snap ring from the counter shaft front end.



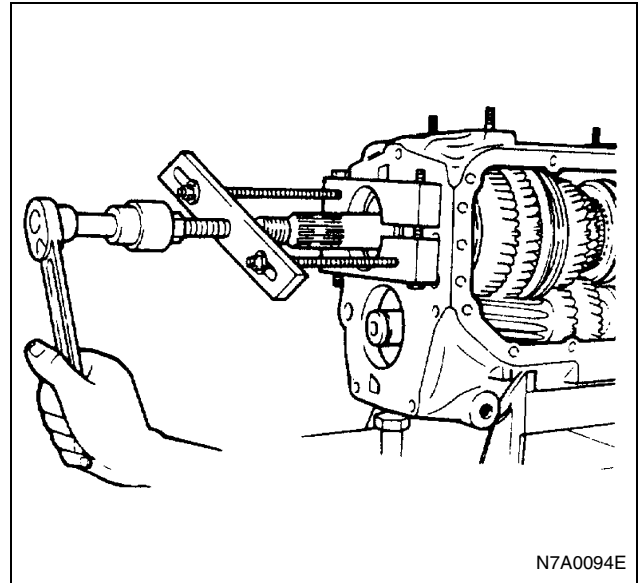
33. Top Gear Shaft Assembly

- Remove the top gear shaft bearing outer race toward front end using a hammer and soft metal bar.
- Remove the block ring and needle bearing.



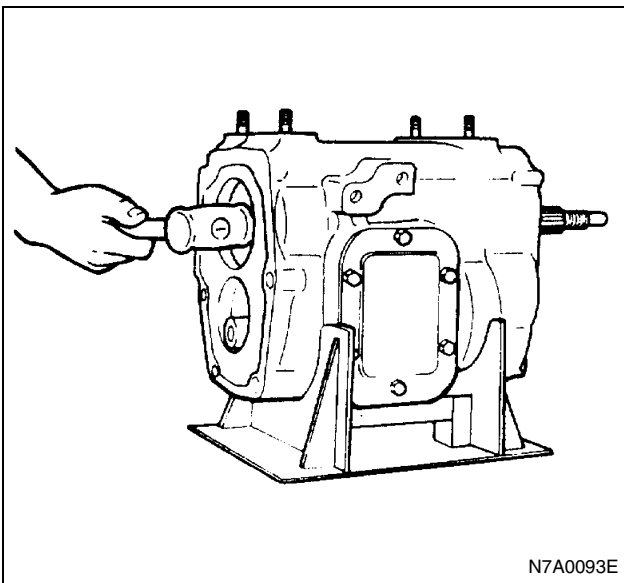
34. Main Shaft Rear Bearing

- Move the main shaft approximately 3 mm (0.1 in) rearward by tapping on its front end with brass or plastic hammer.



35. Main Shaft Assembly

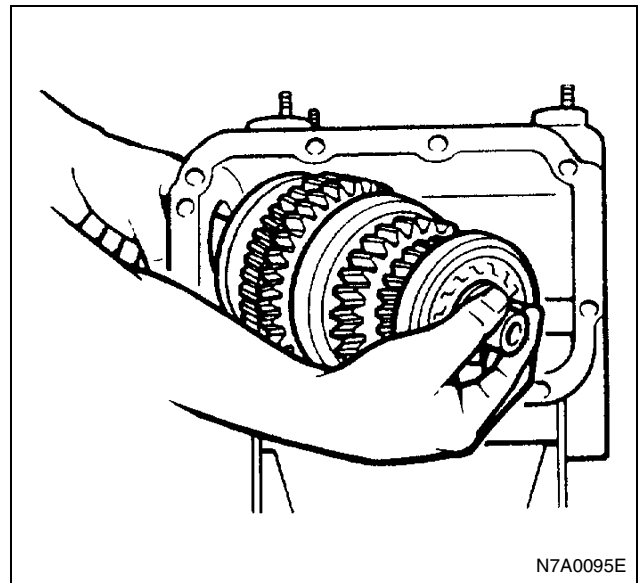
- Take main shaft assembly out from the transmission case.



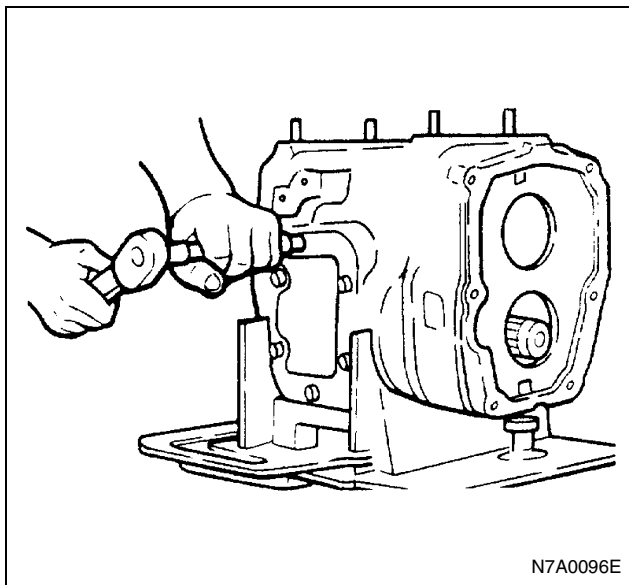
- Remove the snap ring and set the bearing remover to the snap ring groove to remove the bearing.

Bearing Remover: 5-8840-2078-0

Universal Puller: 5-8840-2027-0

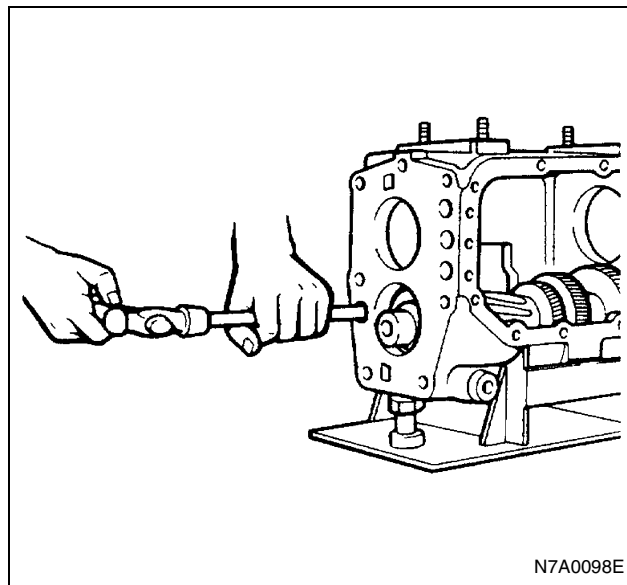


36. Side Cover



37. Reverse Idle Gear Shaft

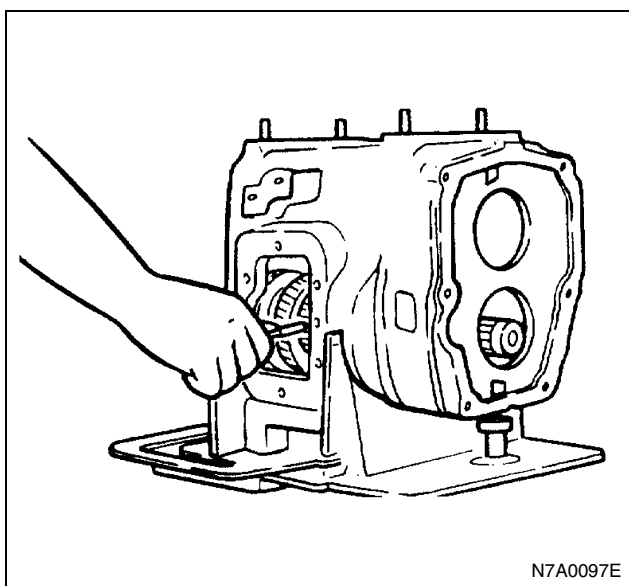
- Take out the pin of reverse idle gear shaft from the transmission case.



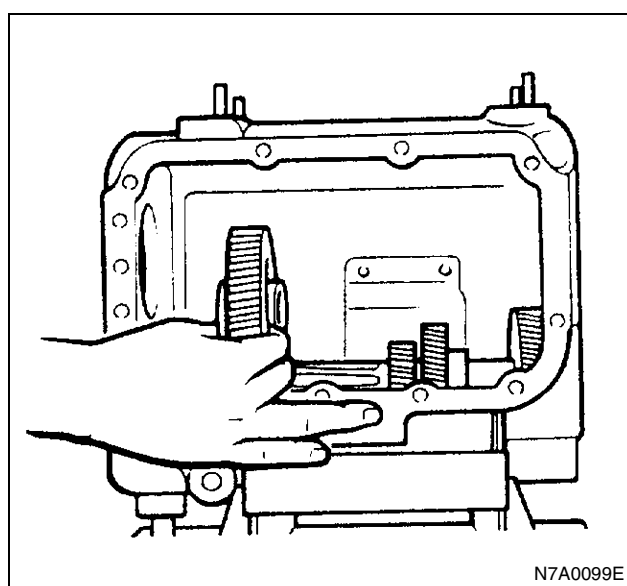
38. Reverse Idle Gear

39. Thrust Washer

40. Conical Spring

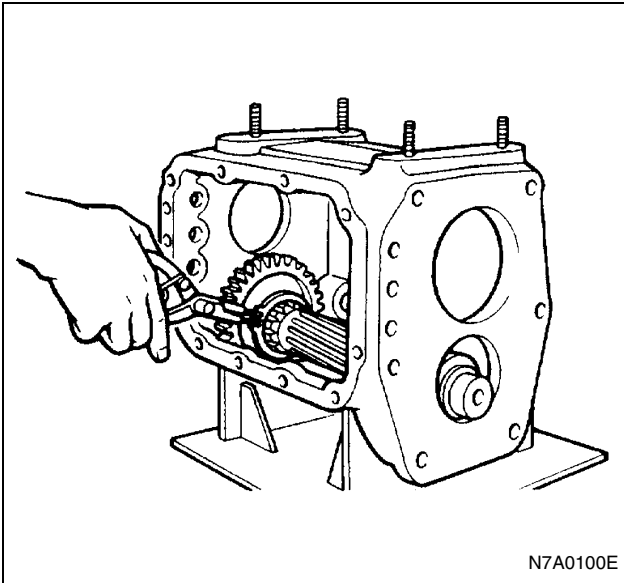


- Drive out the reverse idle gear shaft inward the transmission case, with a suitable bar at the end of reverse gear shaft.

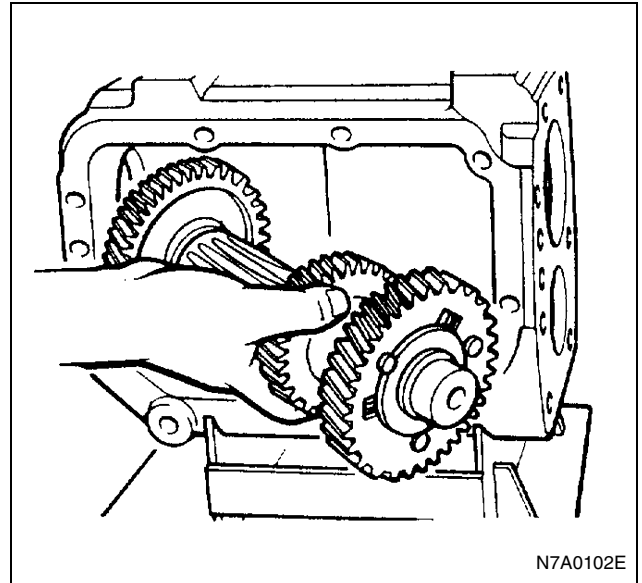


41. Counter Shaft Assembly

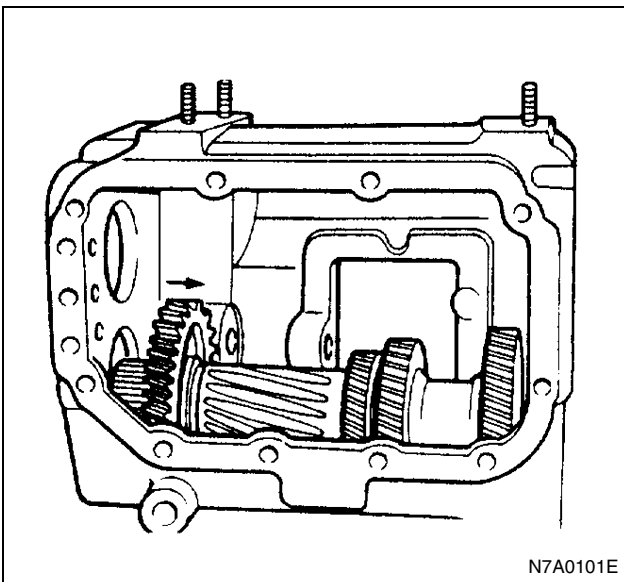
- Remove the snap ring of the counter 5th gear and place aside inward temporarily.



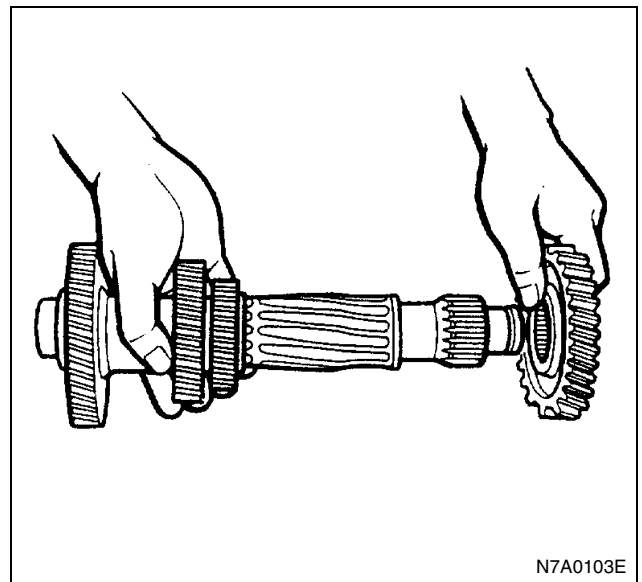
- Move the counter 5th gear inward and take it out together with the counter shaft assembly.



- Remove the counter 5th gear and the snap ring from the counter shaft.



- Remove the counter shaft assembly from the transmission case.



Reassembly

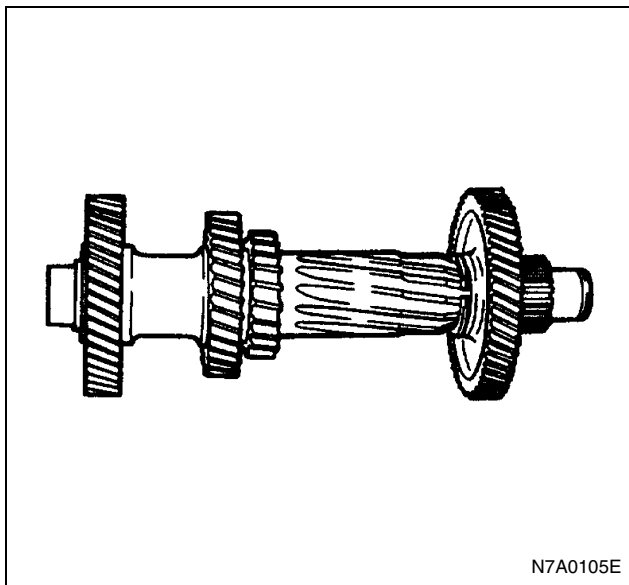
Notice:

Clean each part thoroughly.

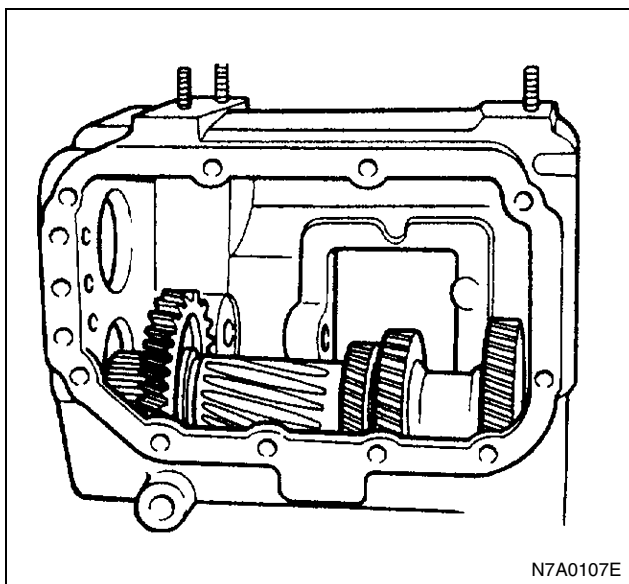
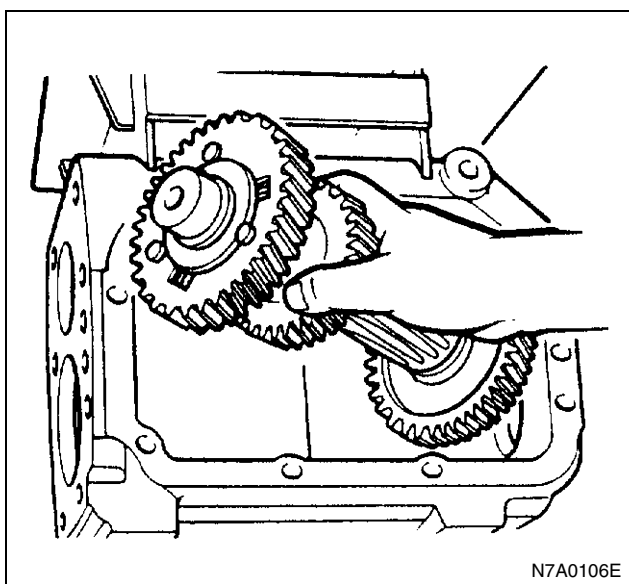
When assembling parts, apply clean engine oil (SAE 5W-30) to their sliding and mating sections.

1. Counter Shaft Assembly

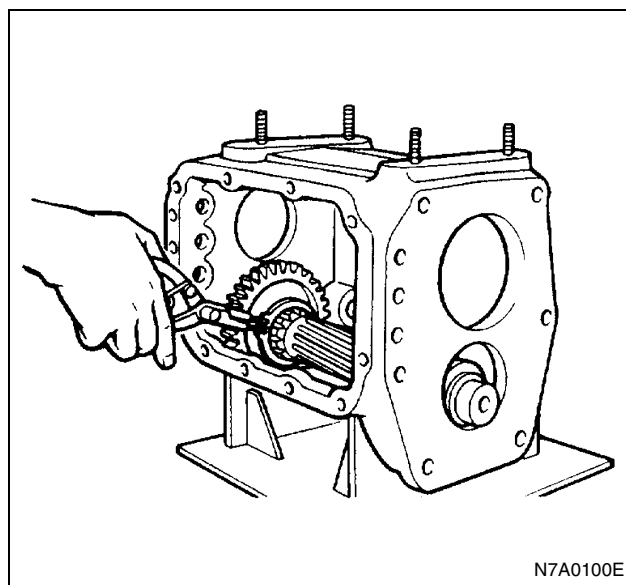
- Install the snap ring to the counter shaft and place it aside inward temporarily.
- Then install the counter 5th gear and move it inward.



- Install the counter shaft assembly in the transmission case.

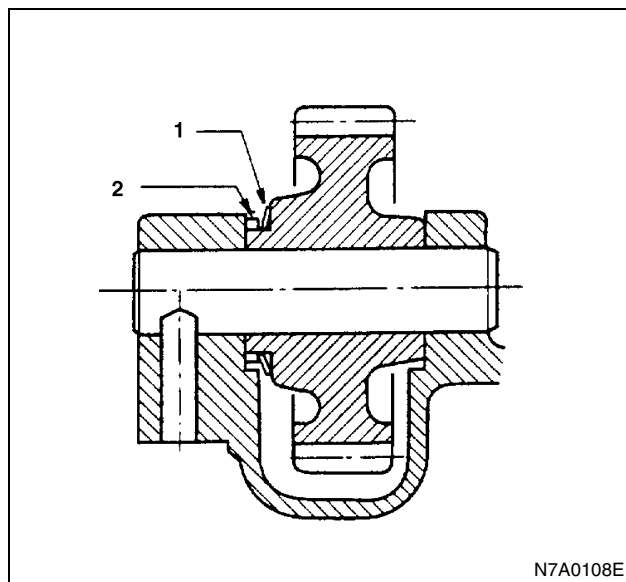


- Install the snap ring to fix the counter 5th gear.

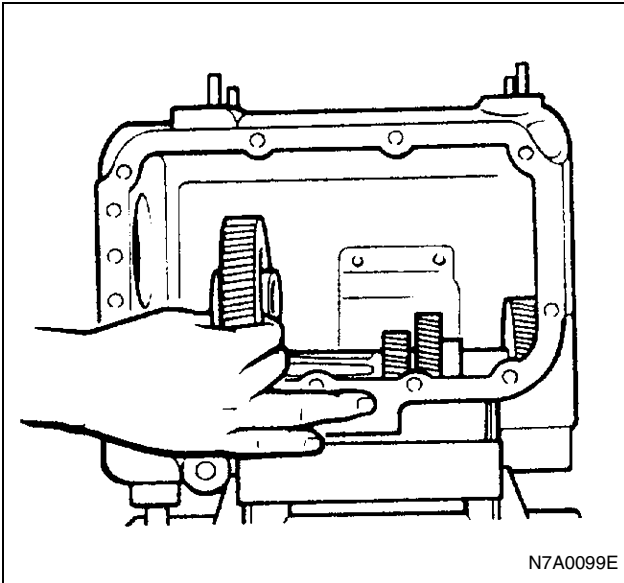


2. Reverse Idle Gear
3. Conical Spring
4. Thrust Washer

- Install the conical spring (1) and the thrust washer (2) to the reverse idle gear.
- The conical spring is to be set up with its concave face to the gear side shown in the illustration.

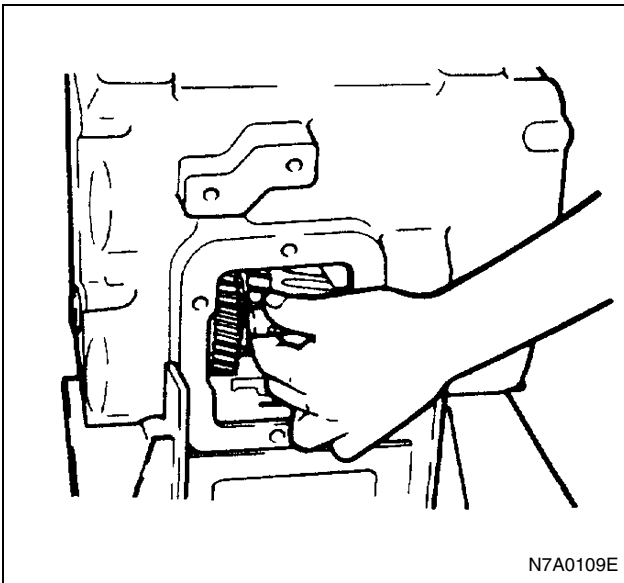


- The reverse idle gear should be installed with the thrust washer side turned to the forward.

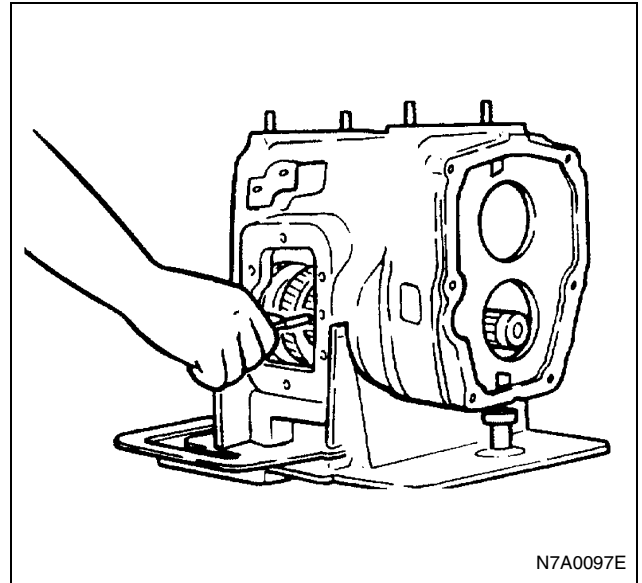


5. Reverse Idle Gear Shaft

- Aligning the knock pin hole on the reverse idle gear shaft with its hole of the transmission case.



- Then insert the knock pin.

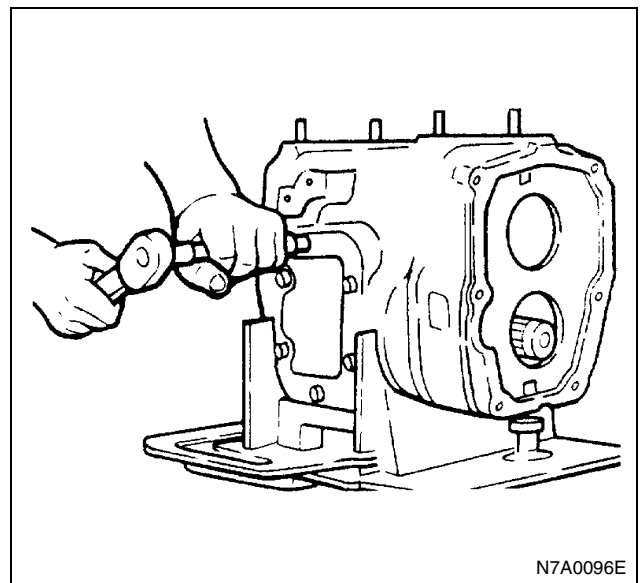


6. Side Cover

- Install the side cover with new gasket.

Tighten:

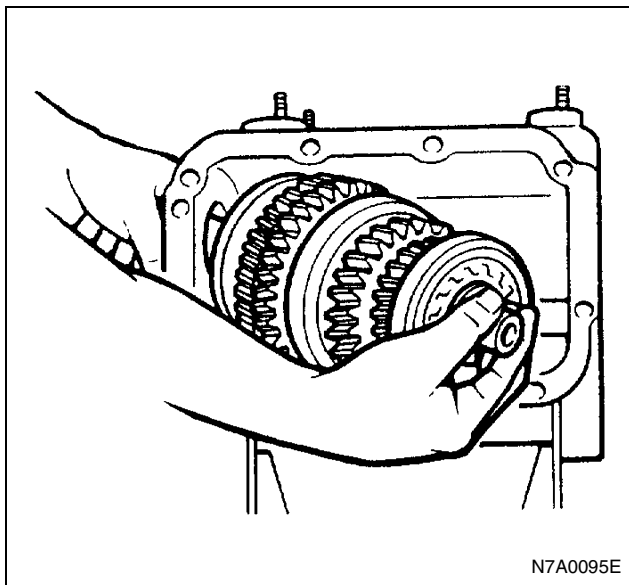
Side cover bolt to 18 N·m (1.8 kg·m / 13 lb·ft)



7. Main Shaft Assembly

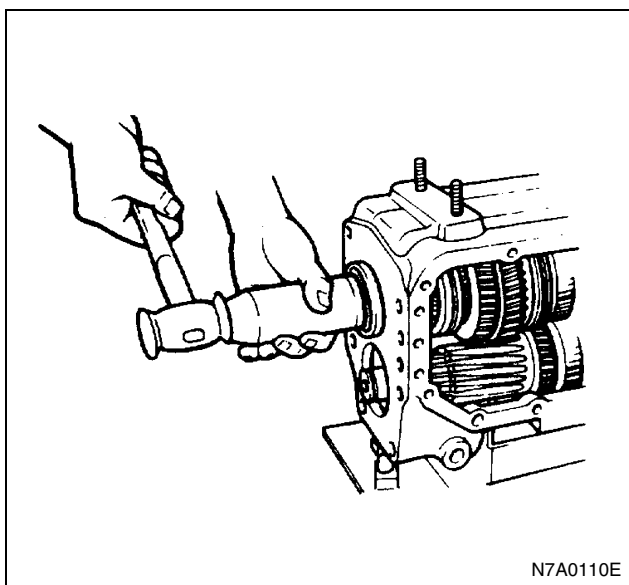
Notice:

Take care that the thrust washer of the reverse gear does not drop off.



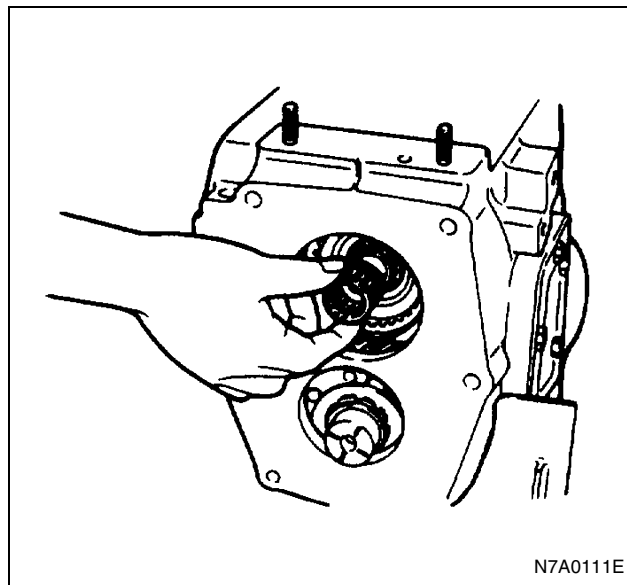
8. Main Shaft Rear Bearing

- Install the snap ring to the rear bearing outer circumference.
- Install the rear bearing using the bearing installer.
Bearing Installer: 9-8522-1615-0
- Check to be certain the block ring on the 5th gear side fitted properly to the inserts.

