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# 1989 Mazda RX-7 Factory Service Manual

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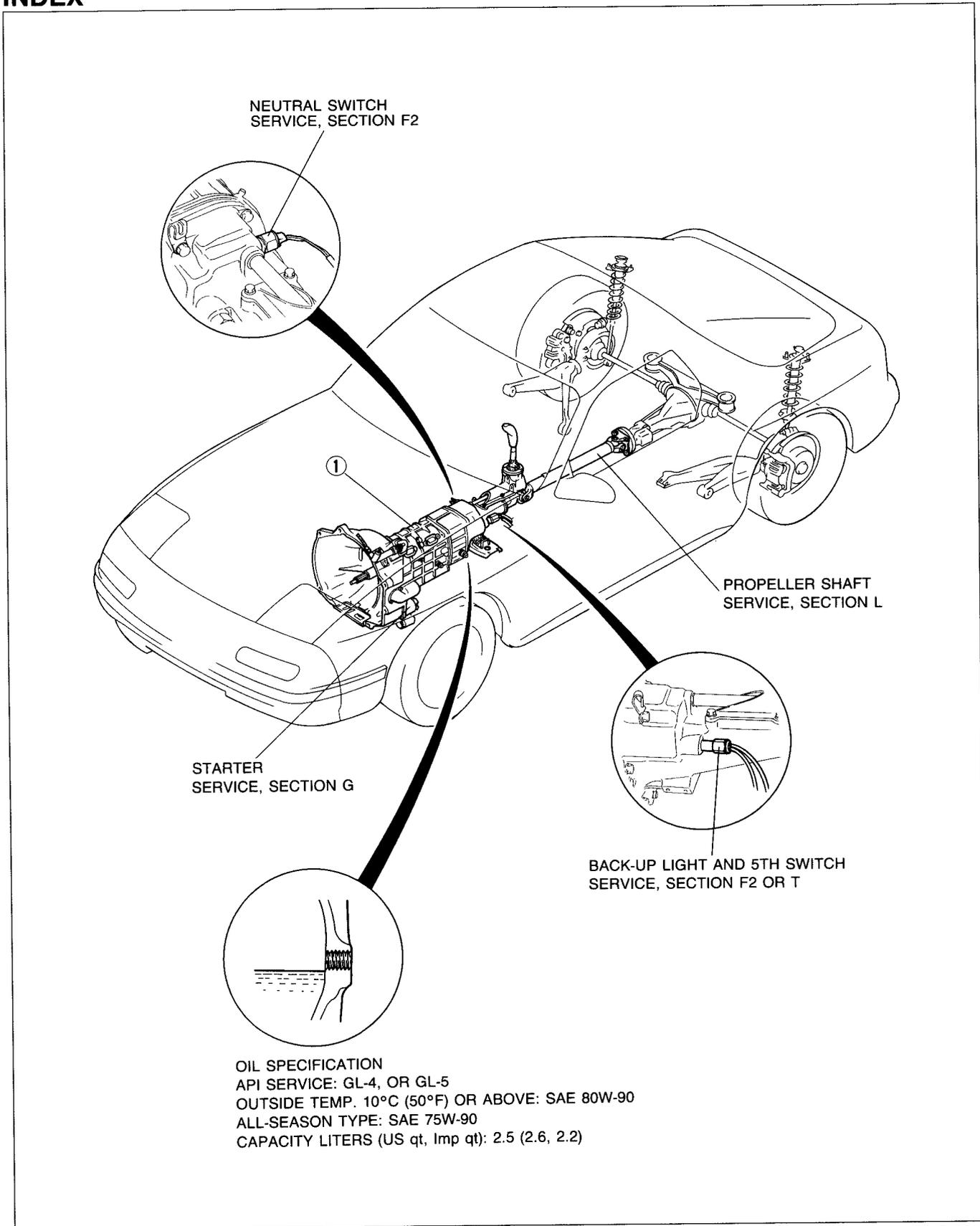
Some parts of the manual may be hard to read or see on the screen, but if you print the pages out it's perfect. Well except for the crookedness ☺.

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# **MANUAL TRANSMISSION (Turbo)**

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**OUTLINE**

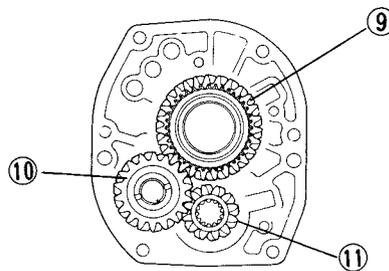