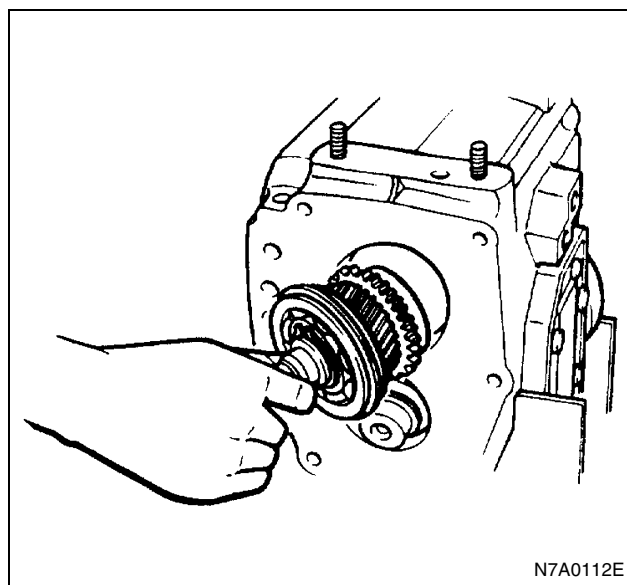


9. Top Gear Shaft Assembly

- Install the needle bearing to the top gear shaft.

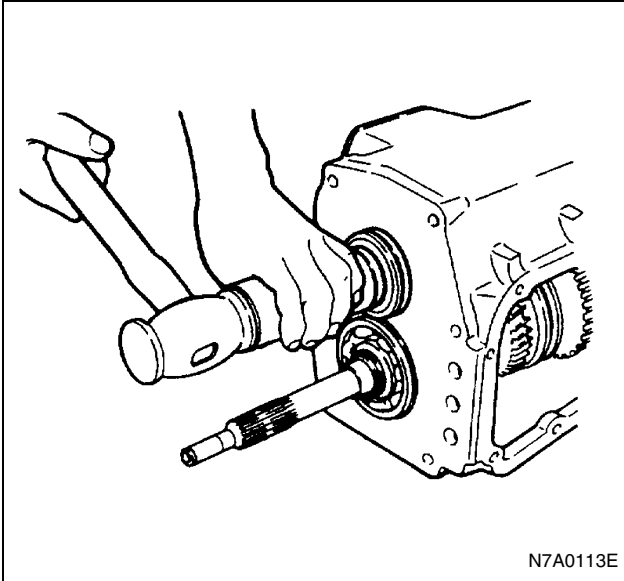


- Install the top gear shaft assembly into the transmission case.
- Check to be certain the block ring on the 4th gear side fitted properly to the inserts.
- Press in the bearing until the snap ring of the bearing outer circumference comes into contact with the transmission case.



10. Counter Shaft Front Bearing

- Use the bearing installer to install the front bearing.
Bearing installer: 5-8840-2244-0
- Install the counter shaft snap ring.



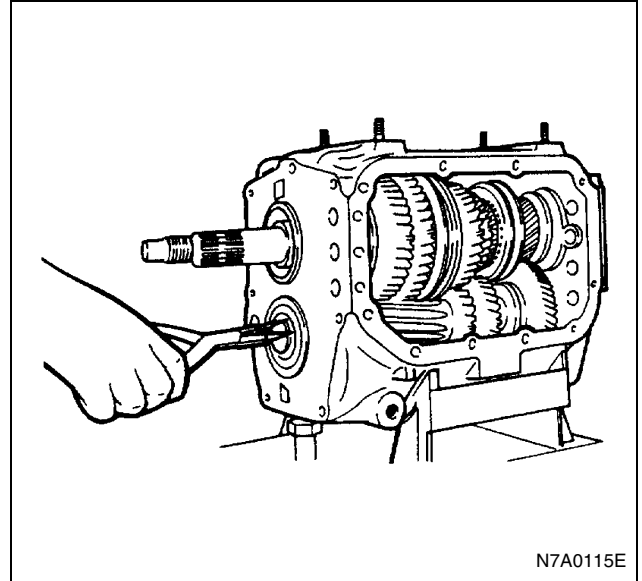
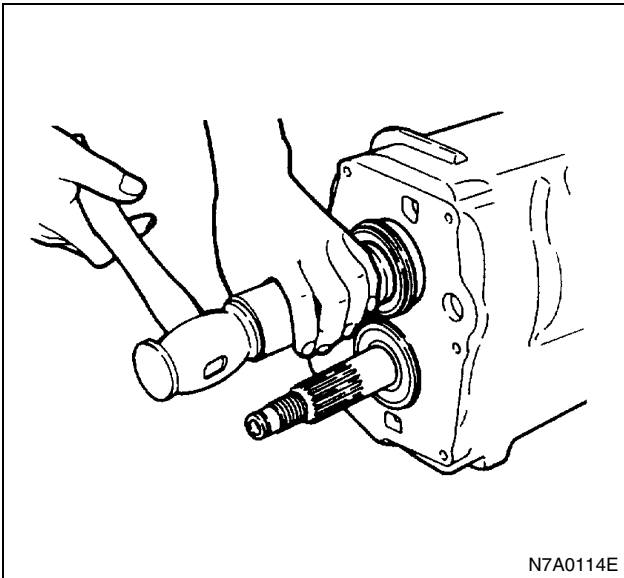
11. Counter Shaft Rear Bearing

- Install the snap ring to the rear bearing outer circumference.
- Install the rear bearing using bearing installer and install the snap ring.
Bearing Installer: 5-8840-2244-0

Notice:

With each gear set to the neutral position, check to see if the shaft and each gear rotate smoothly.

Check to see if each block ring is free. When it gets caught and stuck in the taper cone, use a screwdriver to make it free.



12. 1st/2nd Shift Arm

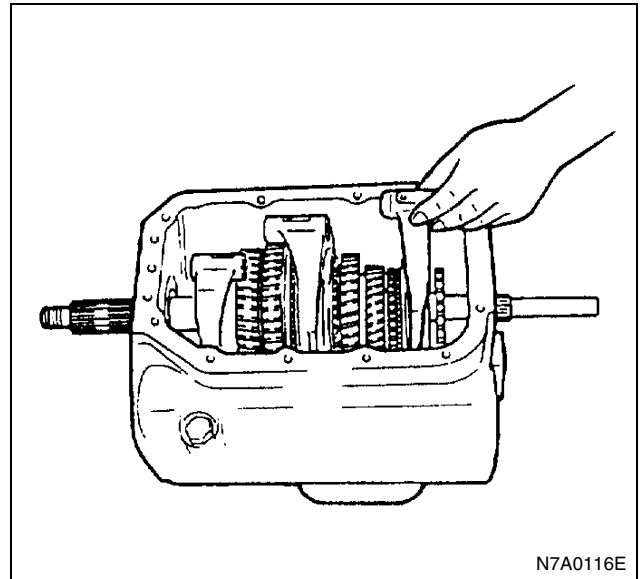
- With the longer boss side set to the front.

13. 3rd/4th Shift Arm

- With the longer boss side set to the rear.

14. 5th/Reverse Shift arm

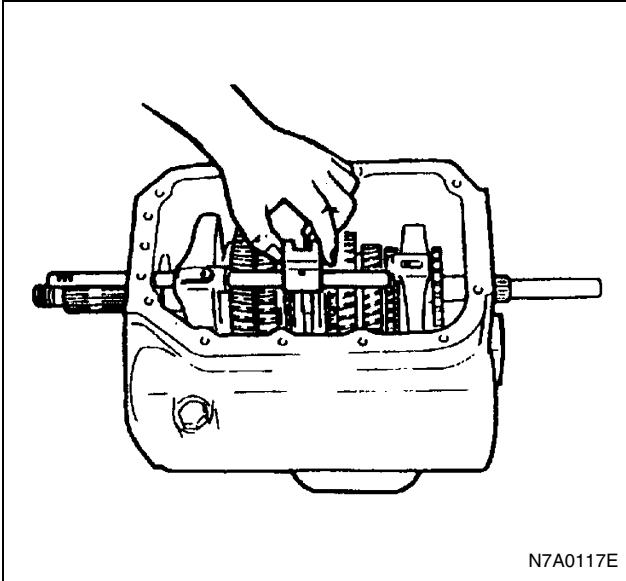
- With the longer boss side set to the front.



15. 5th/Reverse Shift Rod

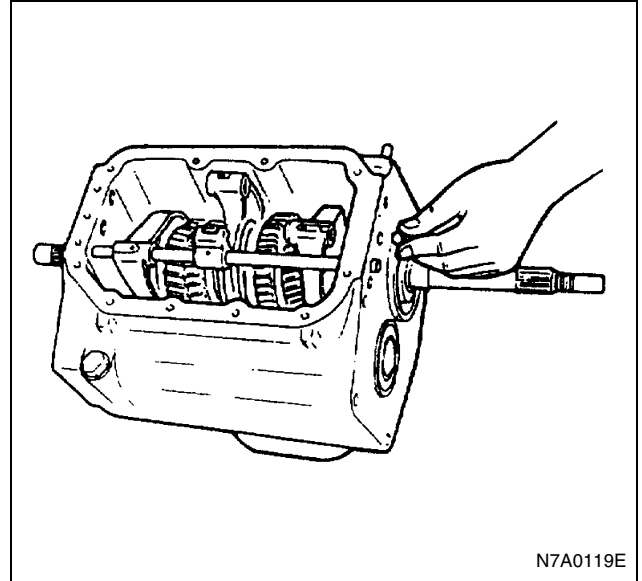
16. 5th/Reverse Shift Block

- Turning the detent groove to the outside (detent ball side), insert the shift rod from the rear side with the detent groove side at the rear.



17. Spring Pin

- Setting the hole of the shift arm and shift block to that of the shift rod, fix them with a new spring pin.
- Install spring pin properly with the slit in line with the shaft center line.

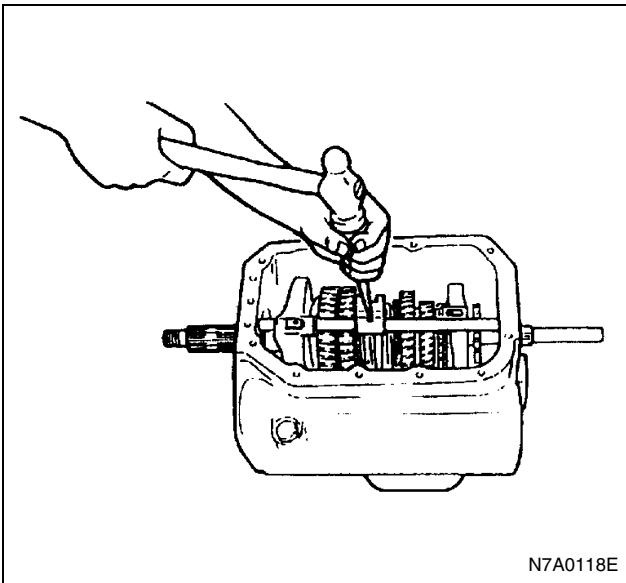


19. Interlock Pin

20. 3rd/4th Shift Rod

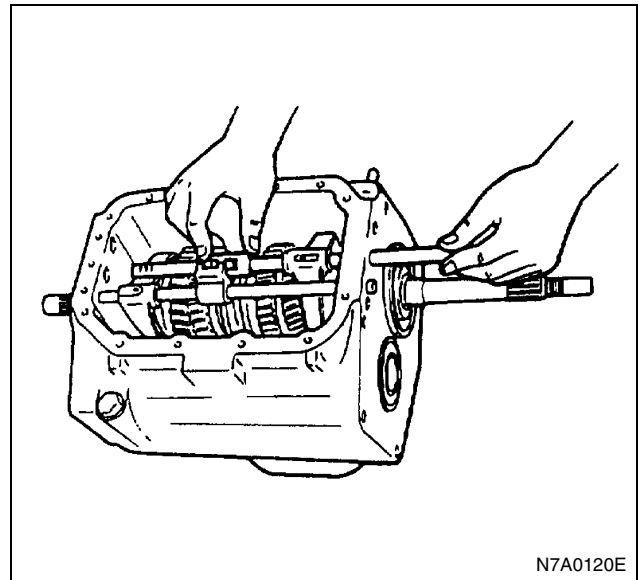
21. 3rd/4th Shift Block

- Apply small amount of multi-purpose grease to the interlock pin.
- Insert an interlock pin into the 3rd/4th shift rod.
- Turning the detent groove to the outside (detent ball side), insert the shift rod from the front side with the detent groove side at the front.



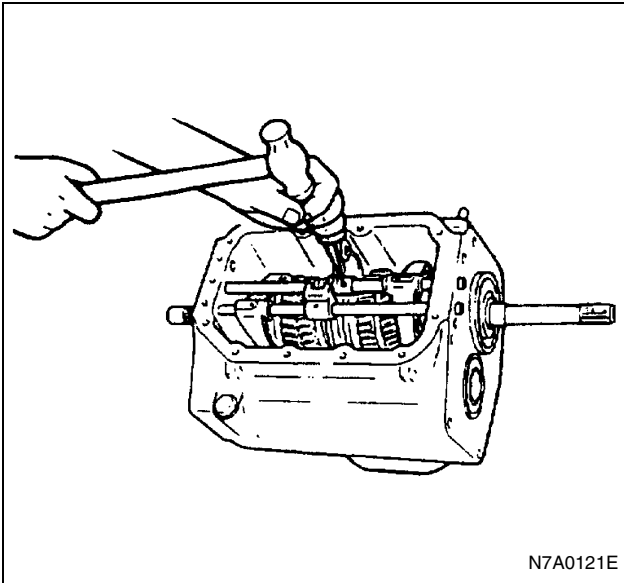
18. Interlock Ball

- Apply small amount of multi-purpose grease to the interlock balls.
- Install the 2 interlock balls in position between the 5th/reverse shift rod and 3rd/4th shift rod.



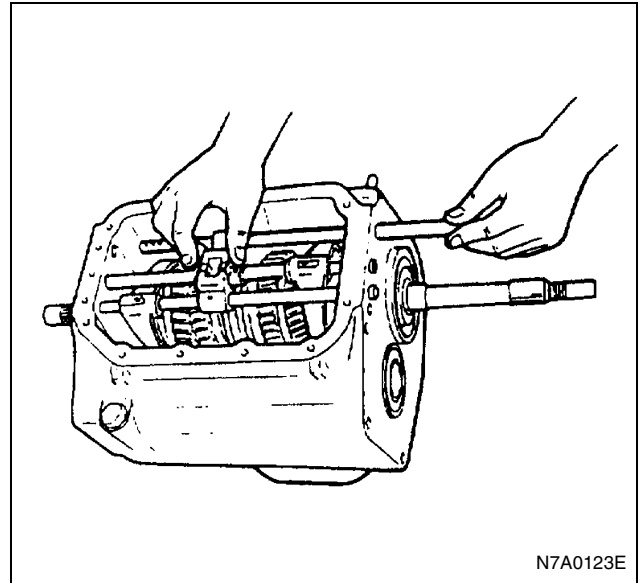
22. Spring Pin

- Setting the hole of the shift arm and shift block to that of the shift rod, fix them with a new spring pin.
- Install spring pin properly with the slit in line with the shaft center line.



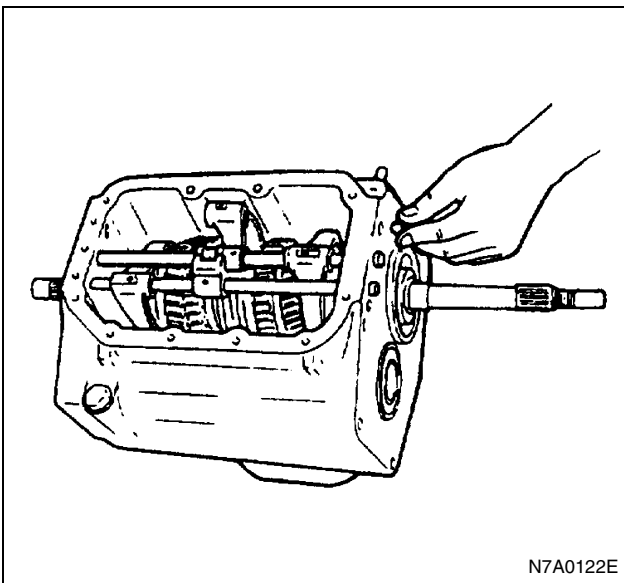
23. Interlock Ball

- Apply small amount of multi-purpose grease to the interlock balls.
- Install the 2 interlock balls in position between the 3rd/4th shift rod and 1st/2nd shift rod.



26. Spring Pin

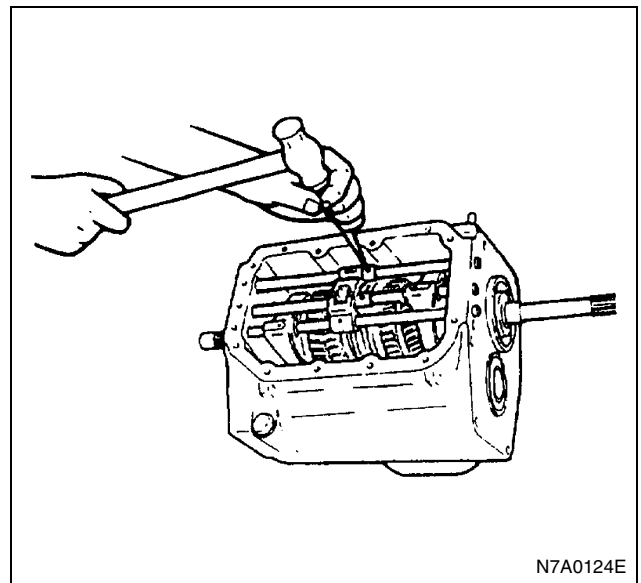
- Setting the hole of the shift arm and shift block to that of the shift rod, fix them with a new spring pin.
- Install spring pin properly with the slit in line with the shaft center line.



24. 1st/2nd Shift Rod

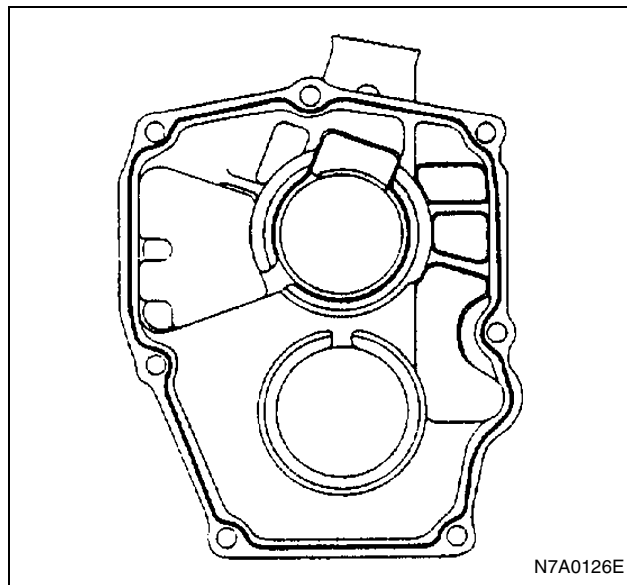
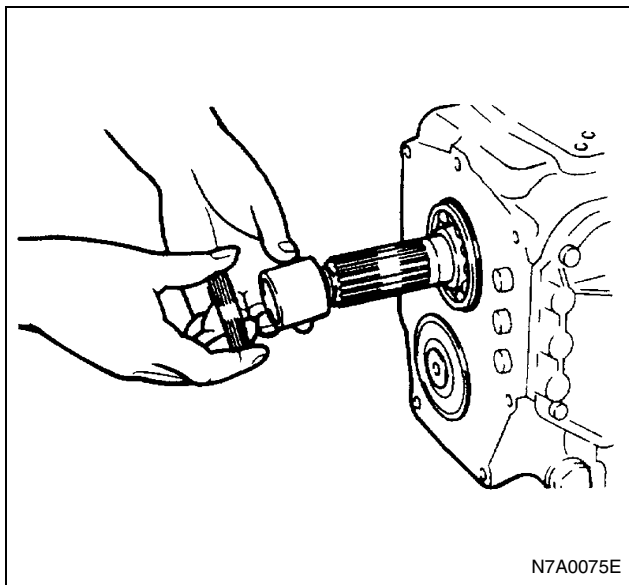
25. 1st/2nd Shift Block

- Before reassembly, set the 5th/reverse and 3rd/4th shift rods already reassembled in neutral position.
- Turning the detent groove to the outside (detent ball side), insert the shift rod from the front side with the detent groove side at the front.



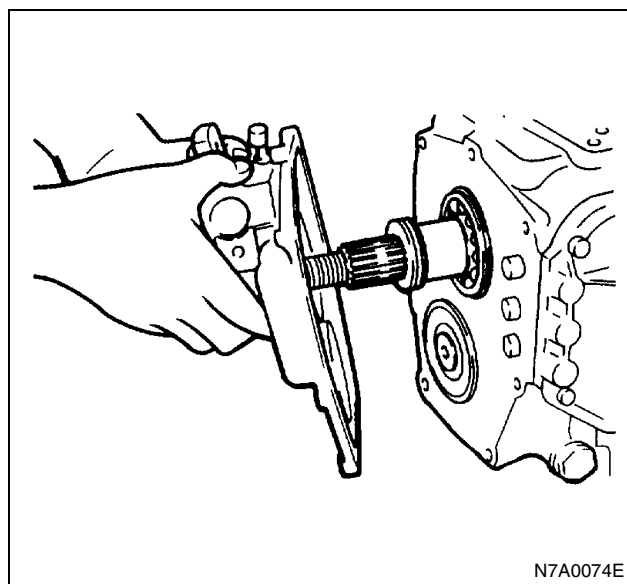
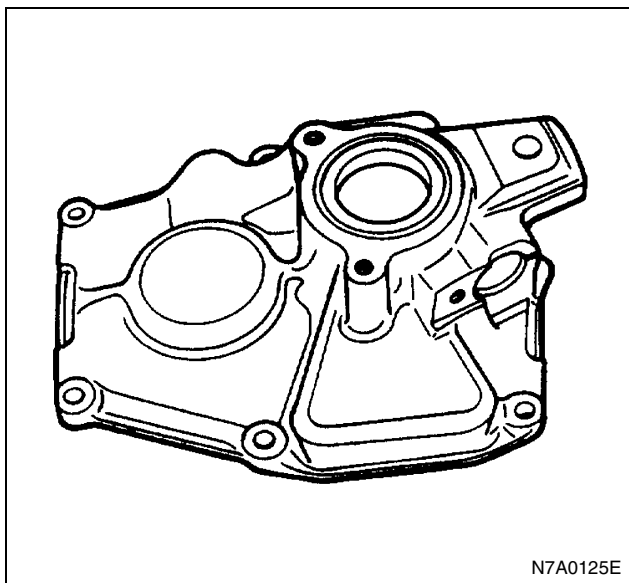
27. Spacer

28. Vehicle Speed Sensor Drive Gear



29. Rear Cover

- Apply engine oil to the new oil seal outer circumference and apply multi-purpose grease to the oil seal lip.
 - Use the oil seal installer to install oil seal to the rear cover.
- Oil Seal Installer: 5-8840-2242-0



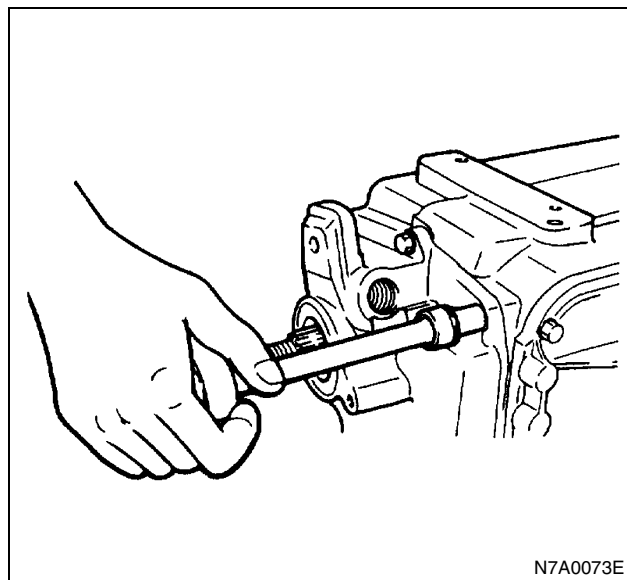
Tighten:

Rear cover bolts to 20 N·m (2.0 kg·m / 14 lb·ft)

- Remove water and oil on the mating face before applying the liquid gasket.
- Apply a $\phi 2$ mm (0.1 in) bead of the liquid gasket (Three Bond 1215 or equivalent) to the rear cover surface shown in the illustration.

Caution:

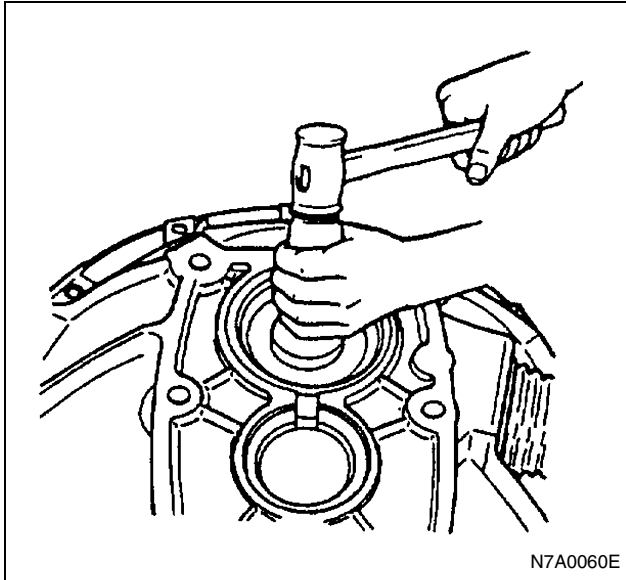
Install the rear cover on the transmission case within 30 minutes after liquid gasket application.



30. Clutch Housing

- Apply engine oil to the new oil seal outer circumference and apply multi-purpose grease to the oil seal lip.
- Use the oil seal installer to install the oil seal to the clutch housing.

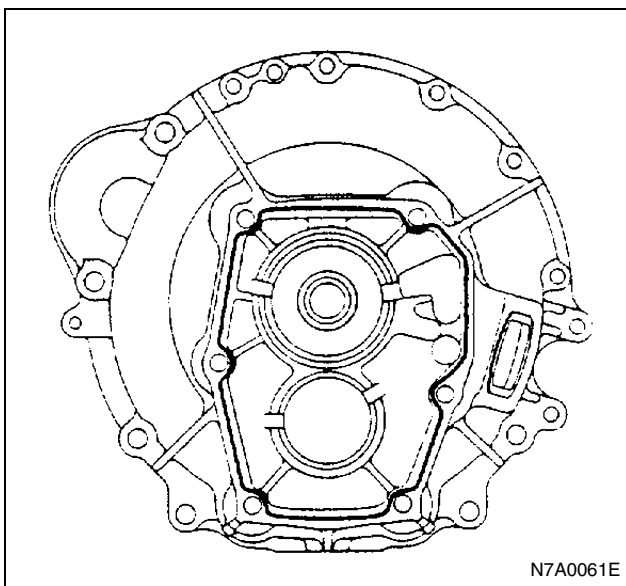
Oil Seal Installer: 5-8840-2064-0



- Remove water and oil on the mating face before applying the liquid gasket.
- Apply a $\phi 2$ mm (0.1 in) bead of the liquid gasket (Three Bond 1215 or equivalent) to the clutch housing surface shown in the illustration.

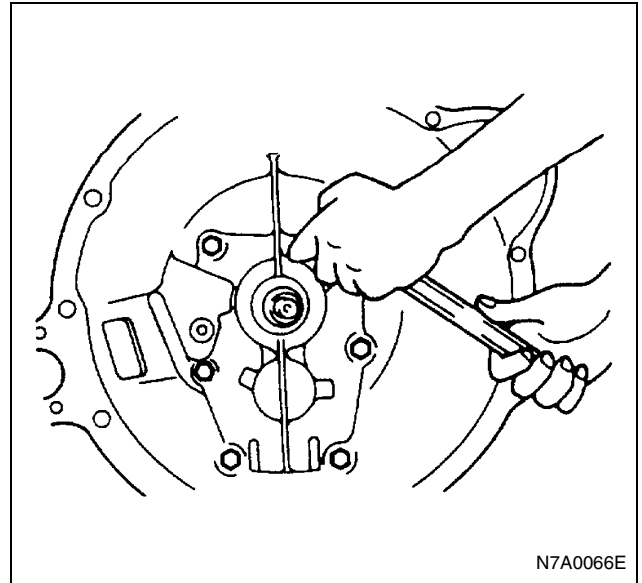
Caution:

Install the clutch housing on the transmission case within 30 minutes after liquid gasket application.



Tighten:

Clutch housing to transmission case bolts to 81 N·m (8.3 kg·m / 60 lb·ft)



31. Vehicle Speed Sensor Driven Gear Assembly

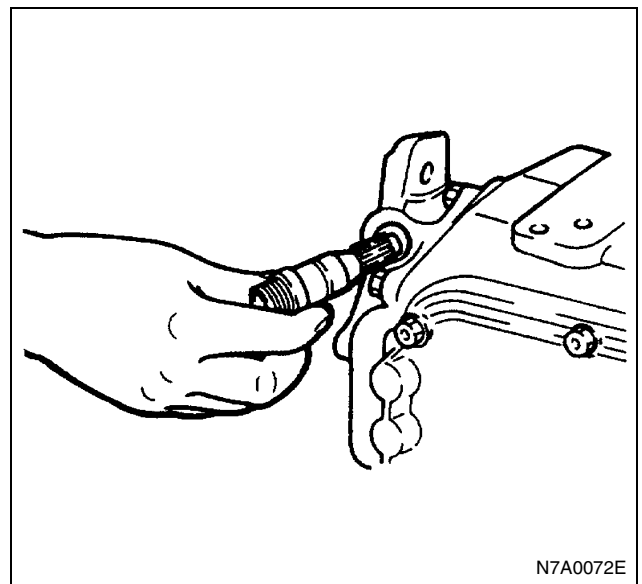
Tighten:

Driven gear lock plate bolt to 15 N·m (1.5 kg·m / 11 lb·ft)

- Install the vehicle speed sensor with key rod.

Tighten:

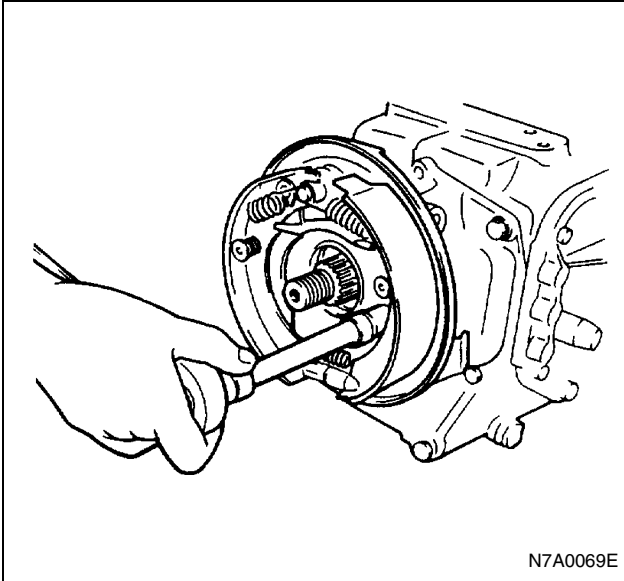
Vehicle speed sensor to 25 N·m (2.5 kg·m / 18 lb·ft)



32. Parking Brake Assembly

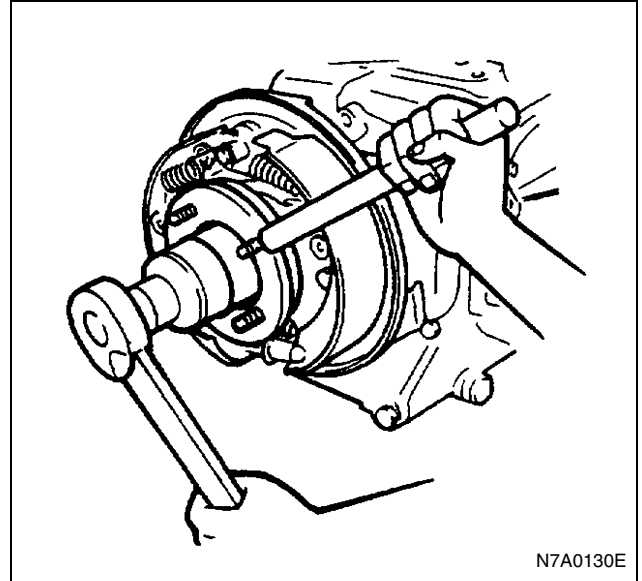
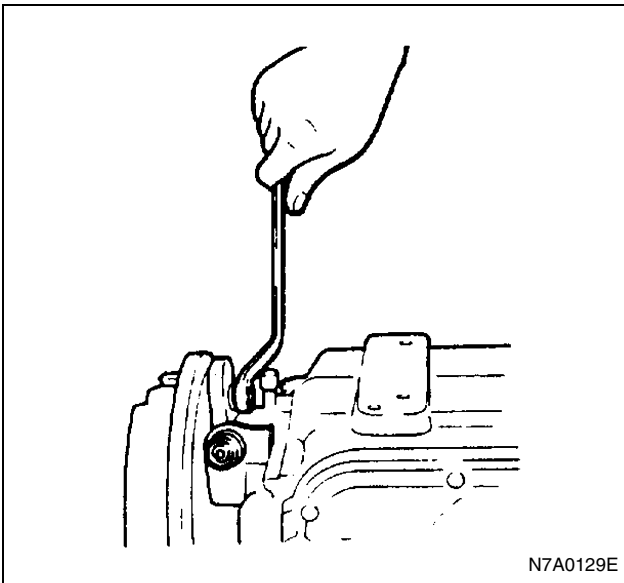
Tighten:

Parking brake bolts M8 to 25 N·m (2.6 kg·m / 19 lb·ft)



Tighten:

Parking brake nut M12 to 113 N·m (11.5 kg·m / 83 lb·ft)



- Align the lock nut with the V-shaped groove at the tip of the main shaft, and caulk the nut lip portion by using a chisel. (Round edge approximately 1 mm (0.04 in) × 60°).
- As shown in the illustration, be sure to caulk the nut lip so that the clearance between the V-shaped groove portion at the tip of the main shaft and the caulked up lip (A) is less than 1.5 mm (0.06 in), and the caulking length (B) is 5 mm (0.2 in) or more.

Caution:

Be sure to confirm that there is no crack at the caulked portion of the lock nut after caulking.

33. Coupling Driver

34. Lock Nut

- Install the O-ring and conical washer. The conical washer is to be set up with its identification groove to the nut side.
- Apply the engine oil to the setting face of the new lock nut and tighten it up to the specified torque.

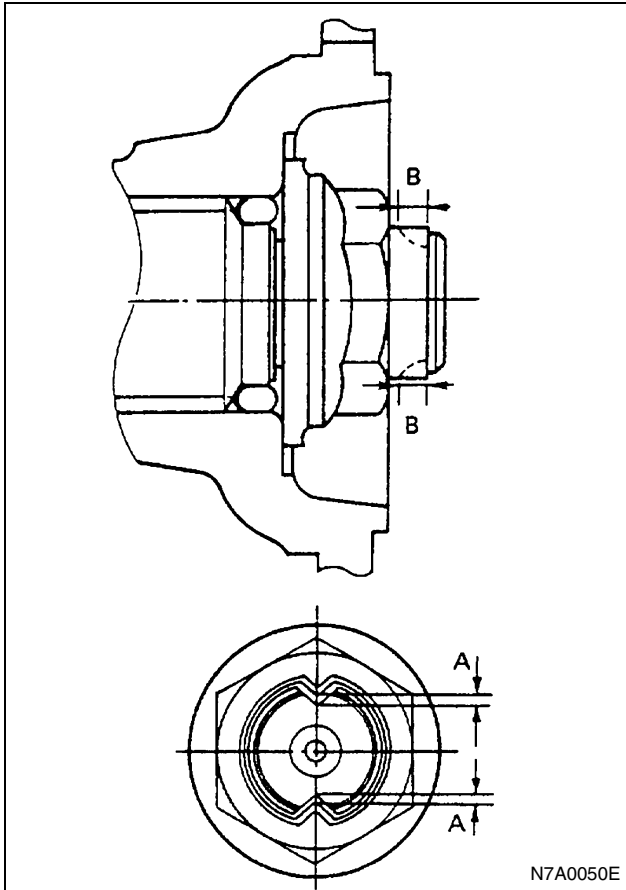
Caution:

Do not reuse the lock nut.

Handle: 5-8840-2043-0

Tighten:

Lock nut to 226 N·m (23.0 kg·m / 166 lb·ft)



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35. Parking Brake Drum

- Adjust the parking brake after installation.
- 1) Rotate the brake drum to align the adjust hole with the adjuster.
- 2) Move the camshaft lever from side to side several times to center the brake shoes.
- 3) Insert a screwdriver into the hole and rotate the adjuster by pushing it upward until the shoes drag on the drum.
- 4) Back off the adjuster 30 notches.
- Install the adjust hole cover.

Tighten:

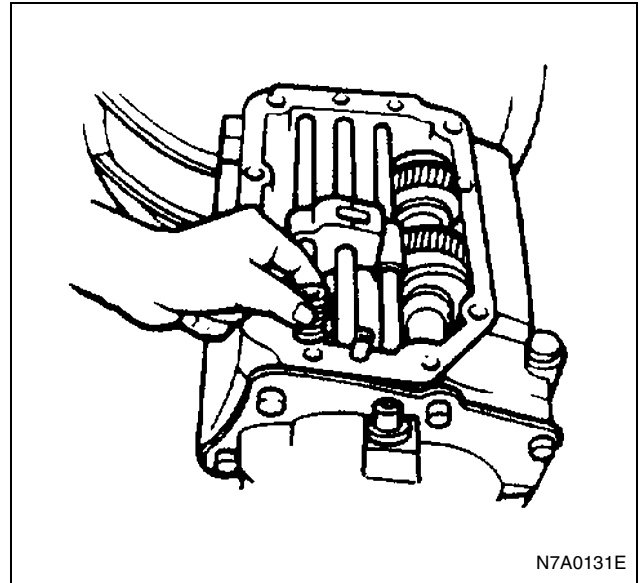
Adjust hole cover bolt to 8 N·m (0.8 kg·m / 69 lb·in)

36. Detent Ball

37. Detent Spring

38. Control Box Assembly

- Apply small amount of multi-purpose grease to the detent balls.
- Install the 3 detent balls and the 3 detent springs to the transmission case.
- Install the control box assembly with new gasket.



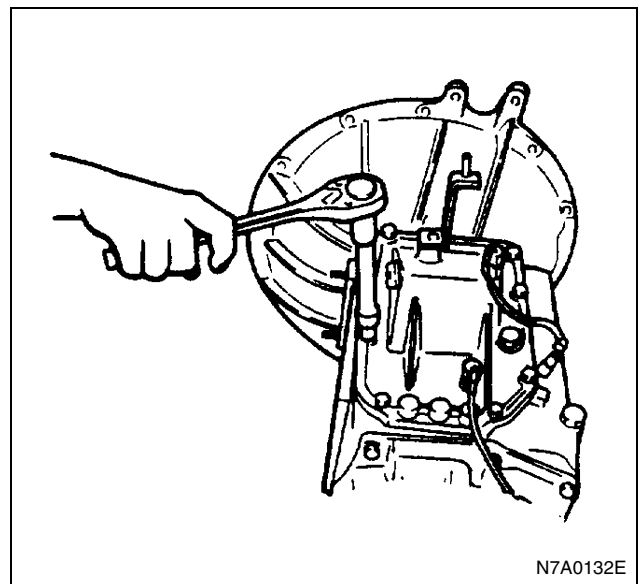
N7A0131E

Tighten:

Control box to transmission case bolts to 20 N·m (2.0 kg·m / 14 lb·ft)

Notice:

Operating the shift lever and the select lever, make sure that they shift to each position smoothly.

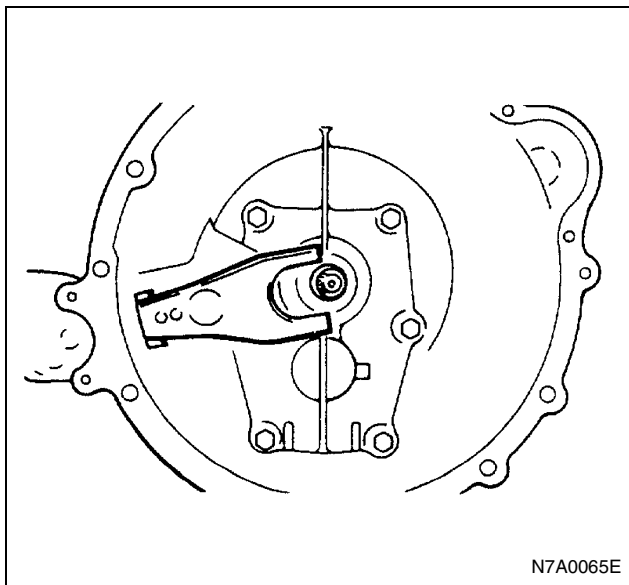


N7A0132E

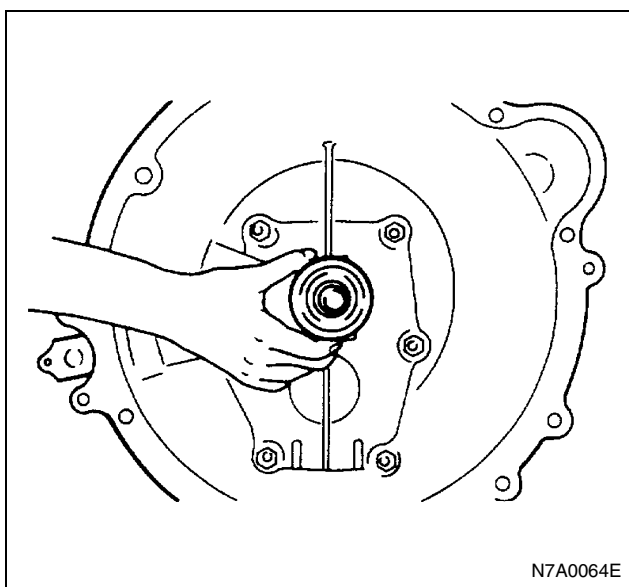
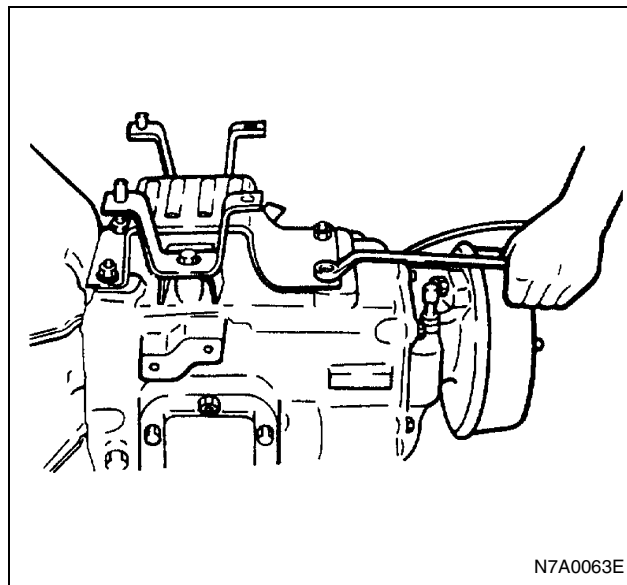
39. Shift Fork and Support Bolt

Tighten:

Support bolt to 52 N·m (5.3 kg·m / 38 lb·ft)



40. Release Bearing Assembly

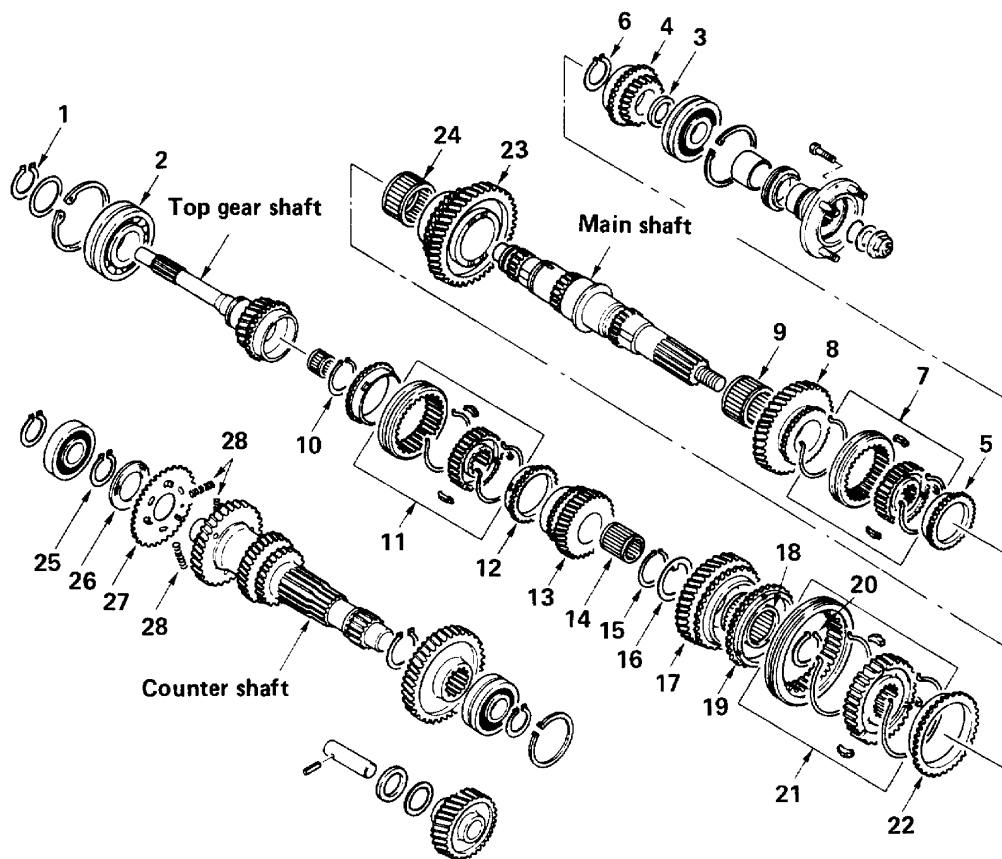


41. Mission Mounting Assembly

Tighten:

Mission mounting bolt to 69 N·m (7.0 kg·m / 51 lb·ft)

Top Gear Shaft Assembly, Main Shaft Assembly and Counter Shaft Assembly



N7A0014E

Legend

Top gear shaft assembly

- 1. Snap ring
- 2. Ball bearing

Main shaft assembly

- 3. Thrust washer
- 4. 5th gear
- 5. Block ring
- 6. Snap ring
- 7. 5th/reverse synchronizer assembly
- 8. Reverse gear
- 9. Needle bearing
- 10. Snap ring
- 11. 3rd/4th synchronizer assembly
- 12. Block ring
- 13. 3rd gear
- 14. Needle bearing
- 15. Snap ring
- 16. Thrust washer
- 17. 2nd gear
- 18. Needle bearing
- 19. Block ring
- 20. Snap ring
- 21. 1st/2nd synchronizer assembly
- 22. Block ring
- 23. 1st gear
- 24. Needle bearing

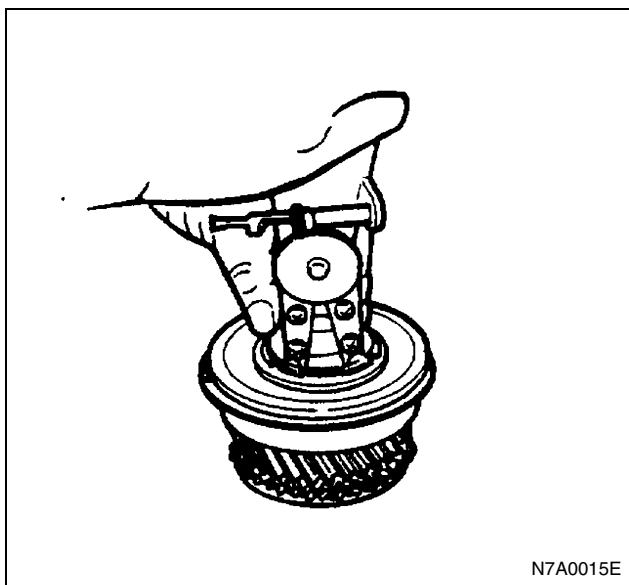
Counter shaft assembly

- 25. Snap ring
- 26. Conical washer
- 27. Anti-lash plate
- 28. Spring

Disassembly

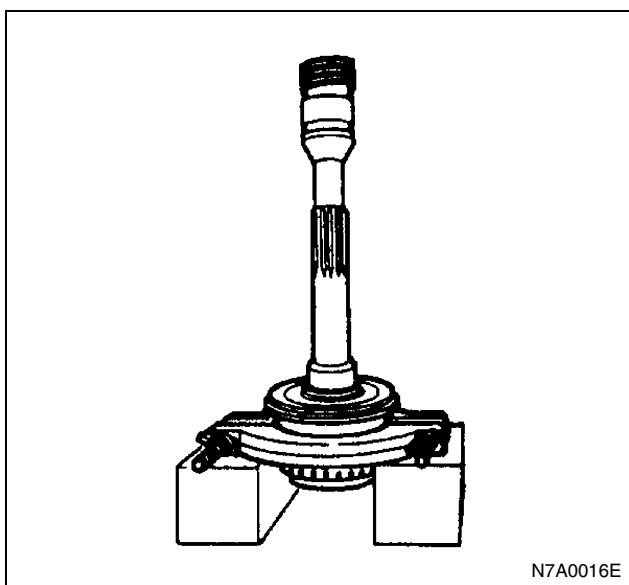
Top Gear Shaft Assembly

1. Snap Ring



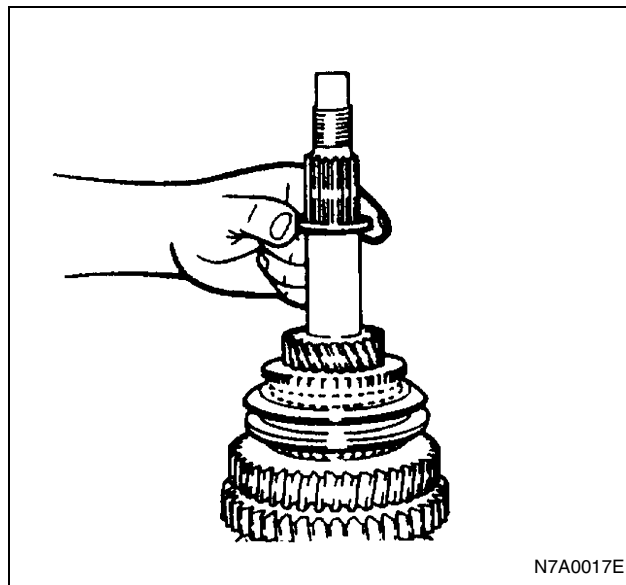
2. Ball Bearing

- Use the bearing remover to remove the bearing from top gear shaft.
Bearing Remover: 5-8840-0587-0



Main Shaft Assembly

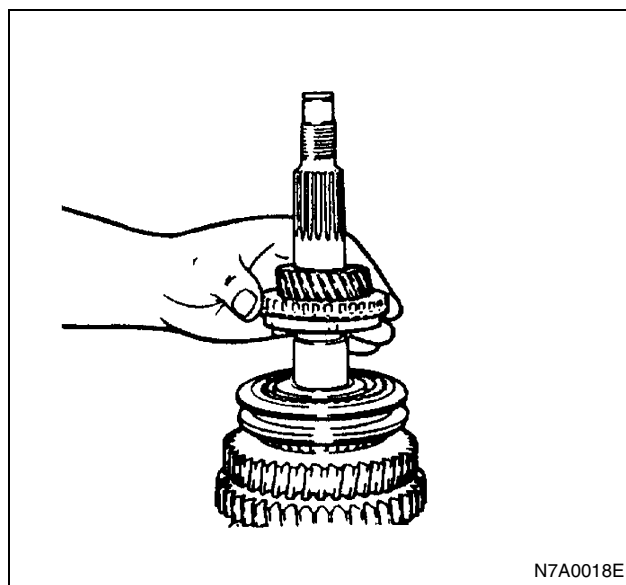
3. Thrust Washer



4. 5th Gear

5. Block Ring

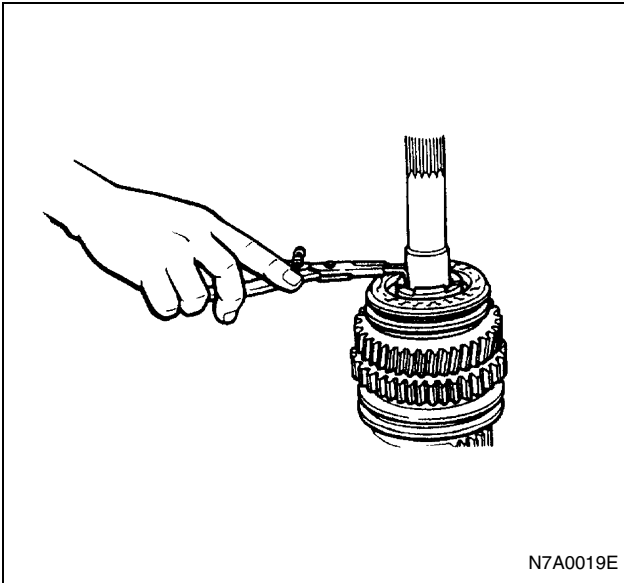
- Attach a backing plate to the vise, secure the main shaft at the top end, and remove the 5th gear and block ring.



6. Snap Ring

Notice:

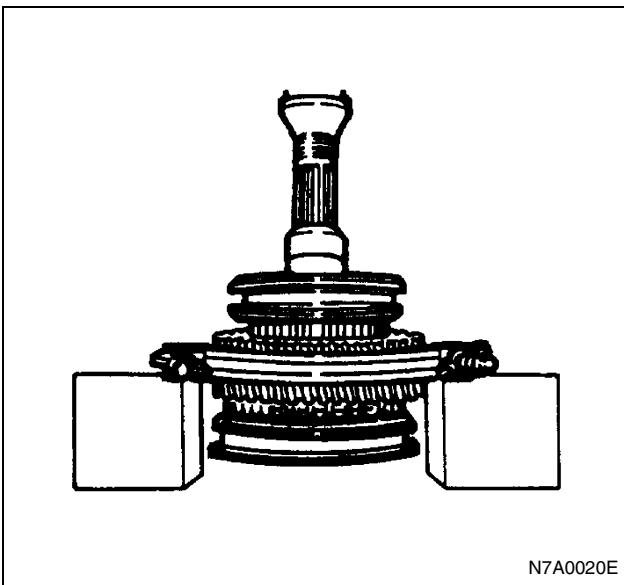
Snap ring of appropriate sizes are combined to fill the gap to the clutch hub. Never mix them with other snap rings.



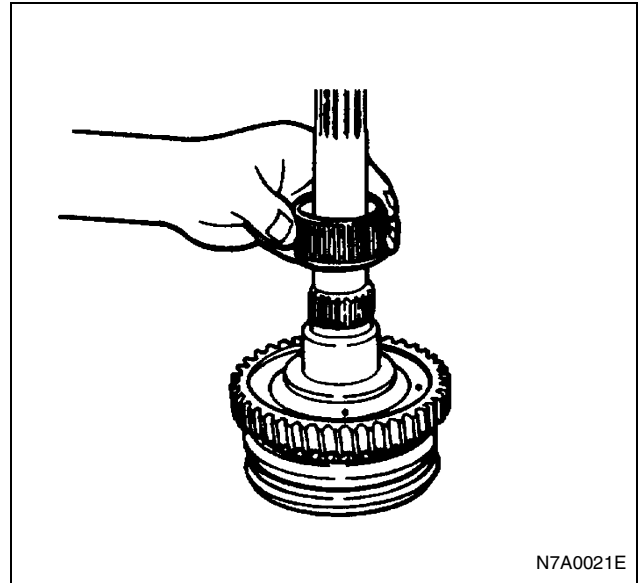
7. 5th/Reverse Synchronizer Assembly

8. Reverse Gear

- Use a bench press and the bearing remover to remove the reverse gear together with the 5th/reverse synchronizer assembly.
Bearing Remover: 5-8840-0587-0
- Disassemble synchronizer assemblies into the clutch hub, sleeve, inserts (3 pieces) and insert springs (2 pieces).



9. Needle Bearing

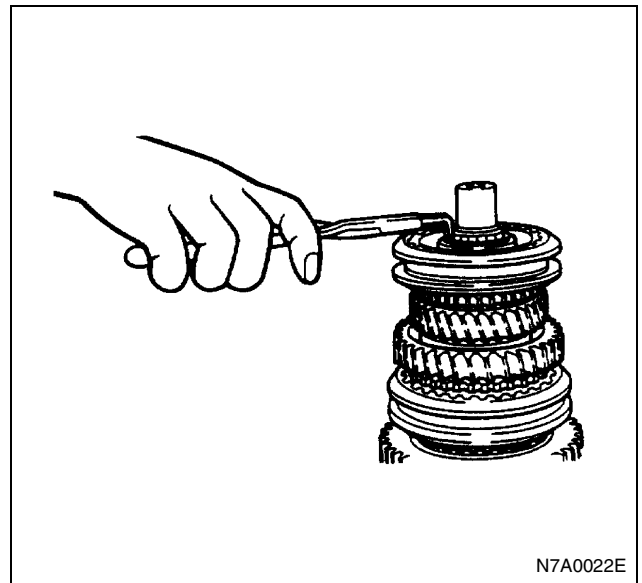


10. Snap Ring

- Attach a backing plate to the vise, secure the main shaft at the spline end, and remove the snap ring at the end.

Notice:

Snap ring of appropriate sizes are combined to fill the gap to the clutch hub. Never mix them with other snap rings.

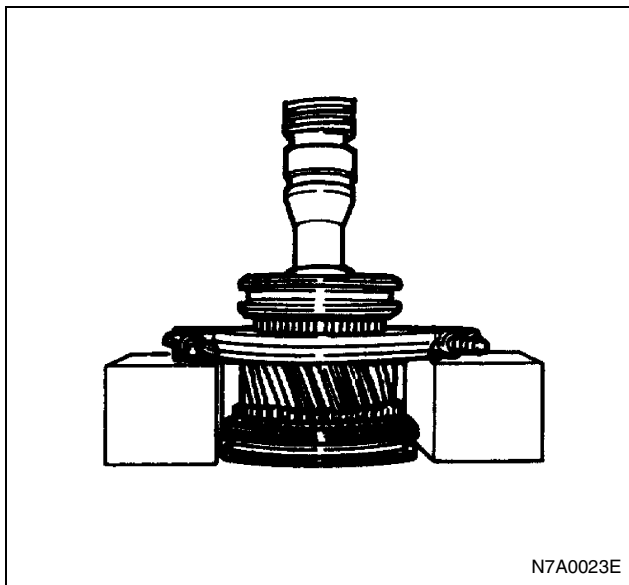


11. 3rd/4th Synchronizer Assembly

12. Block Ring

13. 3rd Gear

- Use a bench press and the bearing remover to remove the 3rd gear together with the 3rd/4th synchronizer assembly and the block ring.
Bearing Remover: 5-8840-0587-0
- Disassemble synchronizer assemblies into the clutch hub, sleeve, inserts (3 pieces) and insert springs (2 pieces).

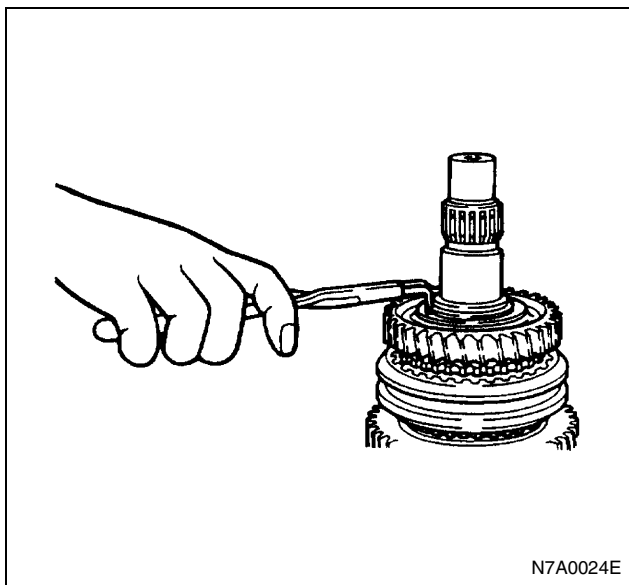


14. Needle Bearing

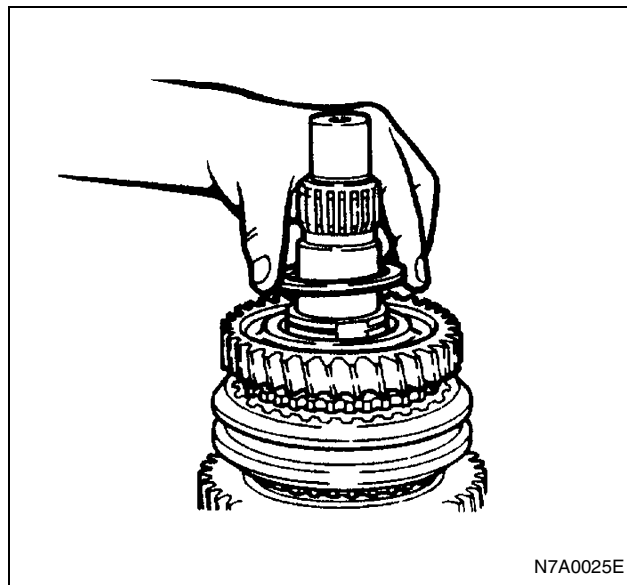
15. Snap Ring

Notice:

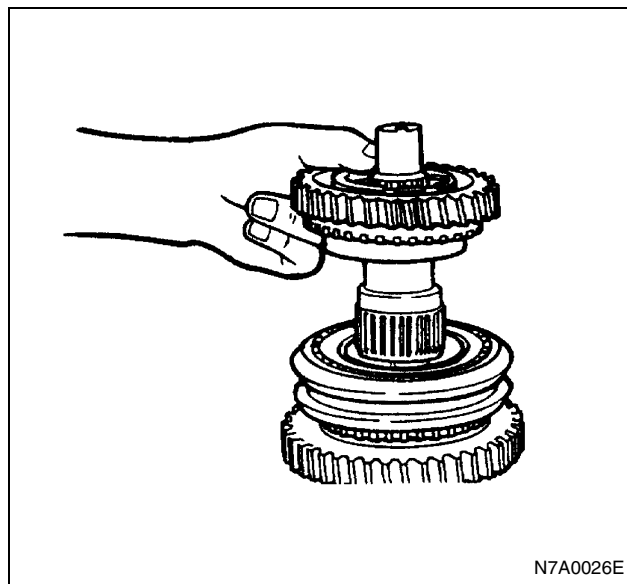
Snap ring of appropriate sizes are combined to fill the gap to the clutch hub. Never mix them with other snap rings.



16. Thrust Washer

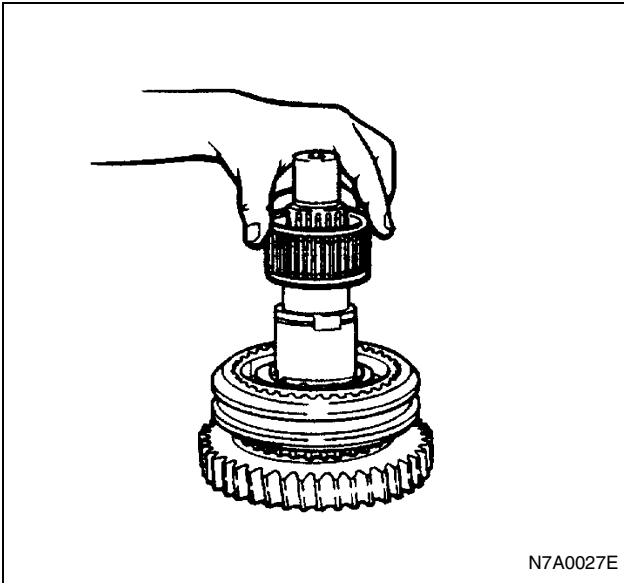


17. 2nd Gear



18. Needle Bearing

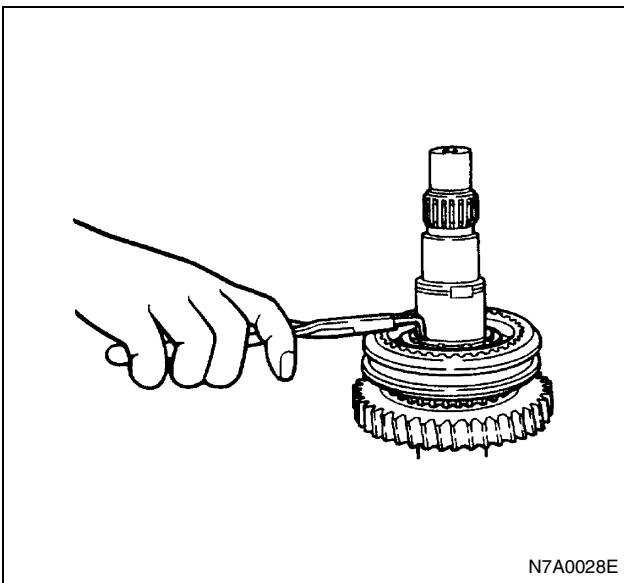
19. Block Ring



20. Snap Ring

Notice:

Snap ring of appropriate sizes are combined to fill the gap to the clutch hub. Never mix them with other snap rings.

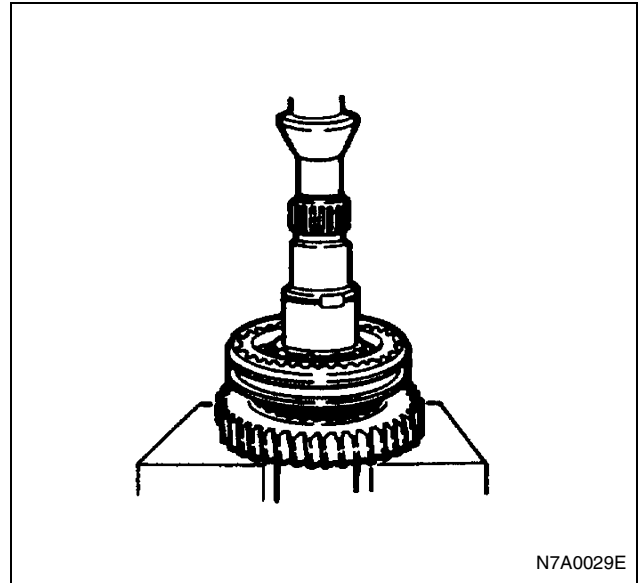


21. 1st/2nd Synchronizer Assembly

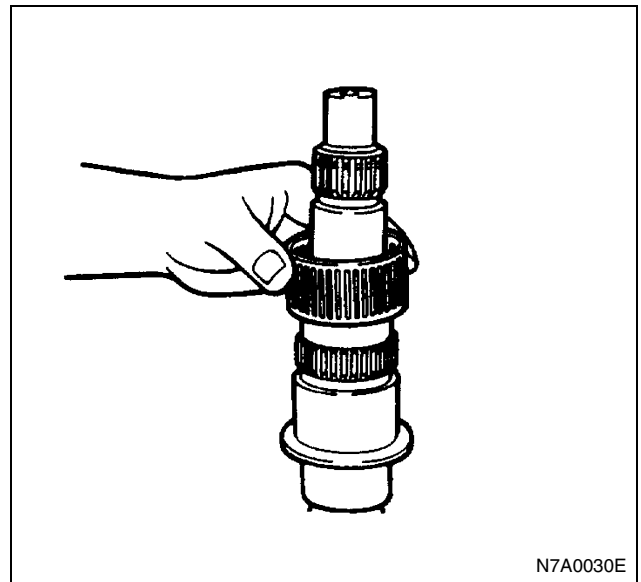
22. Block Ring

23. 1st Gear

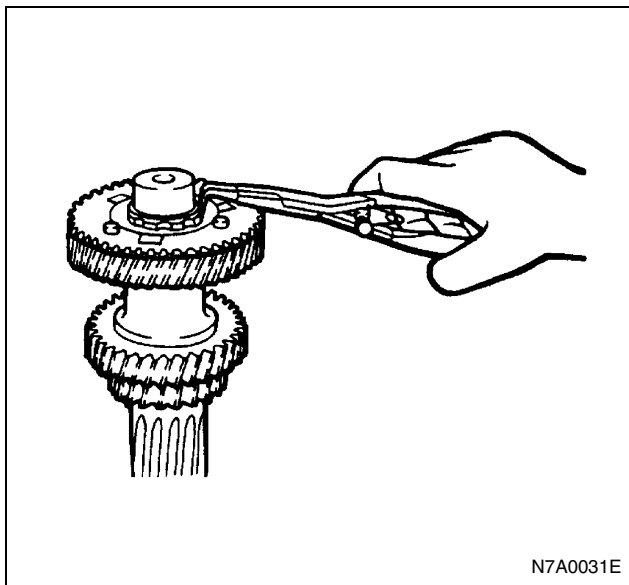
- Use a bench press to remove the 1st gear together with the 1st/2nd synchronizer assembly and the block ring.
- Disassemble synchronizer assemblies into the clutch hub, sleeve, inserts (3 pieces) and insert springs (2 pieces).



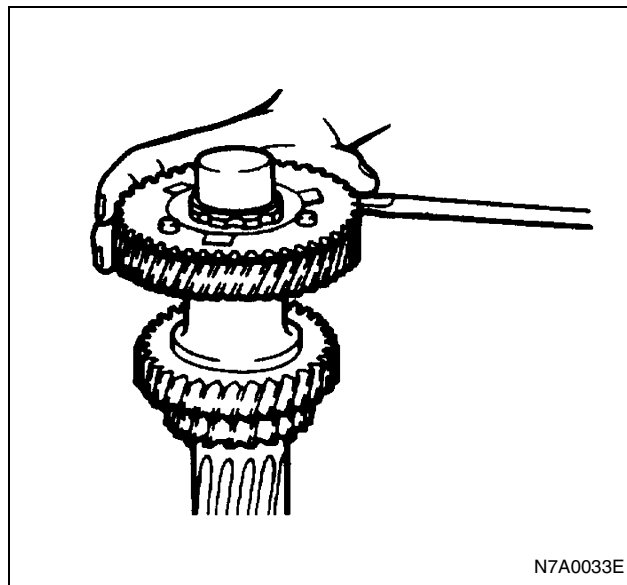
24. Needle Bearing


Counter Shaft Assembly

25. Snap Ring

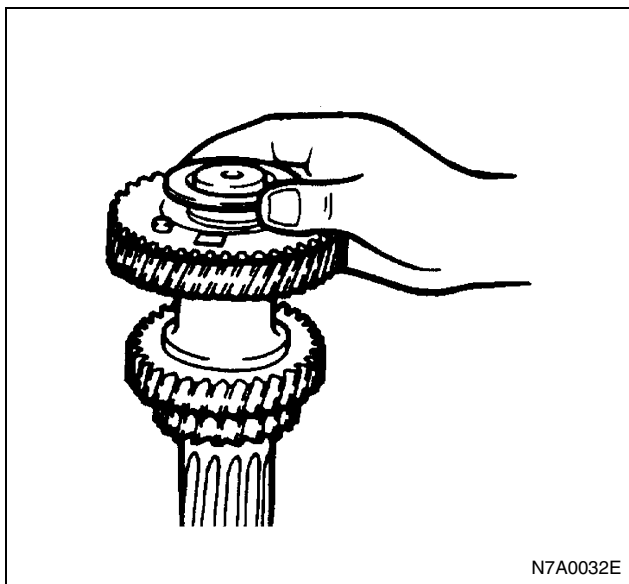


26. Conical Washer



28. Spring

- Remove the 3 springs that are assembled to the counter drive gear side.

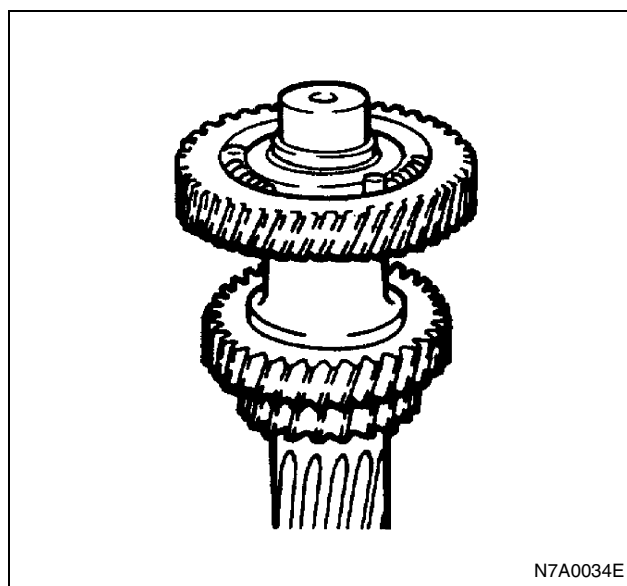


27. Anti-lash Plate

- Insert a flat-end screwdriver between the anti-lash plate and the counter drive gear, and remove the anti-lash plate.

WARNING:

THE ANTI-LASH PLATE SHOULD BE REMOVED VERY SLOWLY WITH SPECIAL CARE OTHERWISE SOME SPRINGS INSTALLED INSIDE THE PLATE COULD POP OUT AND CAUSE INJURY.



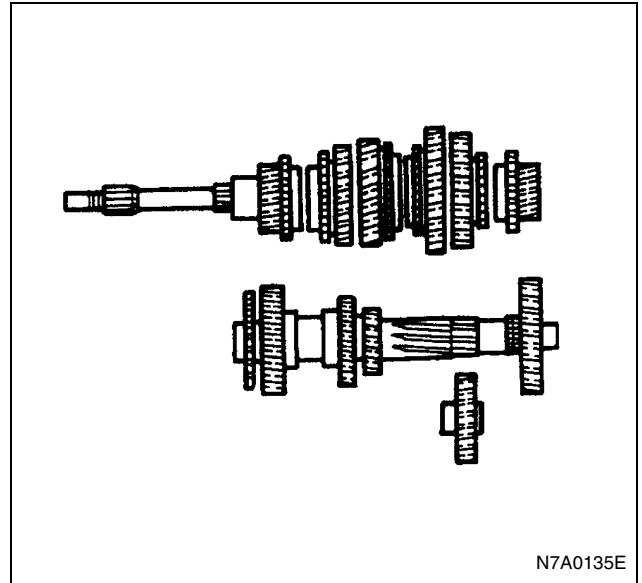
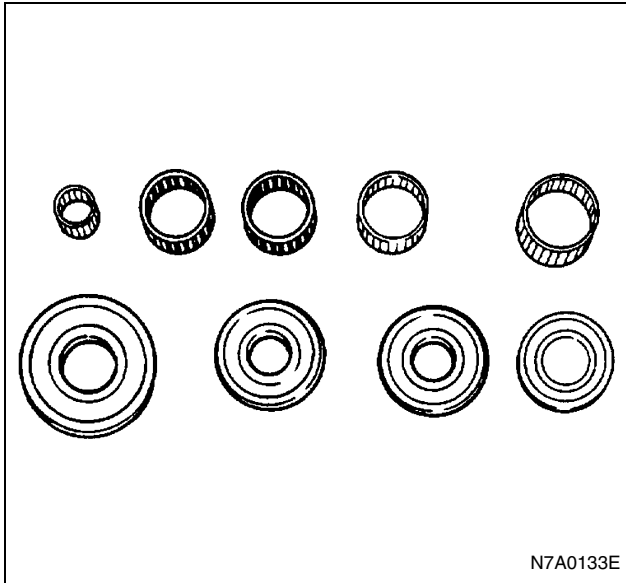
Inspection and Repair

Make the necessary adjustment, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Bearings

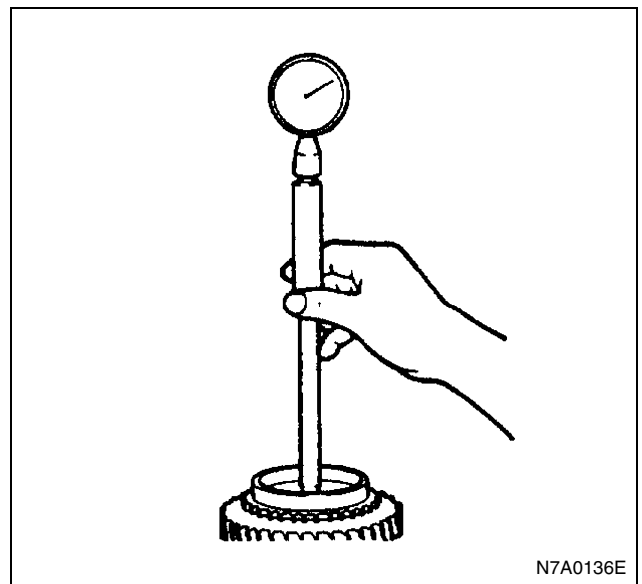
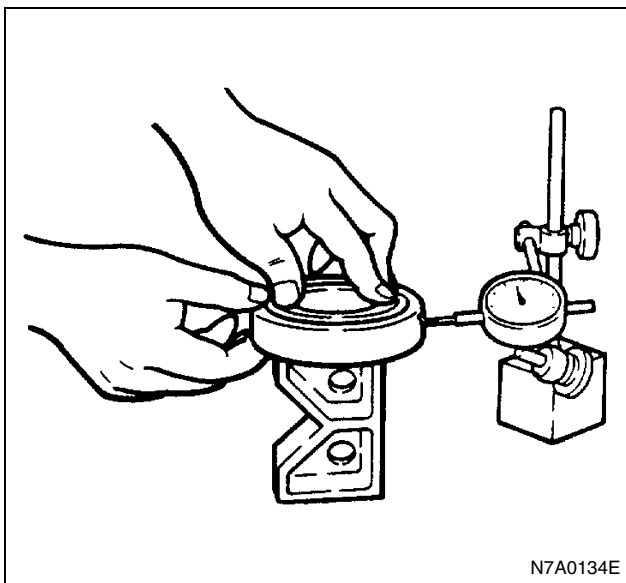
Check each bearing, and replace in either of the following cases.

- Rotation is not smooth.
- Abnormal sound is generated.
- There is extreme damage or rust.
- Rolling element or rolling contact surface of needle roller bearing is discolored, extremely worn or pitted.



Ball Bearing Run-out	mm (in)
Limit	
0.2 (0.01)	

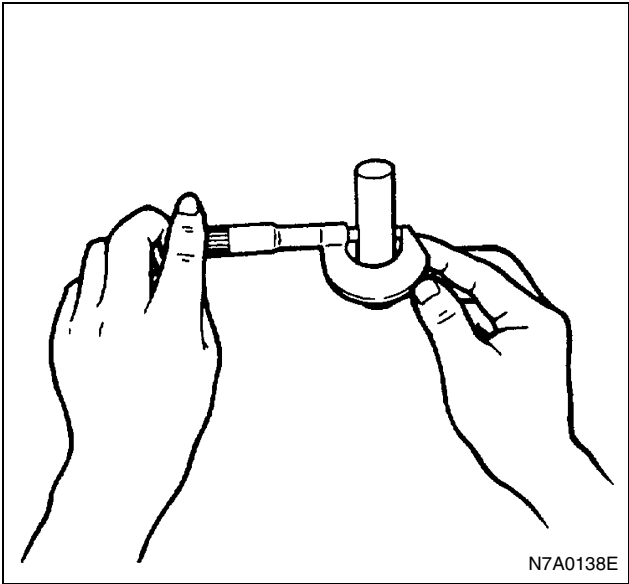
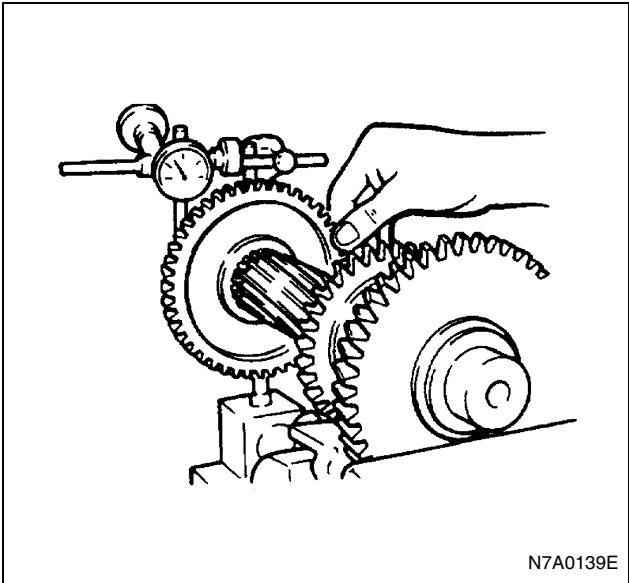
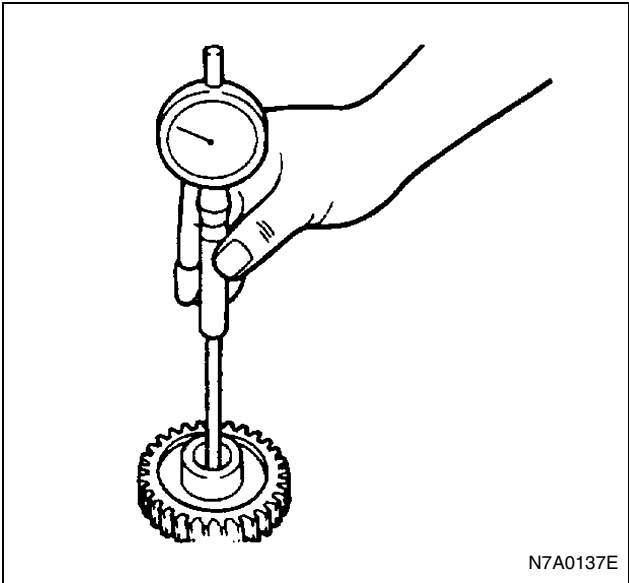
Gear Inside Diameter		mm (in)
Gear	Standard	Limit
3rd Gear	42.0 (1.654)	42.1 (1.657)
2nd Gear	54.0 (2.126)	54.1 (2.130)
1st Gear	61.0 (2.402)	61.1 (2.406)
Reverse Gear	54.0 (2.126)	54.1 (2.130)



Gears

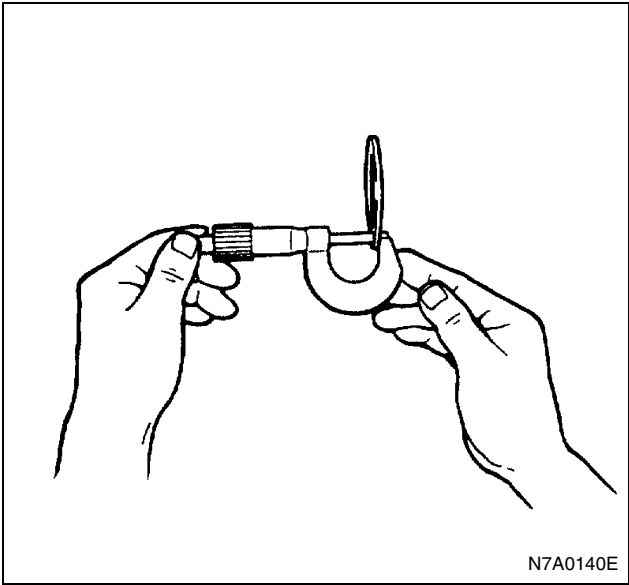
Check each gear for the following points. Correct a slight stepped wear or surface roughness with an oil stone or pencil grinder, or replace the gear if unrecoverable damage is found.

- Break or damage of tooth.
- Roughness or damage of taper cone (contact surface with block ring).
- Extreme wear of tooth.
- Inspect the dog gear teeth, and replace if hard contact is found on the force receive side (coast side) during engine braking.

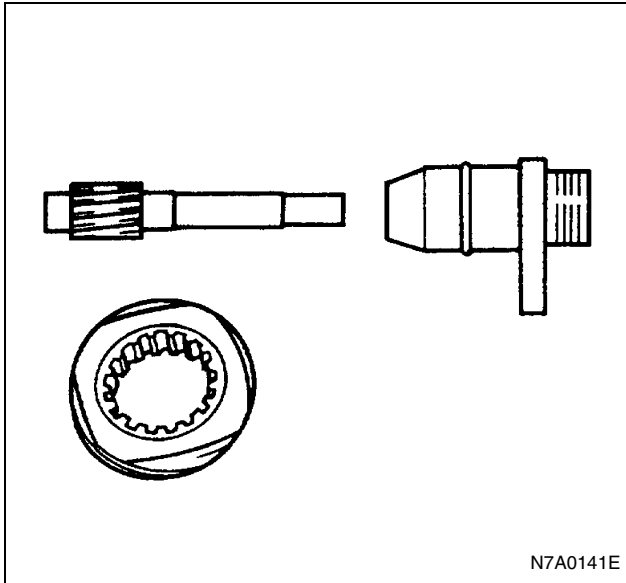


Thrust Washer Thickness		mm (in)
Gear	Standard	Limit
For 2nd Gear	3.0 (0.12)	2.8 (0.11)
For 5th Gear	3.8 (0.15)	3.6 (0.14)

Counter 5th Gear Spline Play (At counter 5th gear outer circumference)		mm (in)
Standard	Limit	
0.18 — 0.43 (0.007 — 0.017)	0.45 (0.018)	



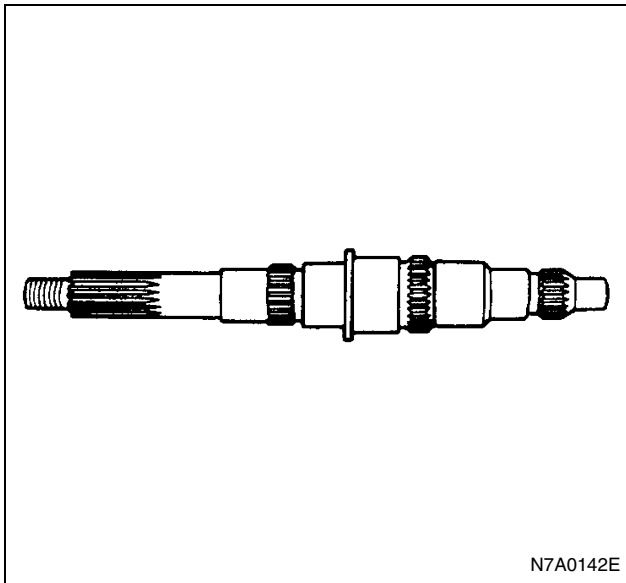
- Wear or damage of the vehicle speed sensor drive gear and driven gear bushing.



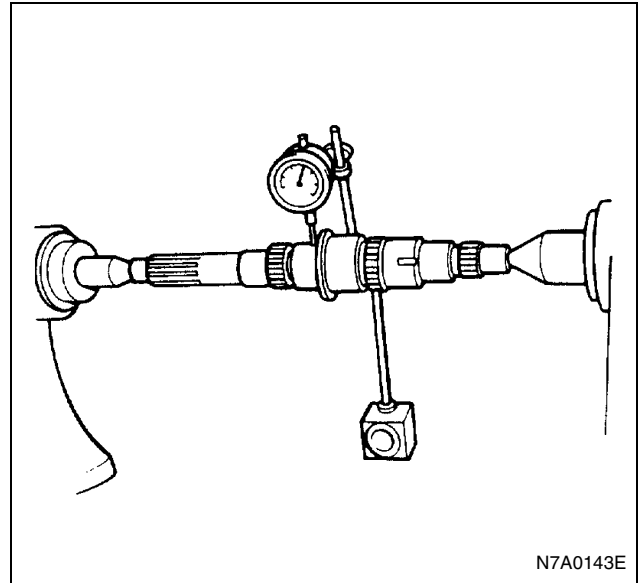
Main Shaft

Check the main shaft external surface for any damage or wear, and its spline sections for wear, damage or bent.

When there is any abnormal condition, or when it is used excessively beyond a proper use limit, replace it with new one.



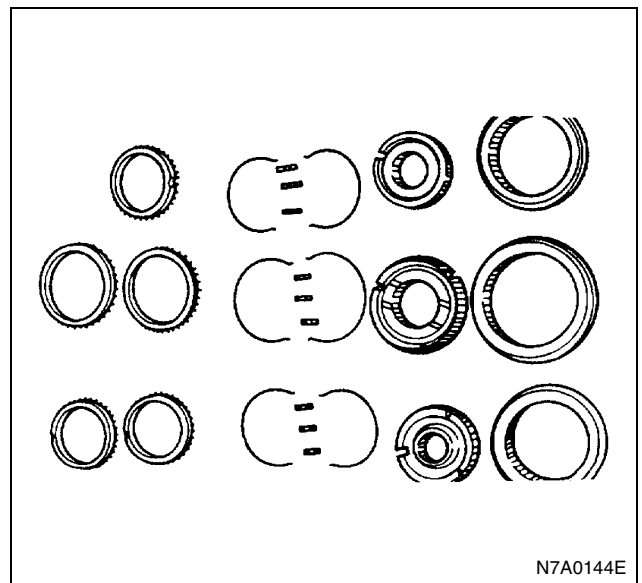
Main Shaft Run-out		mm (in)
Standard	Limit	
0.025 (0.0010) or Less	0.1 (0.004)	



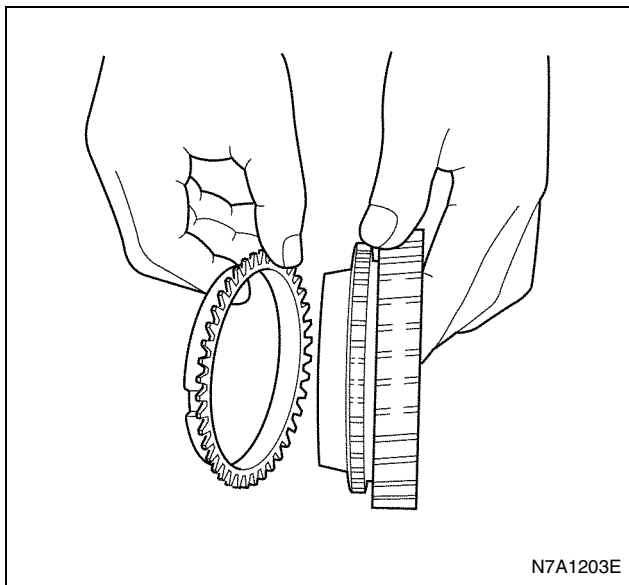
Synchronesh

Check the components of the synchronizer for any abnormal conditions. When there are uneven slight wears or rough surfaces, improve them with an oil stone or pencil grinder.

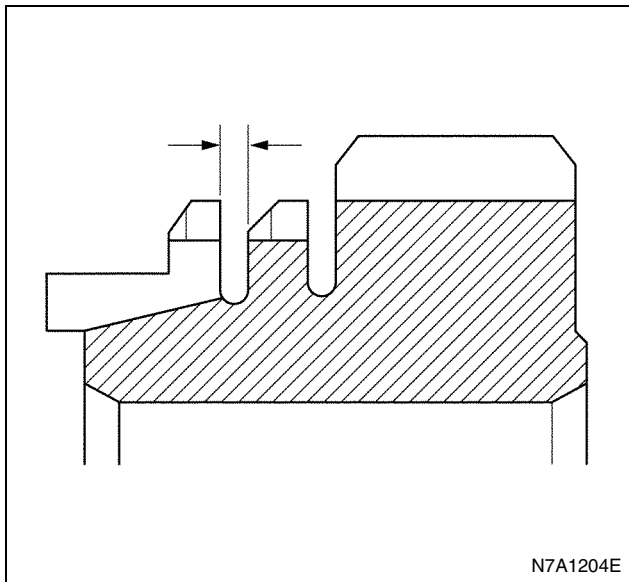
When they are abnormally damaged, or when they are used excessively beyond a proper use limit, replace them with new one.



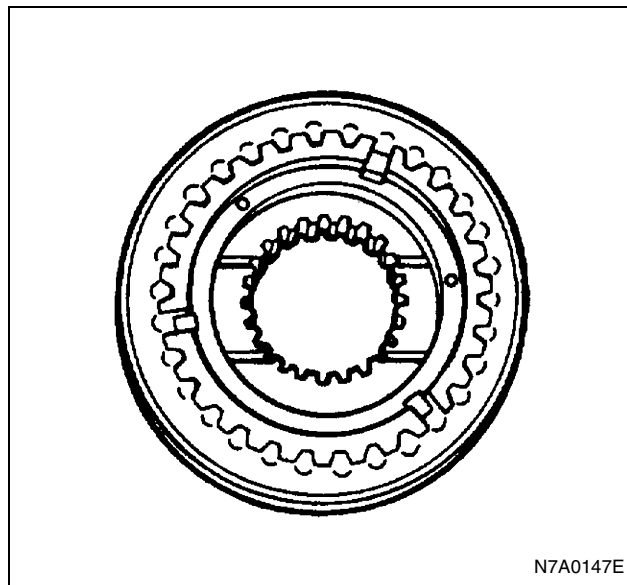
- Damages or wears found on the taper, gear and insert groove sections of the block ring.



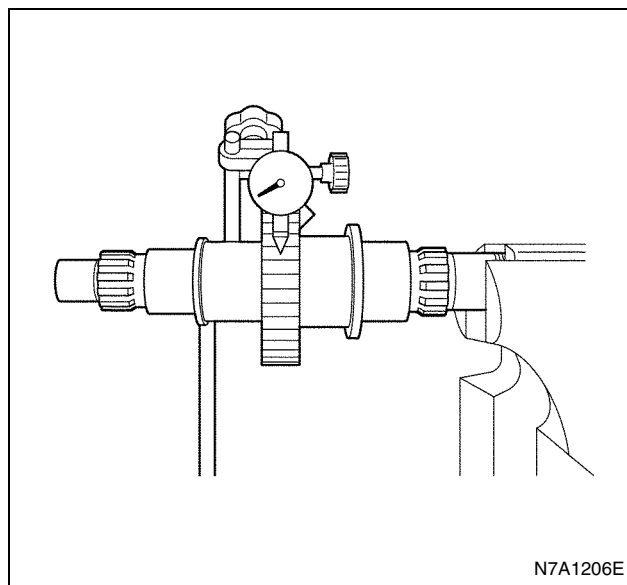
Block Ring and Dog Gear Teeth Clearance		mm (in)
Gear	Standard	Limit
3rd/4th	1.0 (0.04)	0.5 (0.02)
1st/2nd	1.5 (0.06)	0.5 (0.02)
5th	1.5 (0.06)	0.5 (0.02)



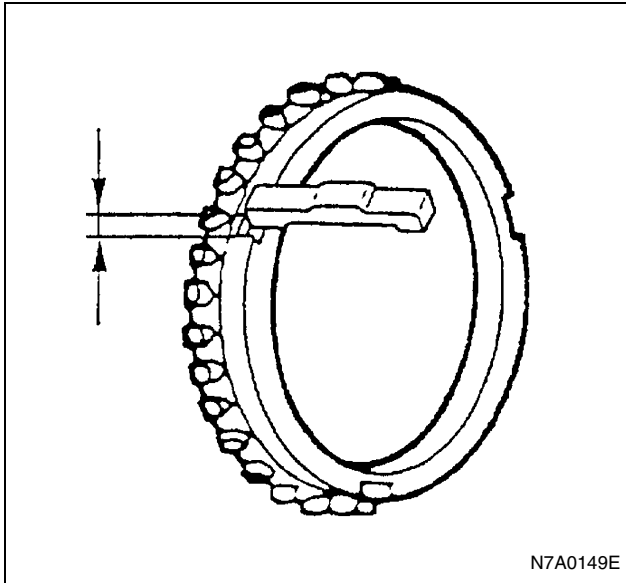
- Wears or damages found on the clutch hub, the sliding sections of the sleeve, the spline sections and insert grooves.



Clutch Hub Spline Play (At clutch hub outer circumference)		mm (in)
Standard	Limit	
0 — 0.05 (0 — 0.002)	0.3 (0.01)	



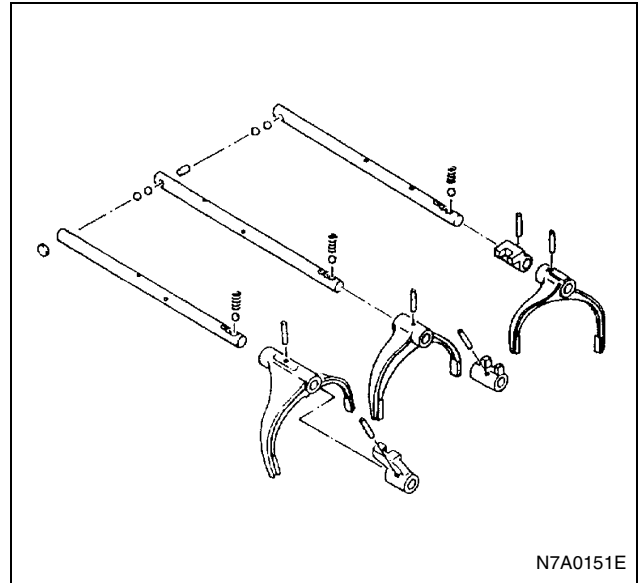
Block Ring Groove and Insert Clearance		mm (in)
Standard	Limit	
3.59 — 3.91 (0.141 — 0.154)	4.1 (0.16)	



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Clutch Hub Groove and Insert Clearance mm (in)

Standard	Limit
0.09 — 0.31 (0.004 — 0.012)	0.4 (0.02)

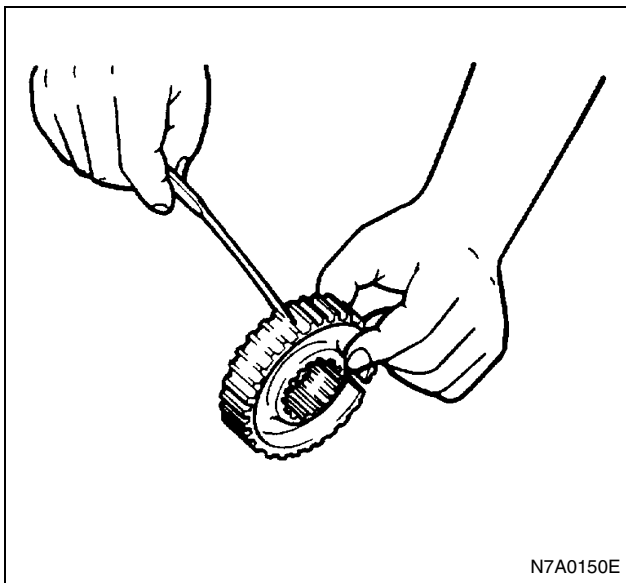


N7A0151E

- Check the shift arm and shift block groove for wear or deformation.

Shift Arm Thickness mm (in)

Standard	Limit
10.0 (0.39)	9.0 (0.35)

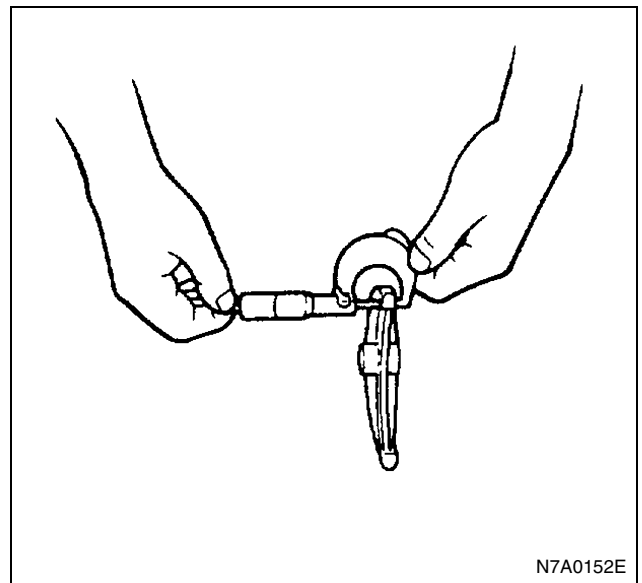


N7A0150E

Shift Mechanism

Inspect all disassembled parts for wear, damage or other abnormal conditions.

- Check the shift rod for wear, bent and damage.

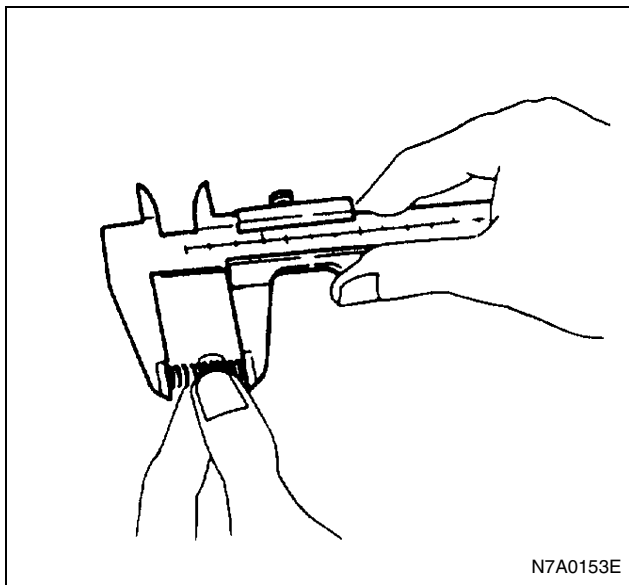


N7A0152E

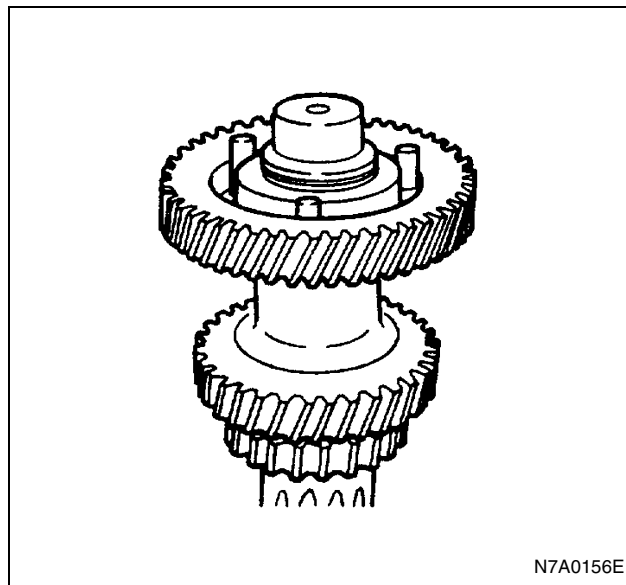
- Check the detent spring for weakening and deformation.

Free Length of Detent Spring mm (in)

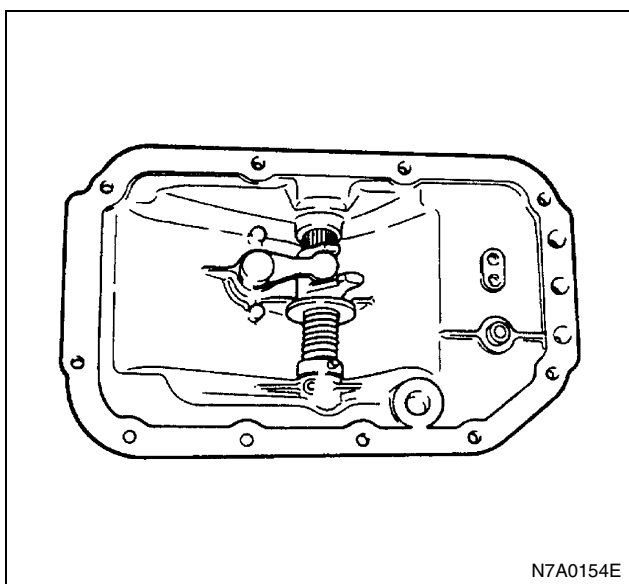
Standard	Limit
31.6 (1.24)	30.1 (1.19)



- The wear of the select lever, and the backlash and awkward operation of the control box.

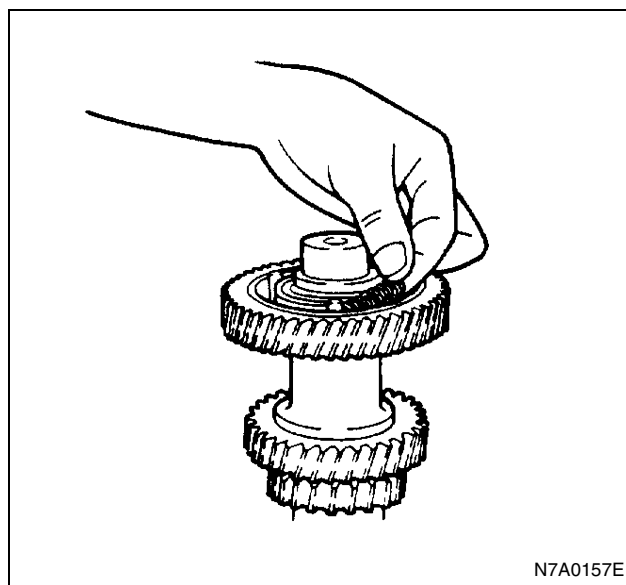


- The spring should be installed to the left of the inside counter drive gear pin.



Notice:

When replacing the pin with a new one, hammer it in until its height becomes 3 mm (0.12 in) from the gear end face.



Reassembly

Notice:

Clean each part thoroughly.

When assembling parts, apply clean engine oil (SAE 5W-30) to their sliding and mating sections.

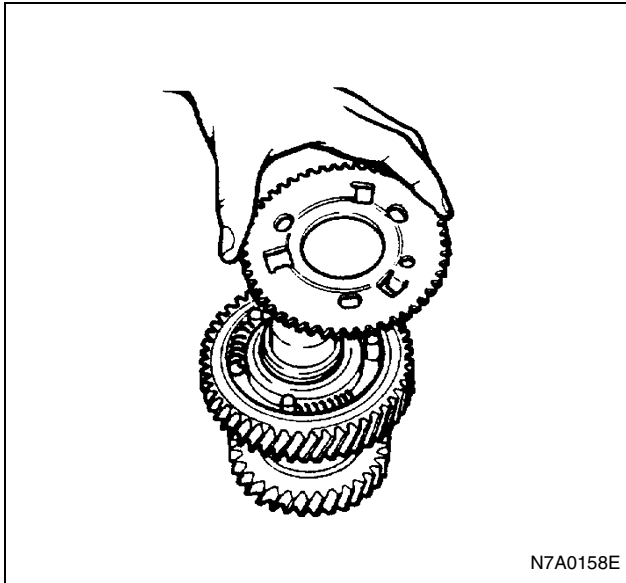
Counter Shaft Assembly

1. Spring

- Attach a backing plate to the vise, secure the counter shaft rear end, and install the springs.

2. Anti-lash Plate

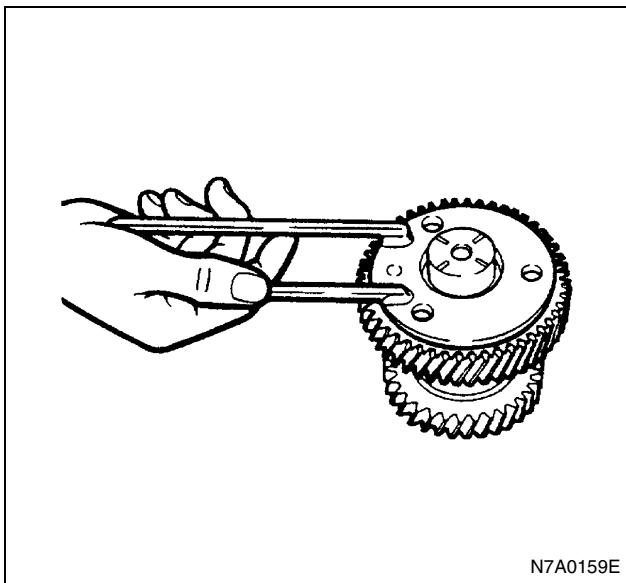
- Assemble the anti-lash plate to the drive gear so that the drive gear hole ($\phi 7.7$ mm/0.3 in) comes roughly in line with the hole ($\phi 7.7$ mm/0.3 in) of the anti-lash plate.



- With the guide pin aligned with the drive gear hole ($\phi 7.7$ mm/0.3 in), set the installer to the guide pin.

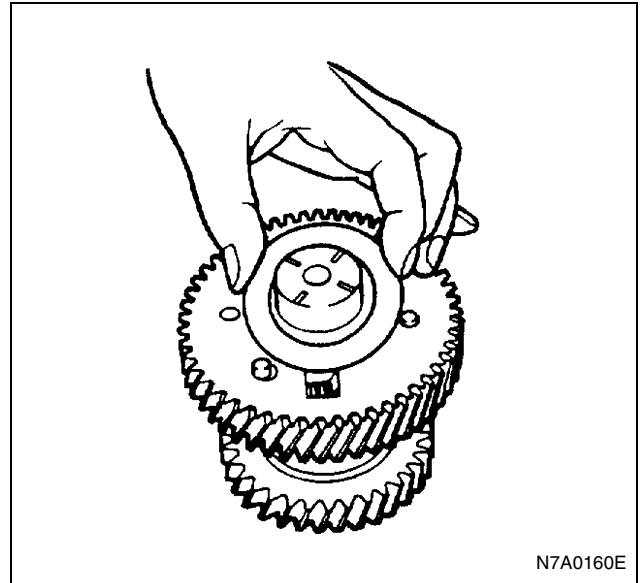
Anti-lash Plate Installer: 5-8840-2044-0

- Turn the installer clockwise. When the drive gear pin comes to the position where it can be seen fully, put the installer into the drive gear side to fix the anti-lash plate to the drive gear.



3. Conical Washer

- Install the conical washer above the anti-lash plate with the convex side (front side) up.



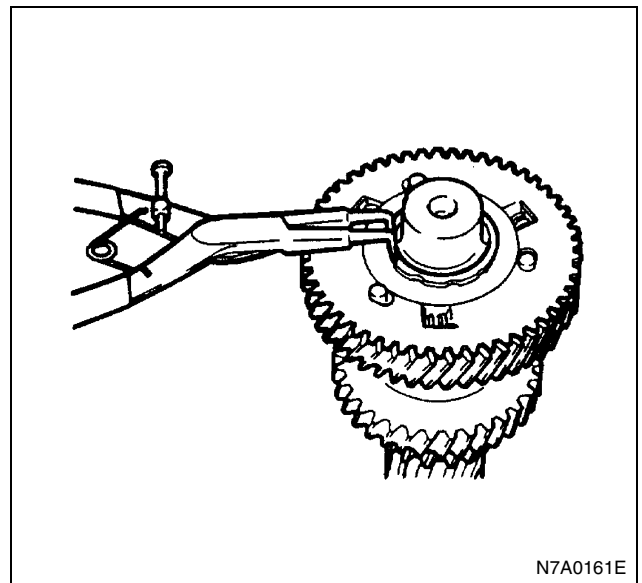
4. Snap Ring

- Use a new snap ring to fix the conical washer.

Notice:

Avoid the reuse of snap ring.

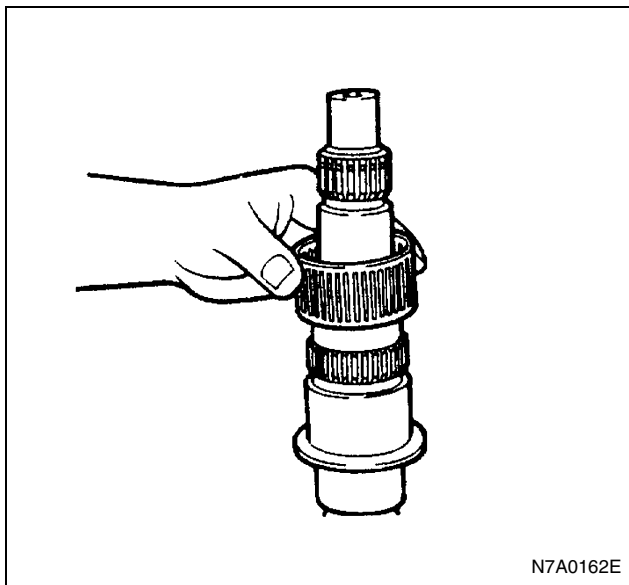
Check visually the anti-lash plate for a warp or curve after assembly.



Main Shaft Assembly

5. Needle Bearing

- Attach a backing plate to the vise, secure the main shaft at the spline end.

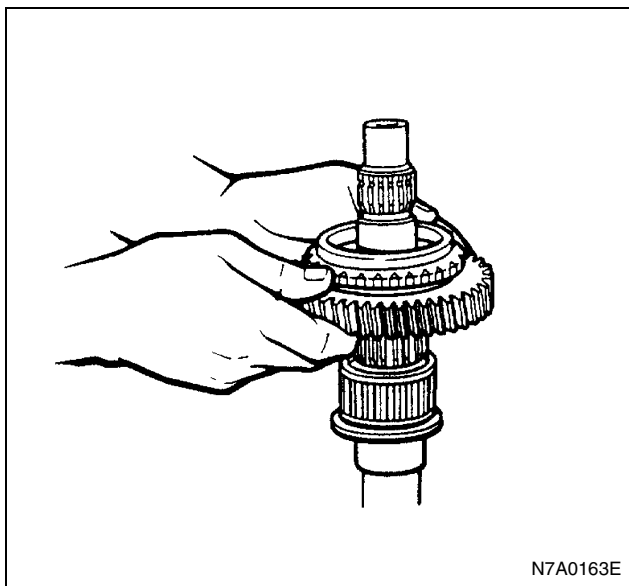


6. 1st Gear

- Install the 1st gear with its taper cone side upward (front of transmission).

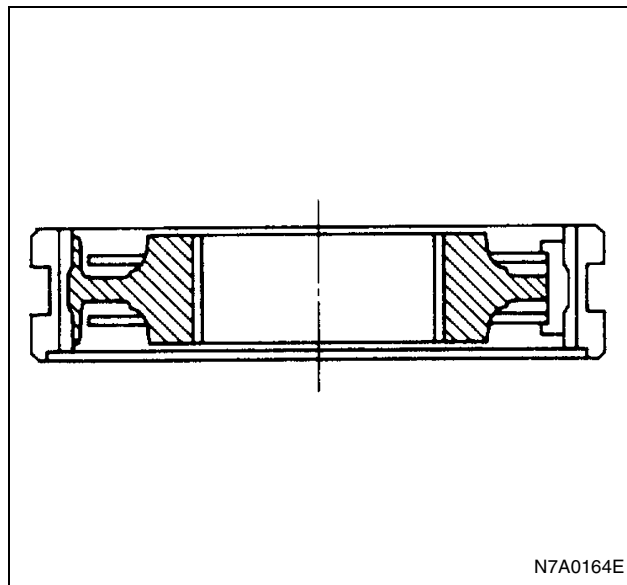
7. Block Ring

- Align the insert groove of the block ring with the insert.

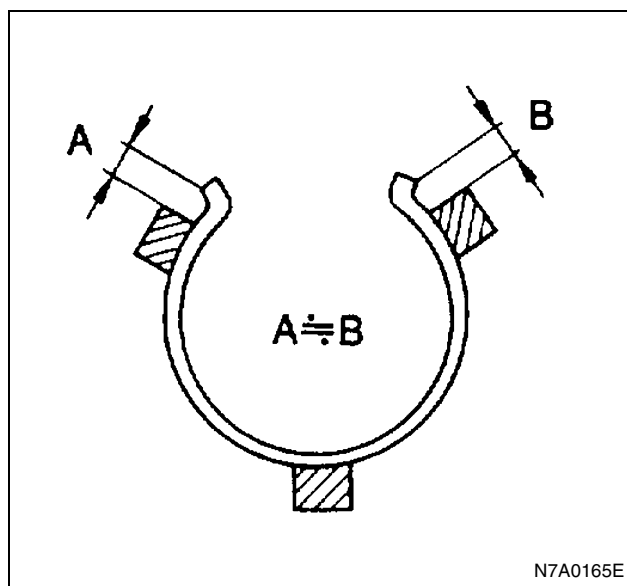


8. 1st/2nd Synchronizer Assembly

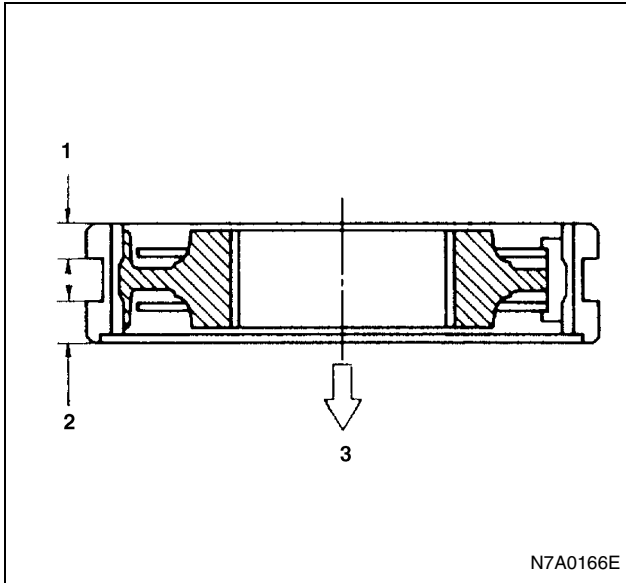
- Assemble the sleeve to the clutch hub. The clutch hub has no specific directionality.
- Put the inserts into the clutch hub groove, and install the insert spring.



- Assemble the insert springs so that the distances (A and B) between inserts and the opening of the spring can be nearly equal, and also this opening may not be the same direction on both side.



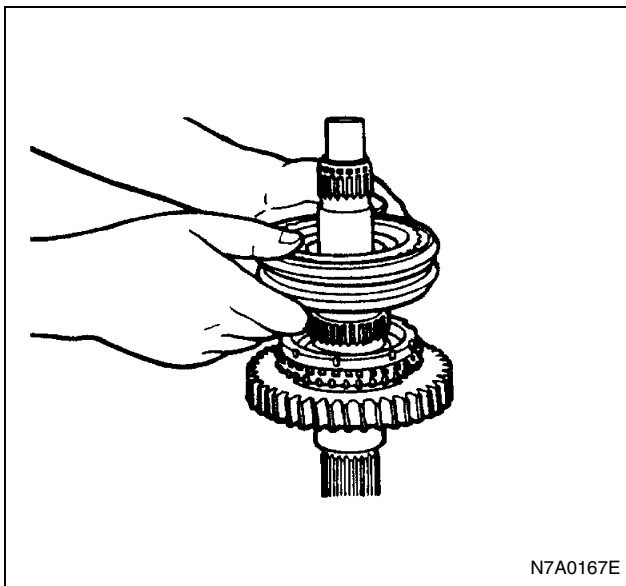
- Larger width side of the sleeve outer circumference should be positioned toward the 1st gear side (rear of transmission).
- Align the insert with the insert groove of the block ring.



Legend

1. Smaller
2. Larger
3. 1st gear

- Tap the clutch hub boss section with a plastic hammer to press it in until it contacts closely with the main shaft stepped section.
- When it is difficult to engage the clutch hub boss with the main shaft spline, heat the clutch hub boss section to a temperature between 80 and 120°C (176 and 248°F) with the piston heater before assembling.
- Check to see if the 1st gear rotates smoothly.



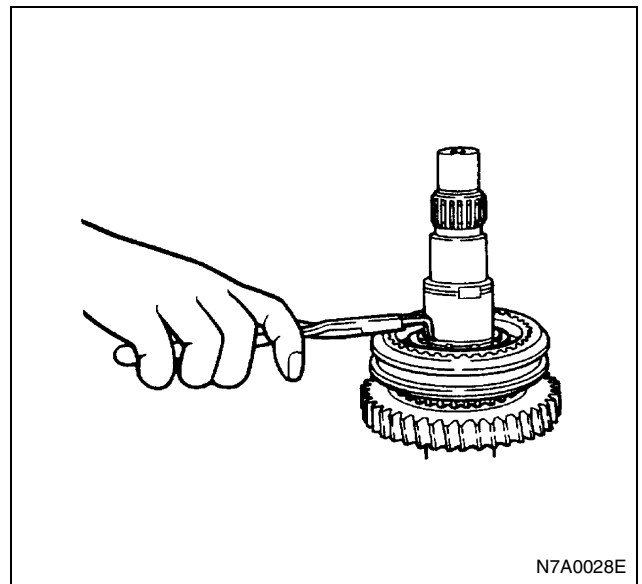
9. Snap Ring

- Install the built-in snap ring and measure the clearance between the snap ring and the clutch hub.

Clutch Hub and Snap Ring Clearance	mm (in)
0 — 0.09 (0 — 0.004)	

- When the clearance is out of the reference value, select a snap ring with the maximum thickness that can be inserted from among the following three types, and built it in.

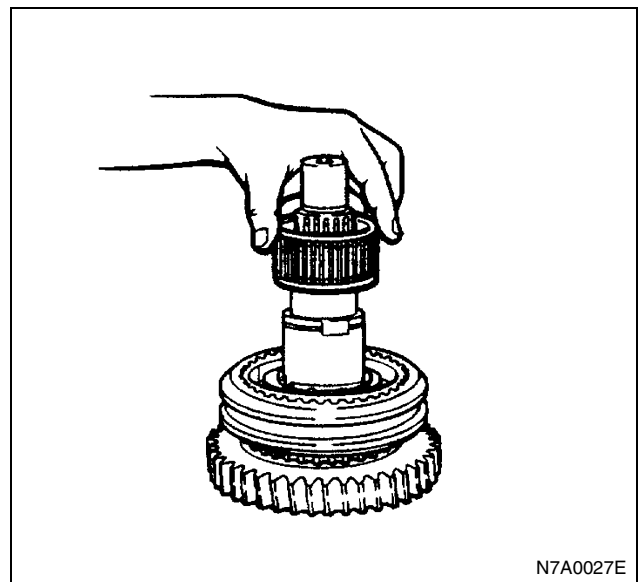
Snap Ring	mm (in)
Color	Thickness (Reference)
Pink	1.75 — 1.80 (0.069 — 0.071)
White	1.80 — 1.85 (0.071 — 0.073)
Yellow	1.85 — 1.90 (0.073 — 0.075)



10. Block Ring

- Align the insert groove of the block ring with the insert.

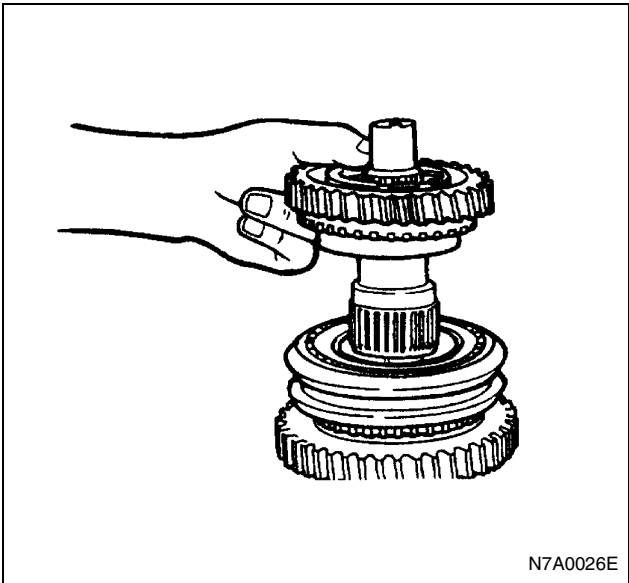
11. Needle Bearing



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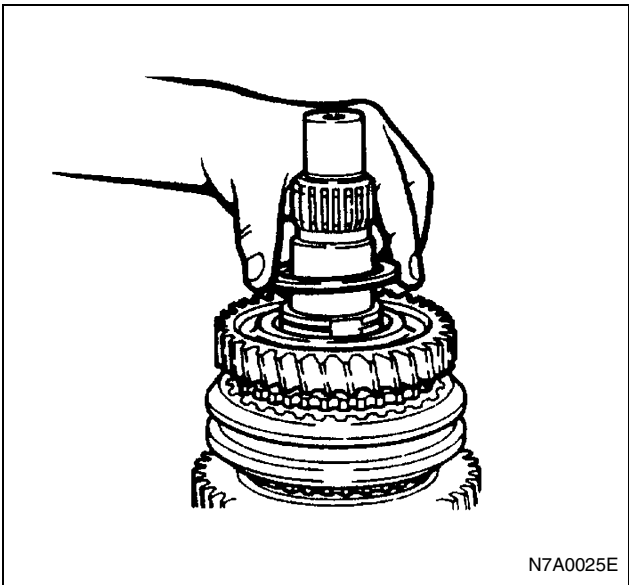
12. 2nd Gear

- Install the 2nd gear with the taper cone side turned to the 1st gear side (to the bottom).



13. Thrust Washer

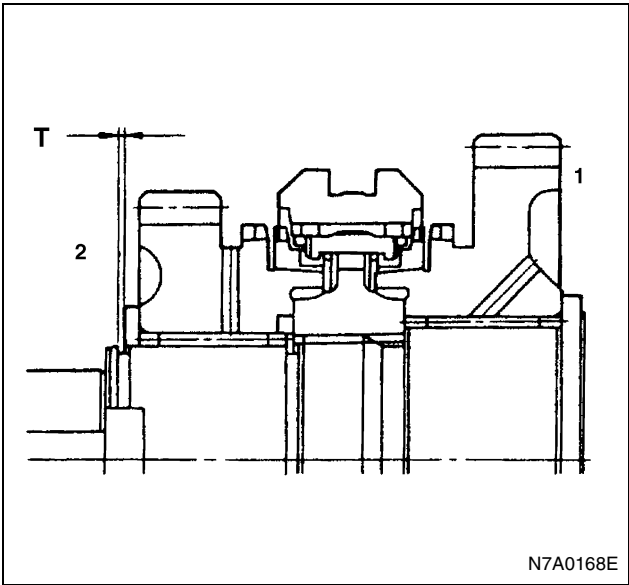
- With the thrust washer set to main shaft groove, assemble it.



14. Snap Ring

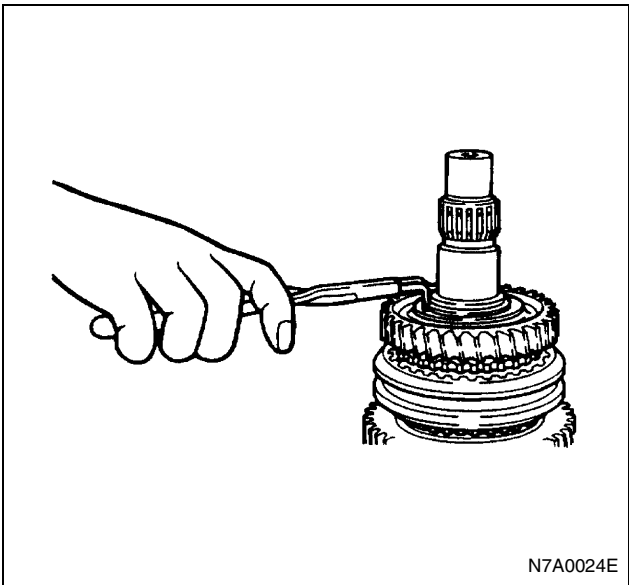
- After installation, measure distance (T) and select the optimum snap ring from the table.

Snap Ring		mm (in)
Distance (T)	Color	Thickness (Reference)
2.20 — 2.27 (0.087 — 0.089)	Yellow	1.85 — 1.90 (0.073 — 0.075)
2.27 — 2.32 (0.089 — 0.091)	Blue	1.90 — 1.95 (0.075 — 0.077)
2.32 — 2.37 (0.091 — 0.093)	Brown	1.95 — 2.00 (0.077 — 0.079)
2.37 — 2.43 (0.093 — 0.096)	Green	2.00 — 2.05 (0.079 — 0.081)



Legend

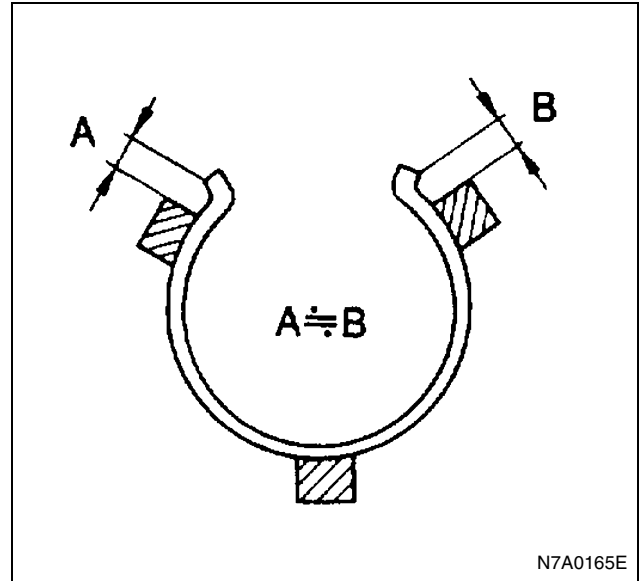
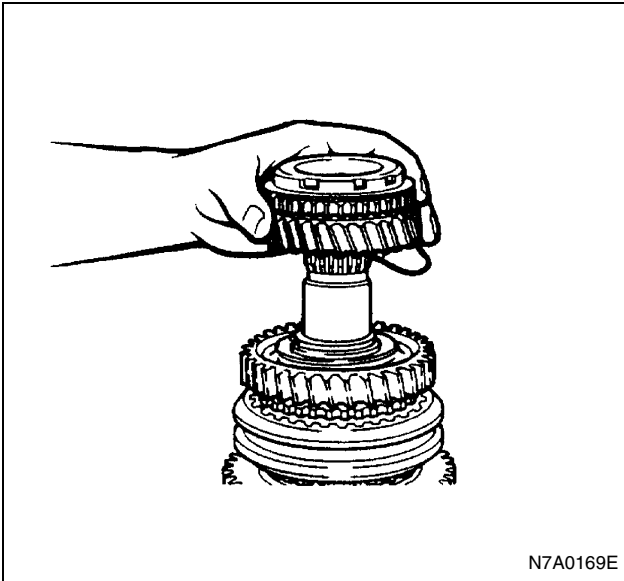
- 1. 1st
- 2. 2nd



- 15. Needle Bearing
- 16. 3rd Gear

- Install with the taper cone side turned upward (front of transmission).

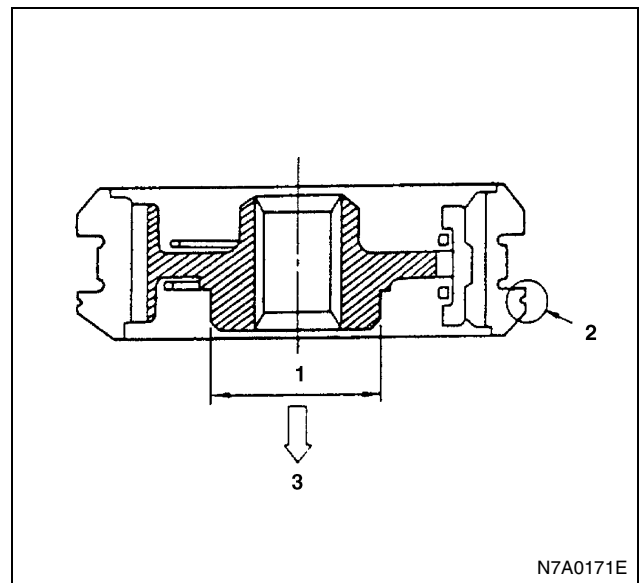
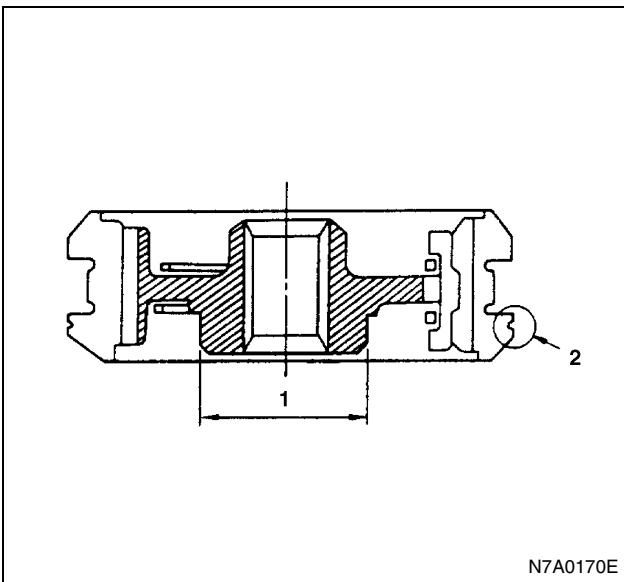
17. Block Ring



- Grooved face of the sleeve and the larger boss of clutch hub should be positioned toward the 3rd gear (rear of transmission).
- Align the insert groove of the block ring with the insert.

18. 3rd/4th Synchronizer Assembly

- Mate the clutch hub and the sleeve so that the larger diameter side of the clutch hub boss and the identification groove of the sleeve outer circumference point to the same direction.
- Put the inserts into the clutch hub groove, and install the insert spring.



Legend

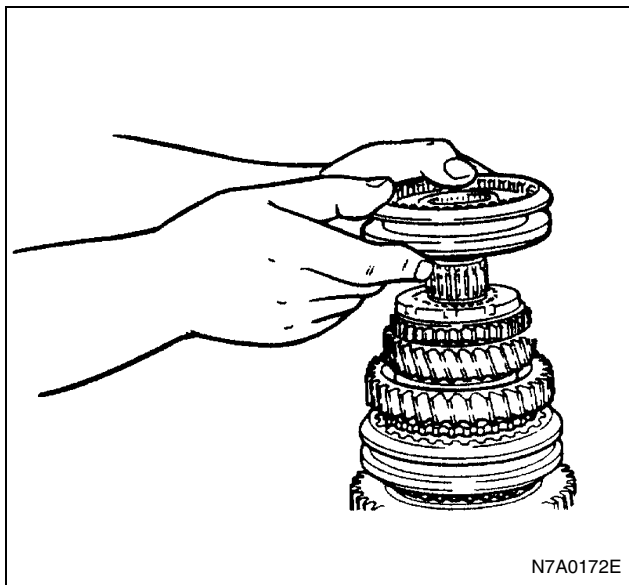
1. Larger
2. Groove
3. 3rd gear

Legend

1. Larger
2. Groove

- Assemble the insert springs so that the distances (A and B) between inserts and the opening of the spring can be nearly equal, and also this opening may not be the same direction on both side.

- Tap the clutch hub boss section with a plastic hammer to press it in until it contacts closely with the main shaft stepped section.
- When it is difficult to engage the clutch hub boss with the main shaft spline, heat the clutch hub boss section to a temperature between 80 and 120°C (176 and 248°F) with the piston heater before assembling.
- Check to see if the 3rd gear rotates smoothly.



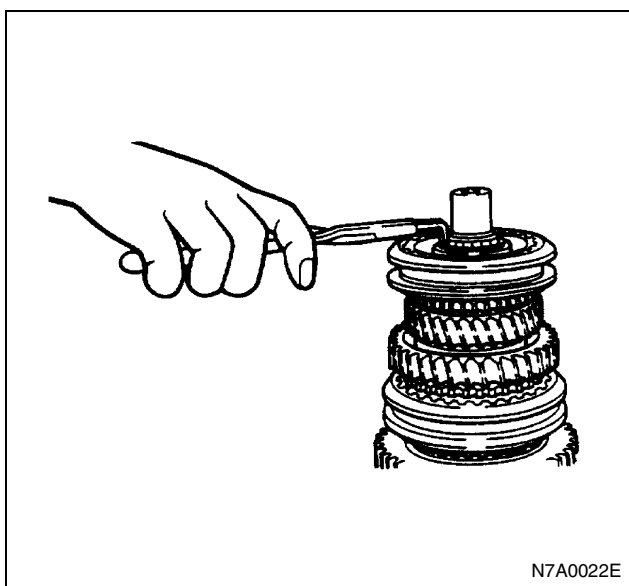
19. Snap Ring

- Install the built-in snap ring and measure the clearance between the snap ring and the clutch hub.

Clutch Hub and Snap Ring Clearance	mm (in)
0 — 0.09 (0 — 0.004)	

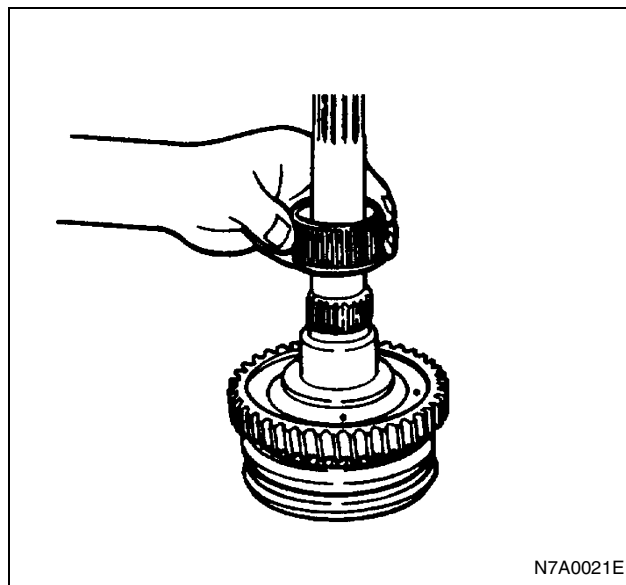
- When the clearance is out of the reference value, select a snap ring with the maximum thickness that can be inserted from among the following three types, and built it in.

Snap Ring		mm (in)
Color	Thickness (Reference)	
Pink	1.75 — 1.80 (0.069 — 0.071)	
White	1.80 — 1.85 (0.071 — 0.073)	
Yellow	1.85 — 1.90 (0.073 — 0.075)	



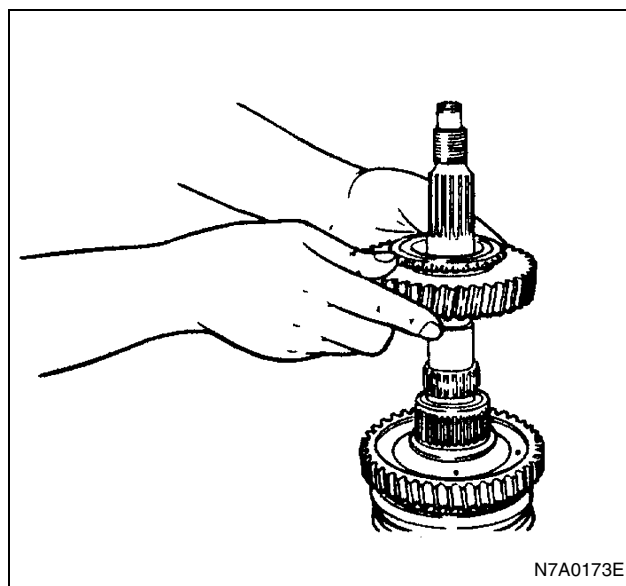
20. Needle Bearing

- Attach a backing plate to the vise, secure the main shaft at the top end.



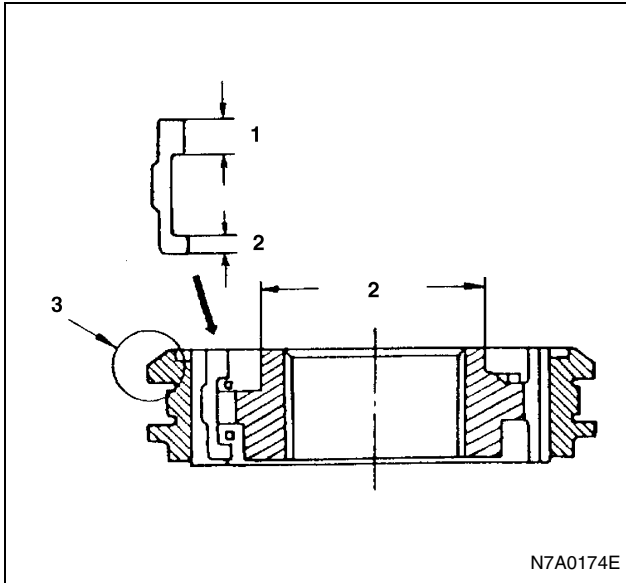
21. Reverse Gear

- Install with the taper cone side turned upward (rear of transmission).



22. 5th/Reverse Synchronizer Assembly

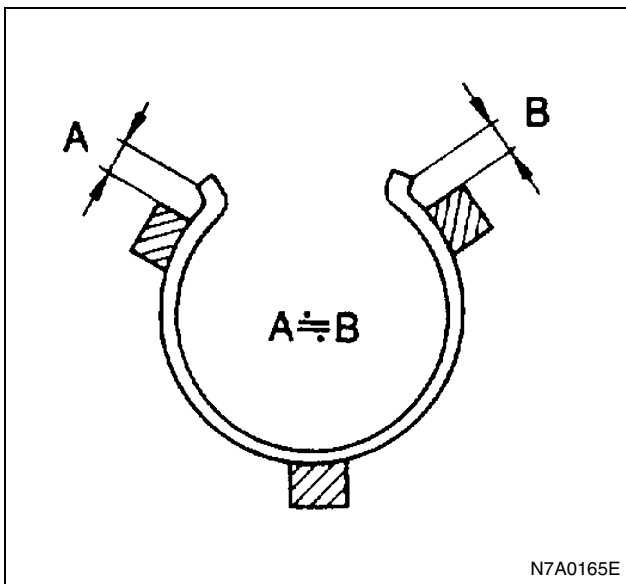
- Mate the clutch hub and the sleeve so that the smaller diameter side of the clutch hub boss and the chamfer of the sleeve outer circumference point to the same direction.
- Put the inserts into the clutch hub groove so that the smaller catch of the insert should be positioned toward the reverse gear (larger diameter side of the clutch hub boss), and install the insert spring.



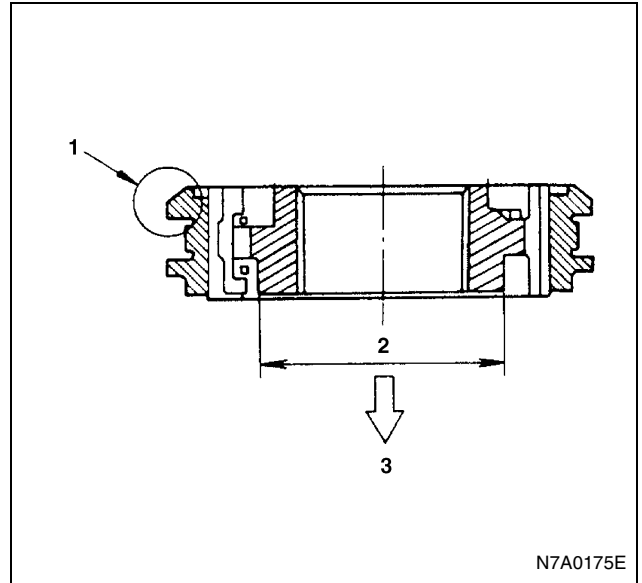
Legend

1. Larger
2. Smaller
3. Chamfer

- Assemble the insert springs so that the distances (A and B) between inserts and the opening of the spring can be nearly equal, and also this opening may not be the same direction on both side.



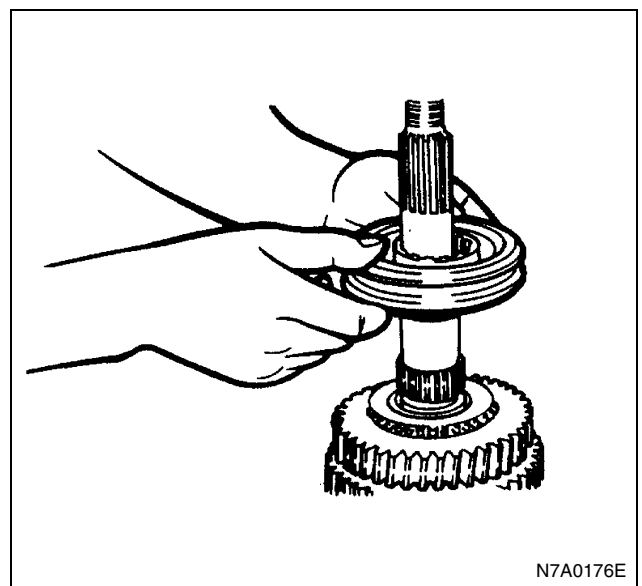
- Face of the clutch hub with larger boss should be positioned toward reverse gear (front of transmission).
- Align the insert with the insert groove of the block ring.



Legend

1. Chamfer
2. Larger
3. Reverse gear

- Tap the clutch hub boss section with a plastic hammer to press it in until it contacts closely with the main shaft stepped section.
- When it is difficult to engage the clutch hub boss with the main shaft spline, heat the clutch hub boss section to a temperature between 80 and 120°C (176 and 248°F) with the piston heater before assembling.
- Check to see if the reverse gear rotates smoothly.



23. Snap Ring

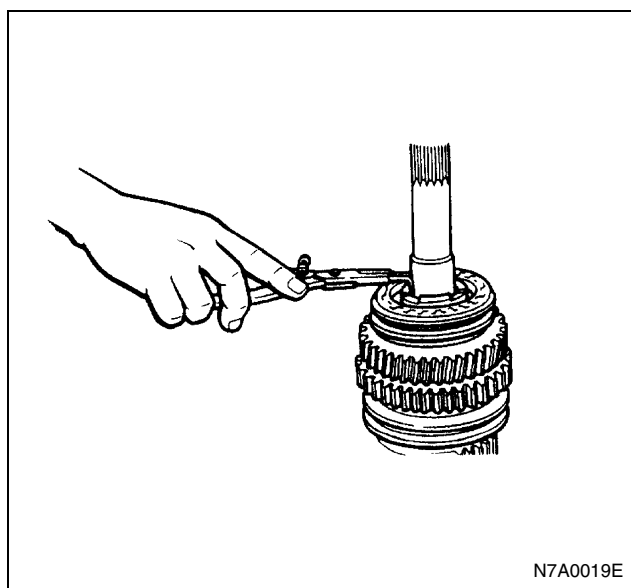
- Install the built-in snap ring and measure the clearance between the snap ring and the clutch hub.

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Clutch Hub and Snap Ring Clearance	mm (in)
0 — 0.09 (0 — 0.004)	

- When the clearance is out of the reference value, select a snap ring with the maximum thickness that can be inserted from among the following three types, and built it in.

Snap Ring	mm (in)
Color	Thickness (Reference)
Pink	1.75 — 1.80 (0.069 — 0.071)
White	1.80 — 1.85 (0.071 — 0.073)
Yellow	1.85 — 1.90 (0.073 — 0.075)



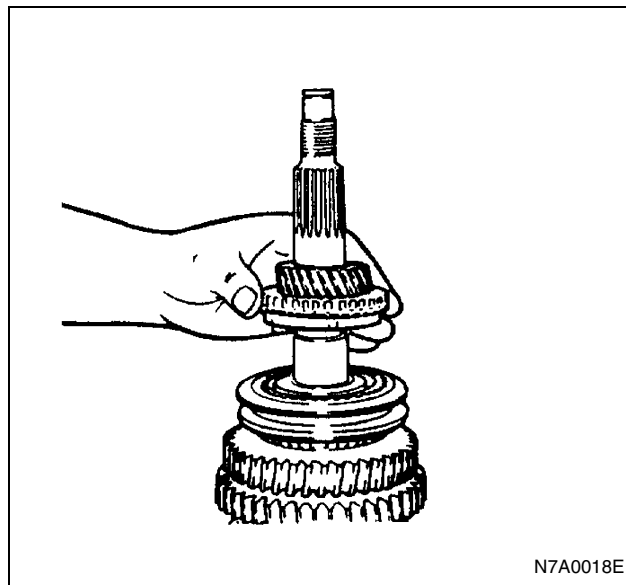
N7A0019E

24. Block Ring

- Align the insert groove of the block ring with the insert.

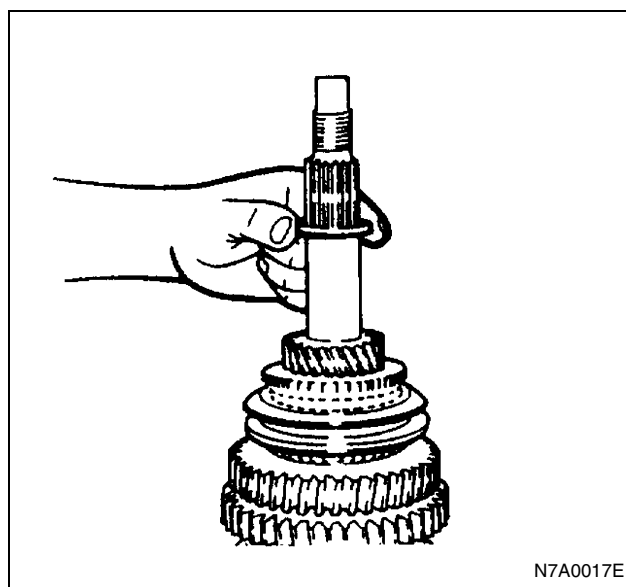
25. 5th Gear

- Install with the taper cone side turned reverse gear side (front of transmission).



N7A0018E

26. Thrust Washer

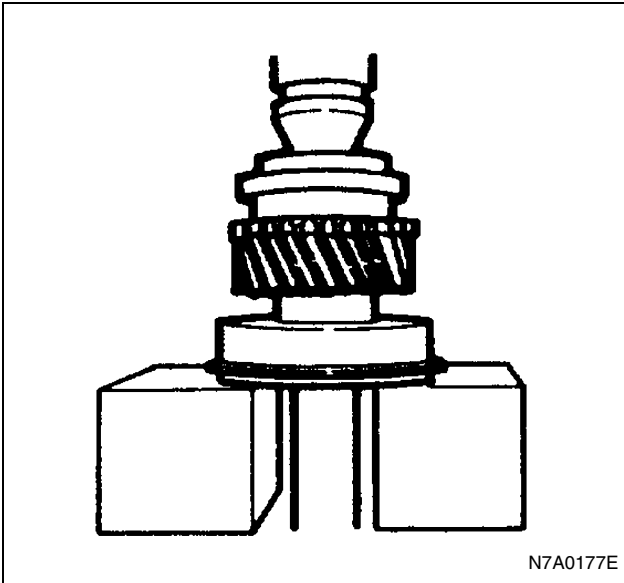


N7A0017E

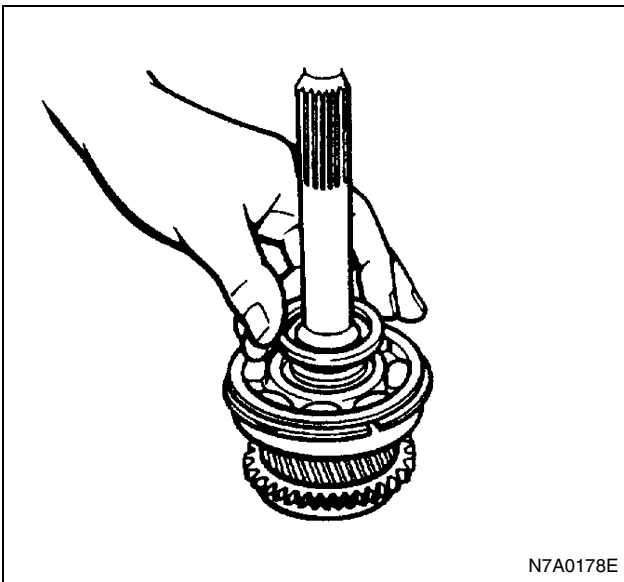
Top Gear Shaft Assembly

27. Ball Bearing

- Install the ball bearing to the top gear shaft and press it in so that the outer circumference snap ring side turns to the outside (in the direction opposite to the gear).

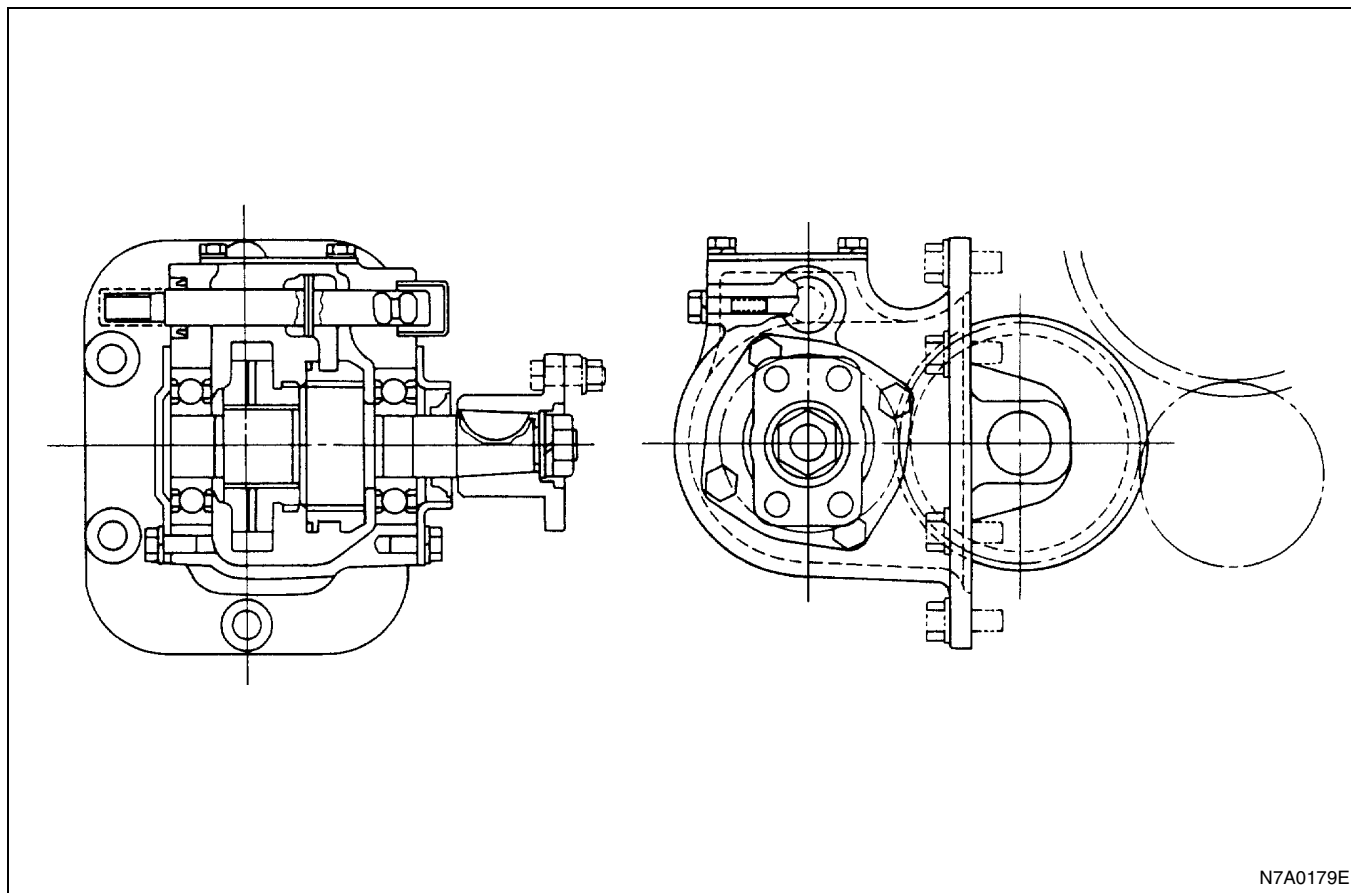


28. Snap Ring



POWER TAKE OFF (PTO)

General Description



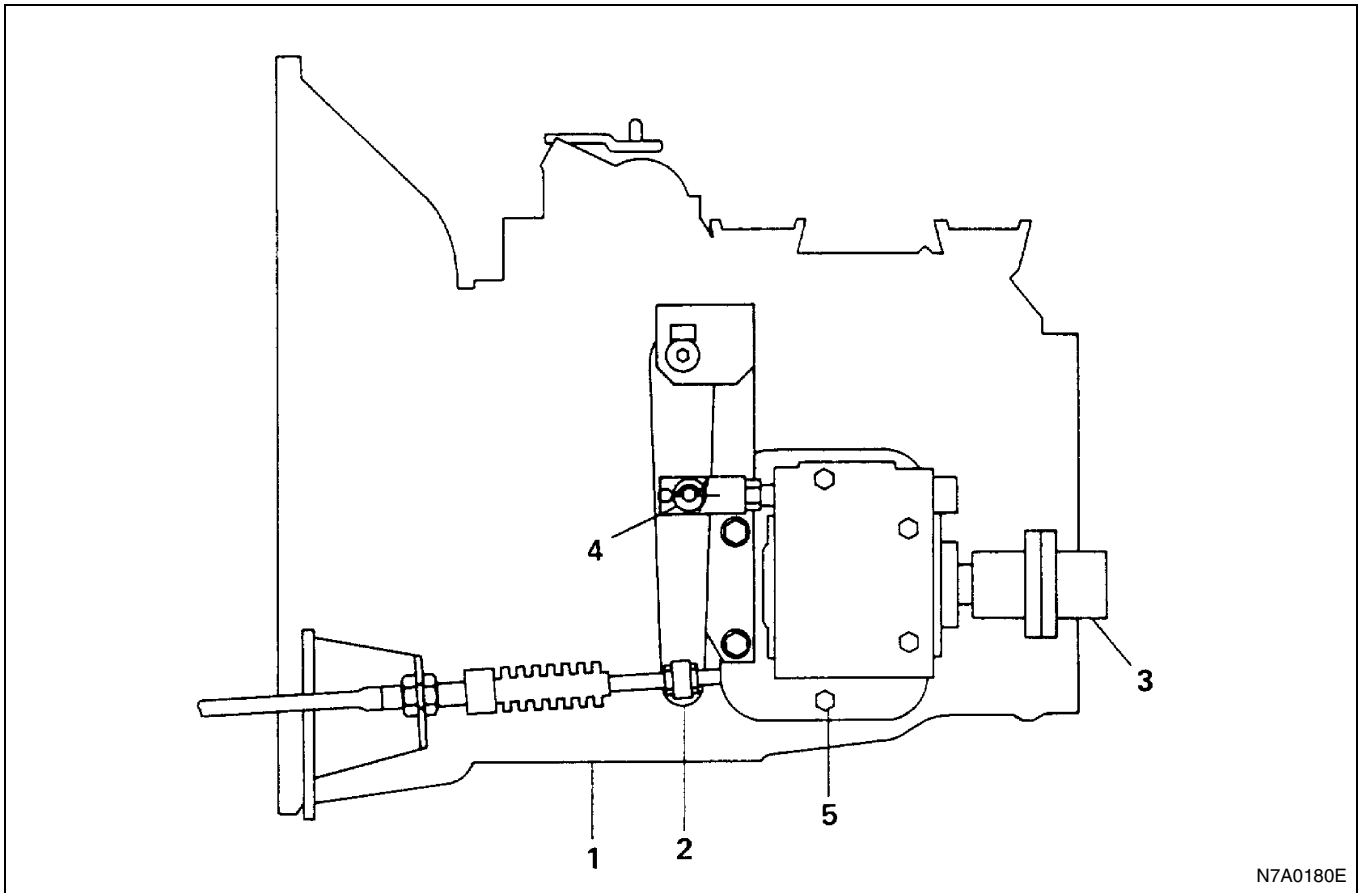
The side PTO is provided at the left side of the transmission.

For the gear, the same helical gear as the one used for the transmission is employed to reduce noises.

The roller type needle bearing is employed for the idle shaft and the ball bearing for the output shaft to obtain the increased durability and quietness.

The gear employed is of a constant-mesh type. The gear engagement control (ON/OFF) by a cable is made by the shift rod provided at the upper section of the case, which slides the sleeve on the output shaft through the shaft arm.

Power Take Off (PTO) Replacement



N7A0180E

Legend

- | | |
|-------------------------------|-------------------|
| 1. Transmission oil | 4. Connecting pin |
| 2. Control cable | 5. PTO assembly |
| 3. PTO output propeller shaft | |

Removal

1. Transmission Oil
 - Remove the drain plug from the transmission case and drain the oil.
2. Control Cable
 - Disconnect the control cable from the PTO shift lever.
3. PTO Output Propeller Shaft
 - Disconnect the propeller shaft from the PTO output flange.
4. Connecting Pin
 - Remove the snap pin, washer and the connecting pin from the shift rod and the shift lever.
5. PTO Assembly
 - Remove the 6 PTO fixing bolts, and the PTO assembly.

- Apply liquid gasket (Three Bond 1141E or equivalent) to the PTO and transmission surfaces, and both sides of the distance plate (if installed).
- Install the distance plate (if installed) and PTO with new gasket(s).

Tighten:

PTO bolt to 37 N·m (3.8 kg·m / 27 lb·ft)

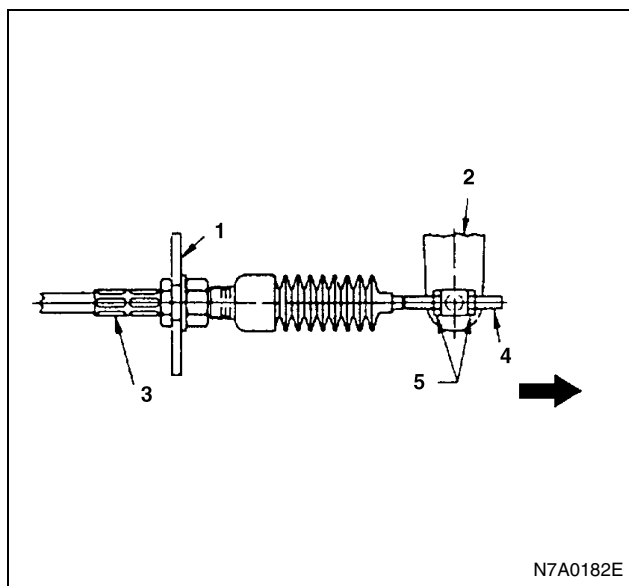
2. Connecting Pin
 - Install the connecting pin to the shift rod and shift lever and install the snap pin with washer.
3. PTO Output Propeller Shaft
4. Control Cable

Inner Cable Adjustment Type

 - 1) Fix the outer cable.
 - 2) Set the PTO shift lever in the OFF position. Be sure to confirm the PTO control lever is in the OFF position (PTO indicator light turned off).
 - 3) Remove slack from the inner cable by pulling the inner cable in the direction of the arrow.
 - 4) Tighten the lock nuts.

Installation

1. PTO Assembly
 - Clean and dry on the mating faces before applying the liquid gasket.



Legend

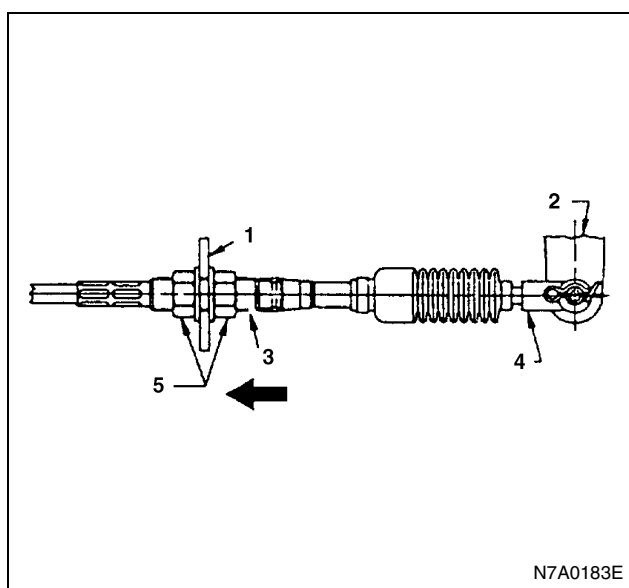
1. Bracket
2. Shift lever
3. Outer cable
4. Inner cable
5. Lock nut

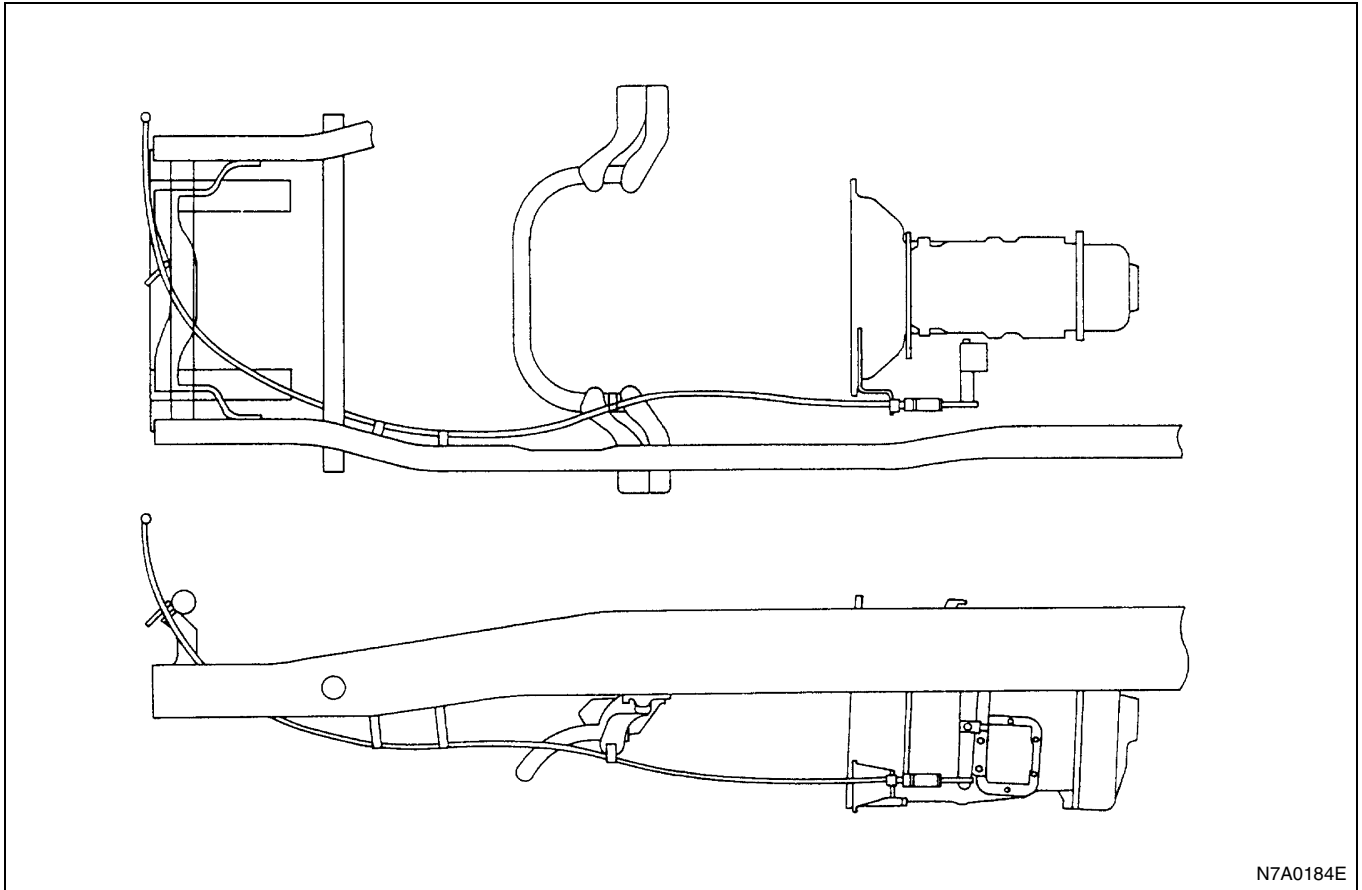
Legend

1. Bracket
2. Shift lever
3. Outer cable
4. Inner cable
5. Lock nut

Outer Cable Adjustment Type

- 1) Set the PTO shift lever in the OFF position. Be sure to confirm the PTO control lever is in the OFF position (PTO indicator light turned off).
- 2) Connect the inner cable to the PTO shift lever.
- 3) Remove slack from the inner cable by pulling the outer cable in the direction of the arrow.
- 4) Tighten the lock nuts.





5. Transmission Oil

- 1) Install the drain plug.

Tighten:

Drain plug to 49 N·m (5.0 kg·m / 36 lb·ft)

- 2) Remove the filler plug and fill the transmission case with the specified engine oil through the filler plug hole.

Oil Capacity	Liters (US-qt/Imp-qt)
2.7 (2.9/2.4)	

Caution:

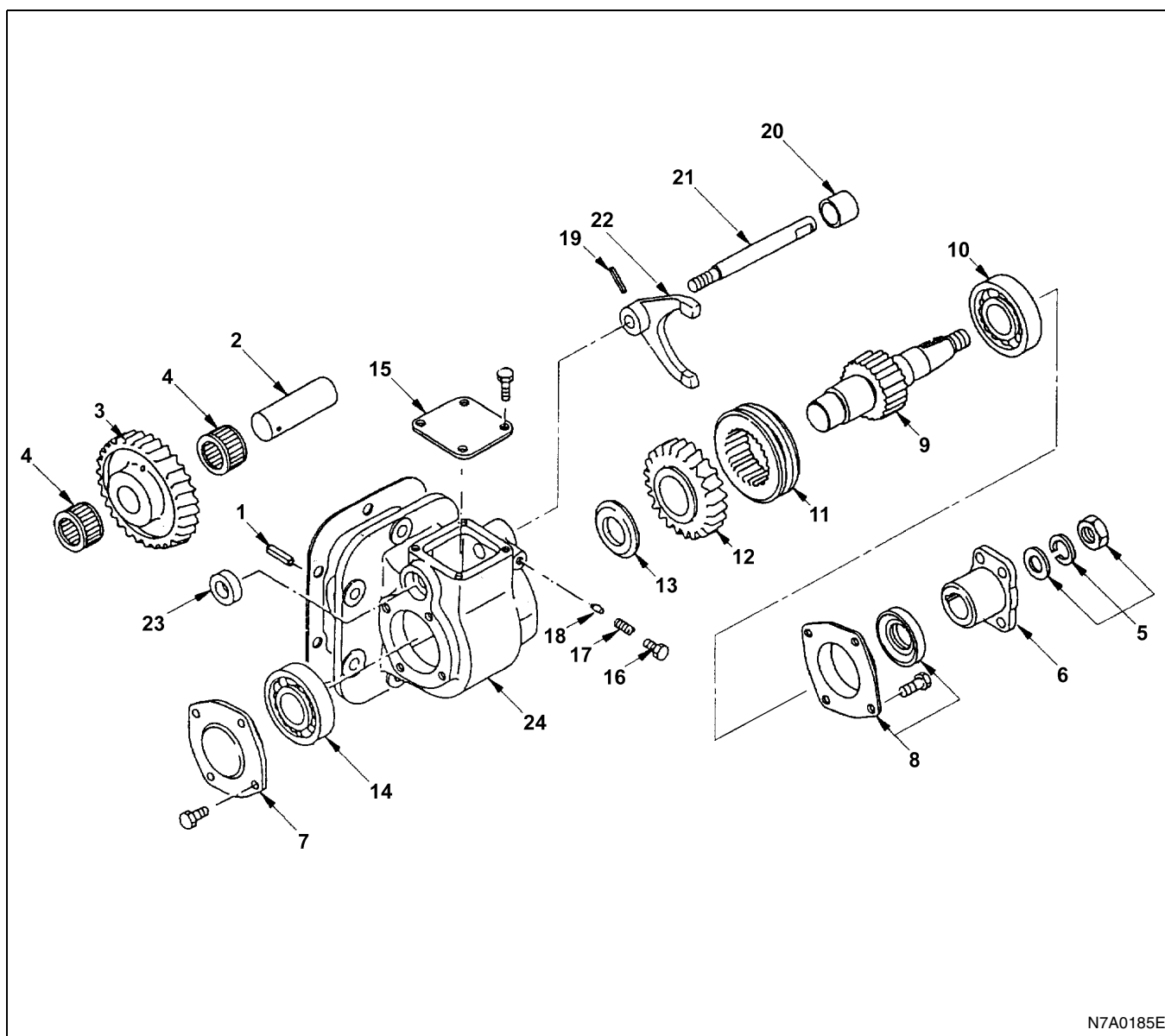
Use ENGINE OIL SAE 5W-30 for transmission case.

- 3) Install the filler plug.

Tighten:

Filler plug to 49 N·m (5.0 kg·m / 36 lb·ft)

Unit Repair



N7A0185E

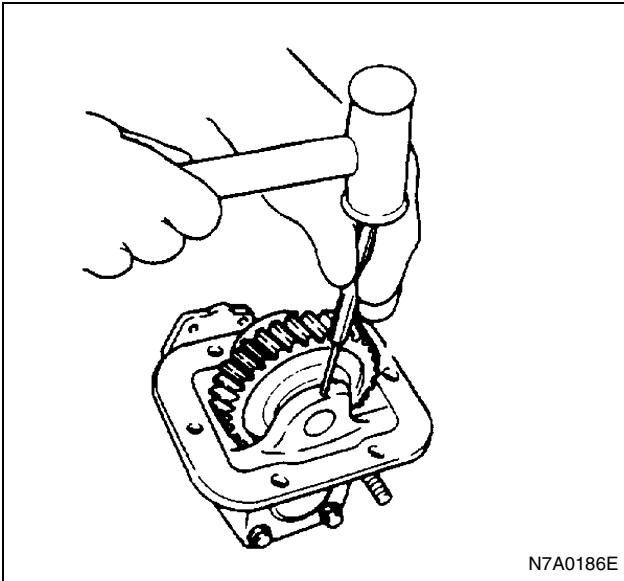
Legend

- | | |
|------------------------------|------------------------|
| 1. Spring pin | 13. Thrust collar |
| 2. Idle gear shaft | 14. Front bearing |
| 3. Idle gear | 15. Upper cover |
| 4. Needle bearing | 16. Plug |
| 5. Lock nut and washer | 17. Detent spring |
| 6. Coupling driver | 18. Detent pin |
| 7. Front cover | 19. Spring pin |
| 8. Rear cover with oil seal | 20. Shift rod plug |
| 9. Output shaft | 21. Shift rod |
| 10. Rear bearing | 22. Shift arm |
| 11. Sleeve | 23. Shift rod oil seal |
| 12. Output gear with bushing | 24. Gear case |

Disassembly

1. Spring Pin

- Tap the spring pin into the idle shaft.
Spring Pin Remover: 9-8529-2201-0

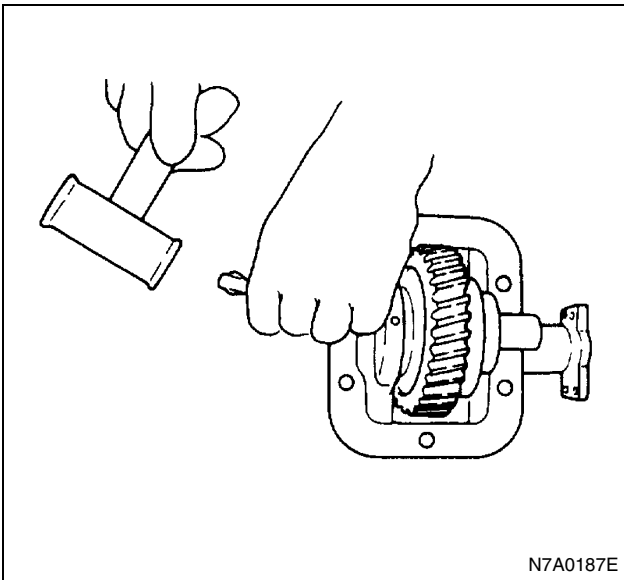


2. Idle Gear Shaft

- Drive out the idle gear shaft by tapping on its front end with a suitable bar and hammer.
- Remove the spring pin from the idle gear shaft.
Spring Pin Remover: 9-8529-2201-0

3. Idle Gear

4. Needle Bearing

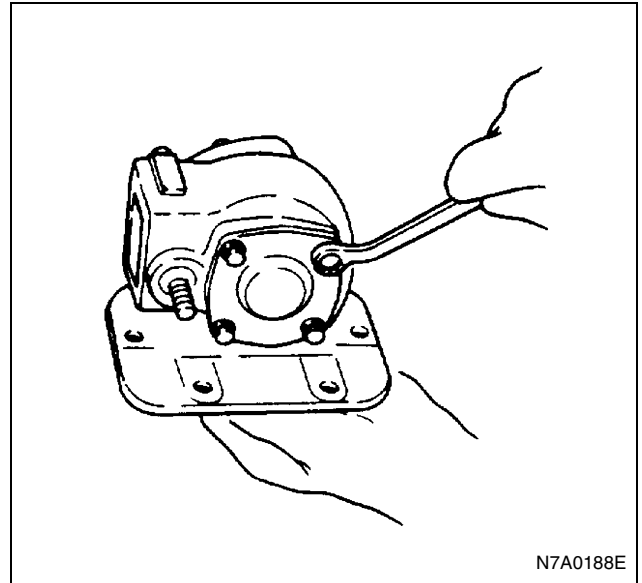


5. Lock Nut and Washer

- Attach a backing plate to the vice, secure the coupling driver, and remove the lock nut, spring washer and plain washer.

6. Coupling Driver

7. Front Cover



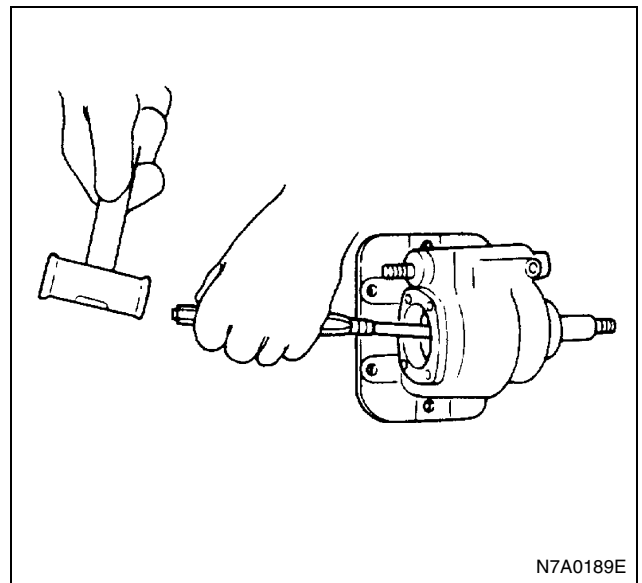
8. Rear Cover (with Oil Seal)

- Remove the oil seal from the rear cover.

9. Output Shaft

10. Rear Bearing

- Drive out the output shaft by tapping on its front end with a suitable bar and hammer.
- Remove the rear bearing from the output shaft.



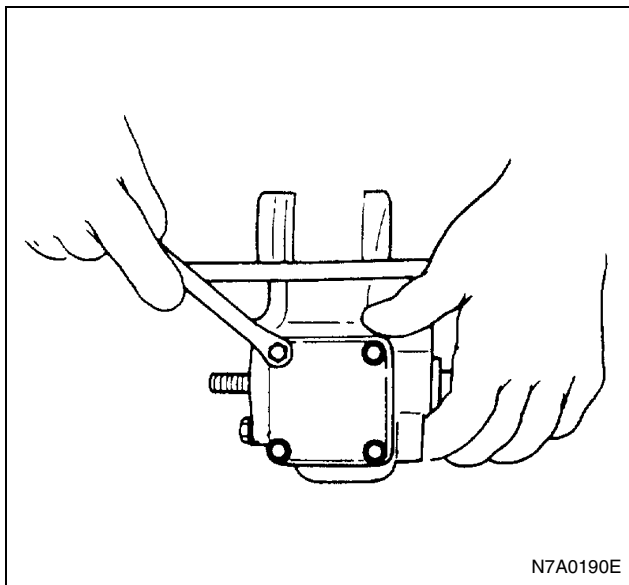
11. Sleeve

12. Output Gear with Bushing

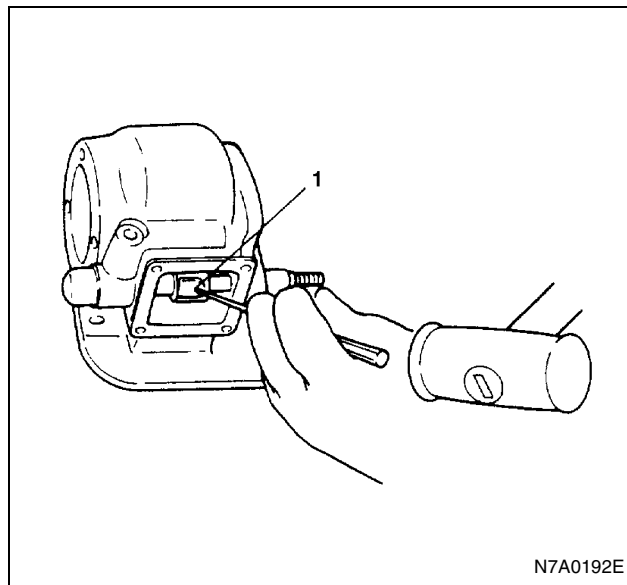
13. Thrust Collar

14. Front Bearing

15. Upper Cover



- 16. Plug
- 17. Detent Spring
- 18. Detent Pin

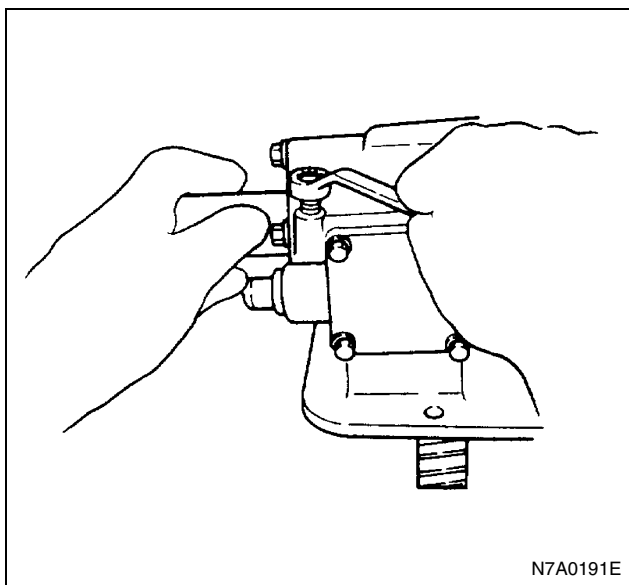


Legend

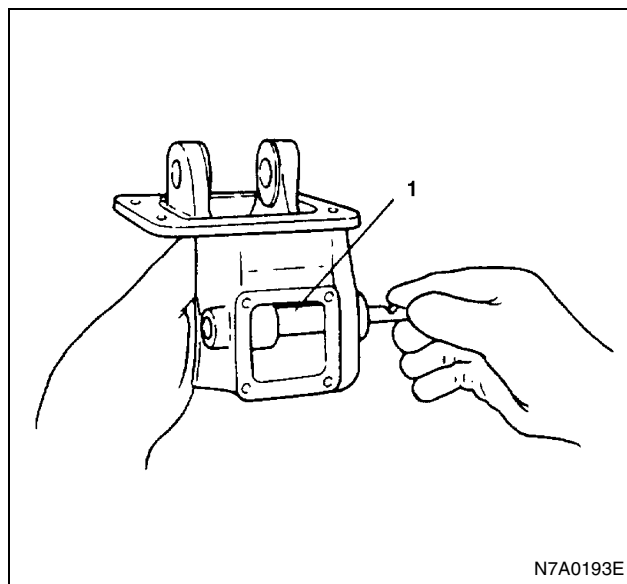
- 1. Spring pin

- 20. Shift Rod Plug
- 21. Shift Rod
- 22. Shift Arm

- Move the shift rod (1) rearward by tapping on its front end. Then, remove the each parts.



- 19. Spring Pin
Spring Pin Remover: 9-8529-2201-0



- 23. Shift Rod Oil Seal
- 24. Gear Case

Inspection and Repair

Make the necessary adjustments, repairs and part replacement if excessive wear or damage is discovered during inspection.

Bearings

Check the each bearing, and replace in either of the following cases.

- Rotation is not smooth.
- Abnormal sound is generated.

- There is extreme damage or rust.
- Rolling element or rolling contact surface of needle roller bearing is discolored, extremely worn or pitted.

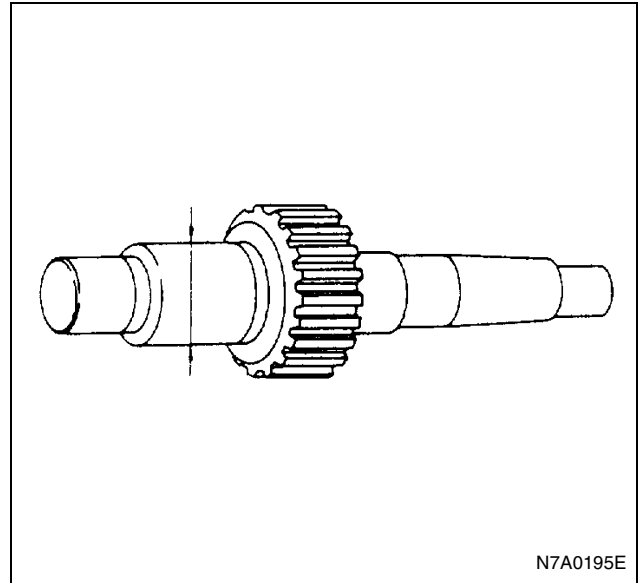
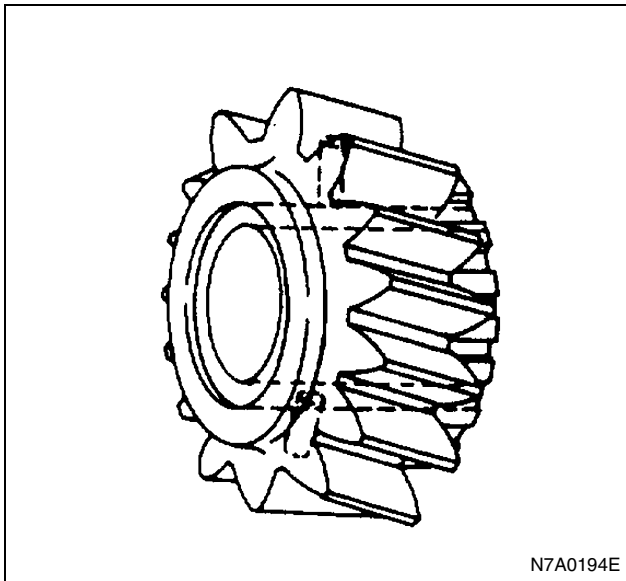
Ball Bearing Run-out	mm (in)
Limit	
0.2 (0.01)	

Gears

Check each gear for the following points. Correct a slight stepped wear or surface roughness with an oil stone or pencil grinder, or replace the gear if unrecoverable damage is found.

- Break or damage of tooth.
- Extreme wear of tooth.

Output Shaft and Output Gear Bushing Clearance	mm (in)
Limit	
0.2 (0.01)	



Idle Gear Shaft and Output Shaft

Check the shaft external surface for any damage or wear, and its spline section for wear, damage or bent. When there is any abnormal condition, or when it is used excessively beyond a proper use limit, replace it with new one.

Shift Mechanism

Inspect all disassembled parts for wear, damage or other abnormal conditions.

- Check the shift rod for wear, bent and damage.
- Check the shift arm for wear or deformation.

Shift Arm Thickness	mm (in)
Standard	Limit
9.0 (0.35)	8.0 (0.31)

- Check the detent spring and detent pin for wear, weakening and deformation.
- The wear of the shift rod, and the awkward operation of the gear case.

Sleeve

Check the sleeve for any abnormal conditions.

Correct a slight stepped wear or surface roughness with an oil stone or pencil grinder, or replace the sleeve if unrecoverable damage is found.

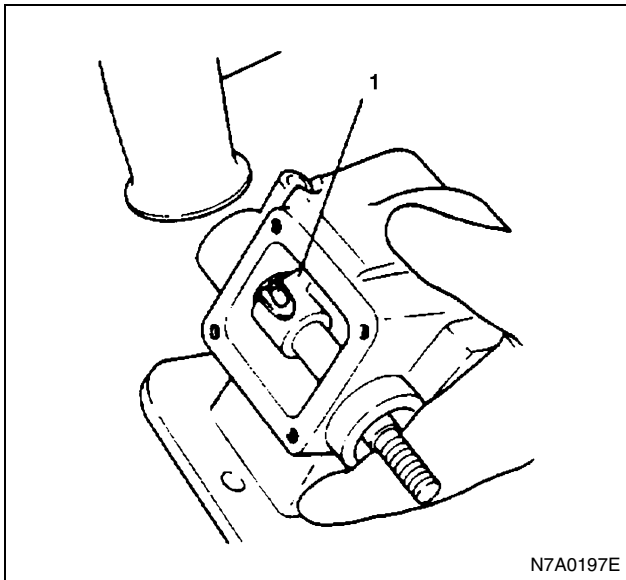
Reassembly

Notice:

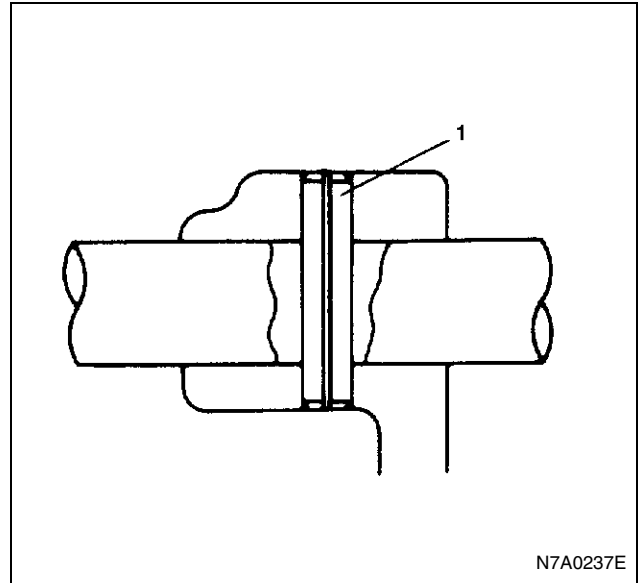
Clean each part thoroughly.

When assembling parts, apply clean engine oil (SAE 5W-30) to their sliding and mating sections.

1. Gear Case
2. Shift Rod Oil Seal
 - Clean and dry on the mating faces before applying the liquid gasket.
 - Apply liquid gasket (Three Bond 1141E or equivalent) to the new oil seal outer circumference and apply multi-purpose grease to the oil seal lip.
 - Use the oil seal installer to install the oil seal.
Oil Seal Installer: 5-8840-2065-0
3. Shift Arm
 - With the boss side of the shift arm (1) set to the rear.



4. Shift Rod
 - Turning the detent groove to the outside (detent pin side), insert the shift rod from the front side with the detent groove side at the front.
5. Spring Pin
 - Setting the hole of the shift arm to that of the shift rod, fix them with a new spring pin (1).



6. Shift Rod Plug
 - Clean and dry on the mating faces before applying the liquid gasket.
 - Apply liquid gasket (LOCTITE 962T or equivalent) to the cap outer circumference.
 - Use the plug installer to install the shift rod cap.
Plug Installer: 5-8840-2067-0

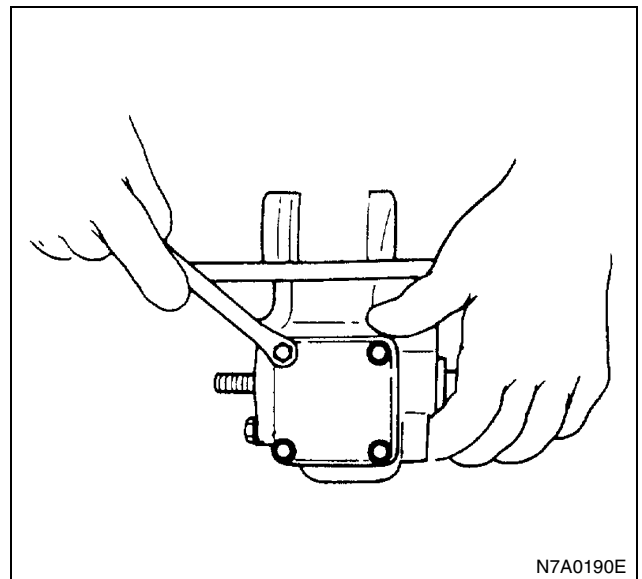
Notice:

When there is any warp or flaw found with the shift rod cap, replace it with new one.

7. Upper Cover
 - Clean and dry on the mating faces before applying the liquid gasket.
 - Apply liquid gasket (FMD-127 or equivalent) to the gear case and upper cover surfaces.
 - Install the upper cover with new gasket.

Tighten:

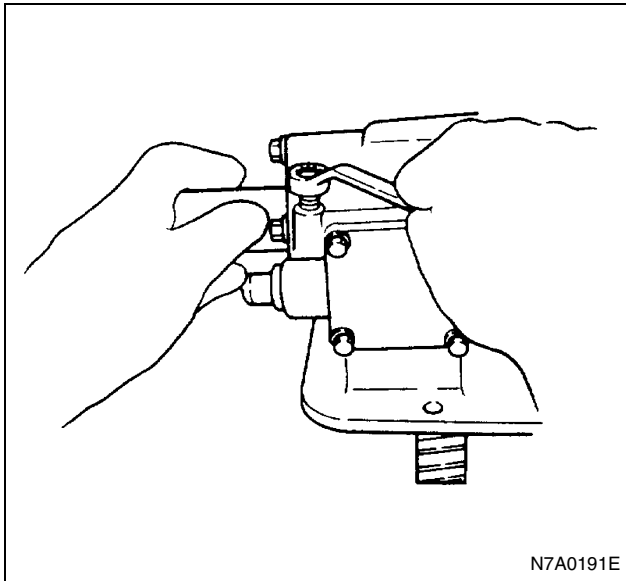
Upper cover bolt to 25 N·m (2.5 kg·m / 18 lb·ft)



8. Detent Pin
9. Detent Spring
10. Plug
 - Remove sealant from the plug and female threaded surfaces and the surfaces must be perfectly dry.
 - Apply liquid gasket (LOCTITE 242 or equivalent) to the plug's threaded portion.

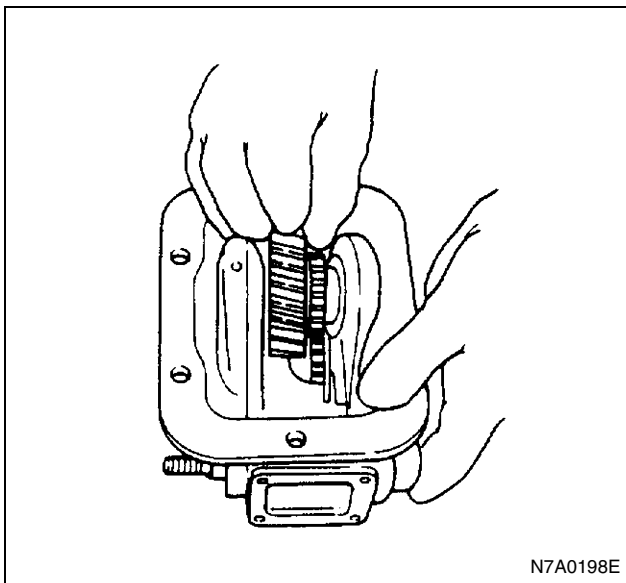
Tighten:

Detent pin plug to 25 N·m (2.5 kg·m / 18 lb·ft)



N7A0191E

11. Output Gear with Bushing
 - Install with the dog gear side turned to the coupling driver side (to the rear).

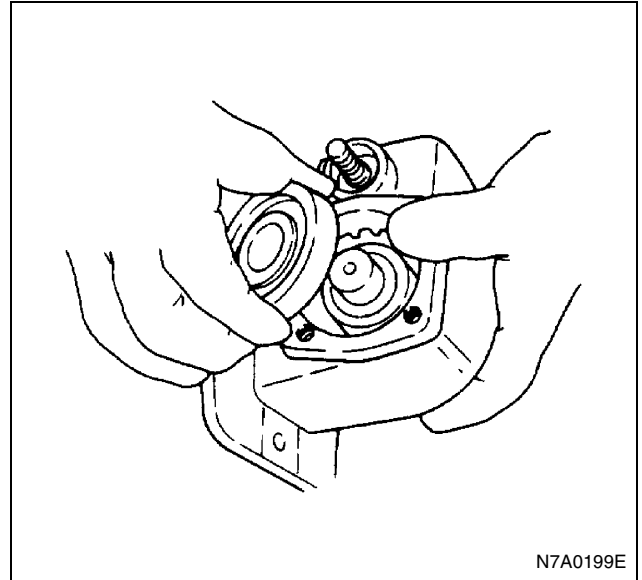


N7A0198E

12. Sleeve
 - Chamfer face of the sleeve outer circumference should be positioned toward the coupling driver and assemble the sleeve groove to the shift arm.
13. Output Shaft

14. Thrust Collar
15. Front Bearing
 - Install the thrust collar and front bearing using bearing installer.

Bearing Installer: 5-8840-2066-0



N7A0199E

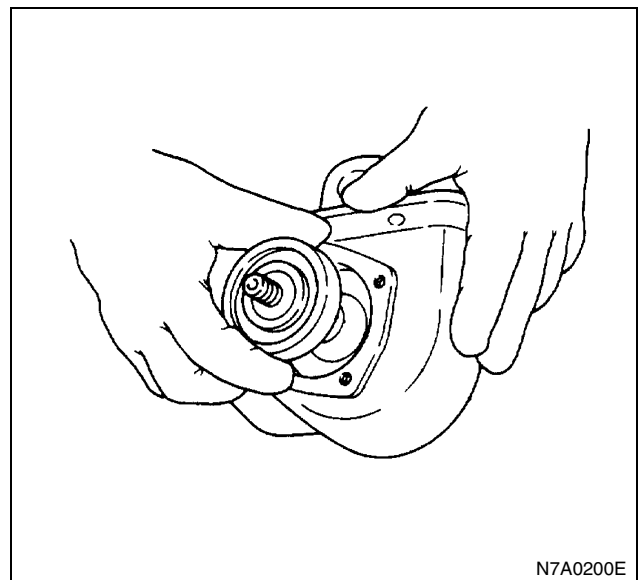
16. Front Cover
 - Clean and dry on the mating faces before applying the liquid gasket.
 - Apply liquid gasket (FMD-127 or equivalent) to the gear case and front cover surfaces.
 - Install the front cover with new gasket.
 - Apply liquid gasket (LOCTITE 242 or equivalent) to the fixing bolt's threaded portion.

Tighten:

Upper cover bolt to 25 N·m (2.5 kg·m / 18 lb·ft)

17. Rear Bearing
 - Use the bearing installer to install the rear bearing.

Bearing Installer: 5-8840-2066-0



N7A0200E

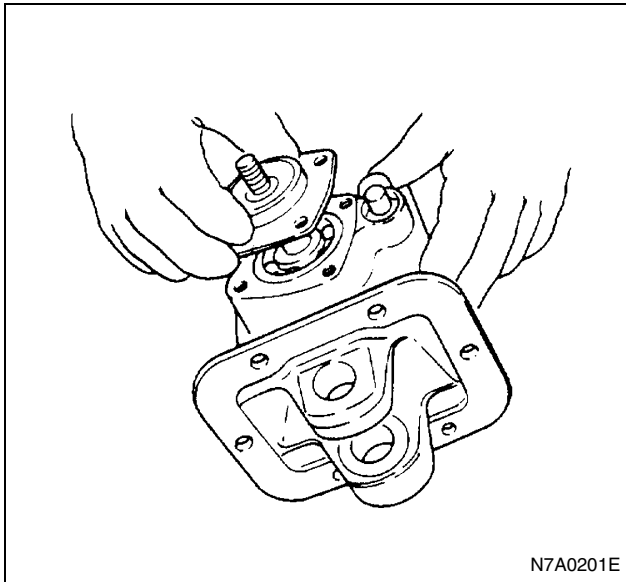
7B-68 MANUAL TRANSMISSION (MSB)

18. Rear Cover

- Apply liquid gasket (FMD-127 or equivalent) to the new oil seal outer circumference and apply multi-purpose grease to the oil seal lip.
- Use oil seal installer to install the oil seal to the rear cover.
- Oil Seal Installer: 5-8840-2064-0
- Apply approx. 3 grams (0.1 ounce) of the Multi-purpose with MOS_2 type grease to the inside of rear cover.
- Clean and dry on the mating faces before applying the liquid gasket.
- Apply liquid gasket (Three Bond 1141E or equivalent) to the rear cover and gear case surfaces.
- Install the rear cover with new gasket.

Tighten:

Rear cover bolt to 25 N·m (2.5 kg·m / 18 lb·ft)



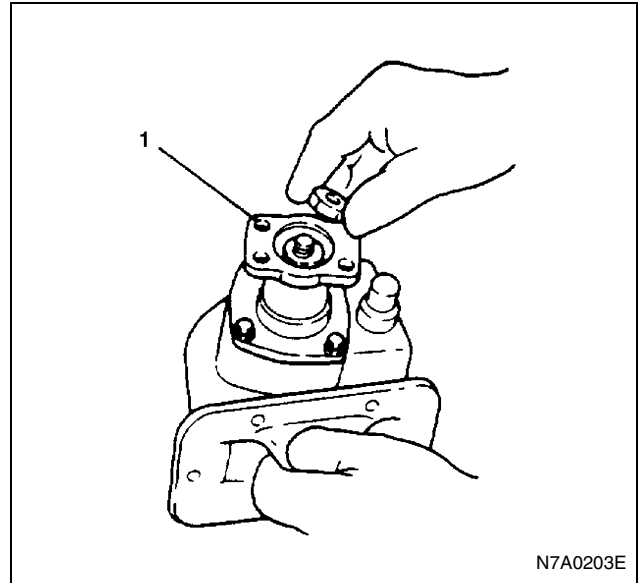
19. Coupling Driver

20. Lock Nut and Washer

- Attach a backing plate to the vice, secure the coupling driver, and tighten the lock nut.

Tighten:

Lock nut to 105 N·m (10.7 kg·m / 77 lb·ft)



Legend

1. Flange

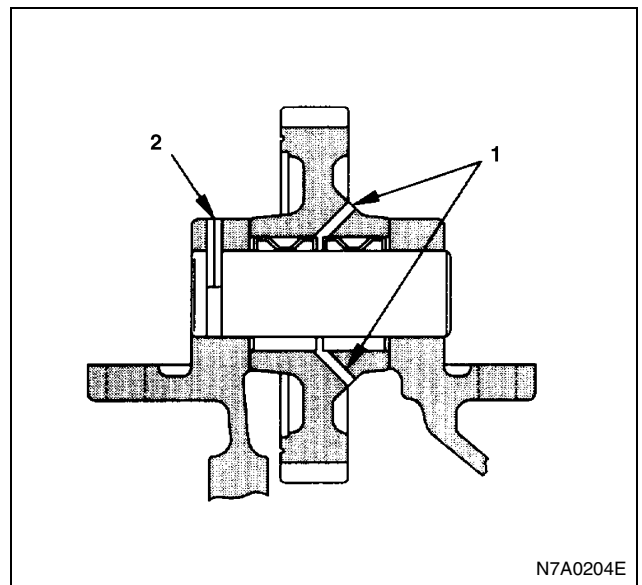
21. Needle Bearing

22. Idle Gear

- Install with the oil holes side turned to the rear.

23. Idle Gear Shaft

24. Spring Pin



Legend

1. Oil hole
2. Spring pin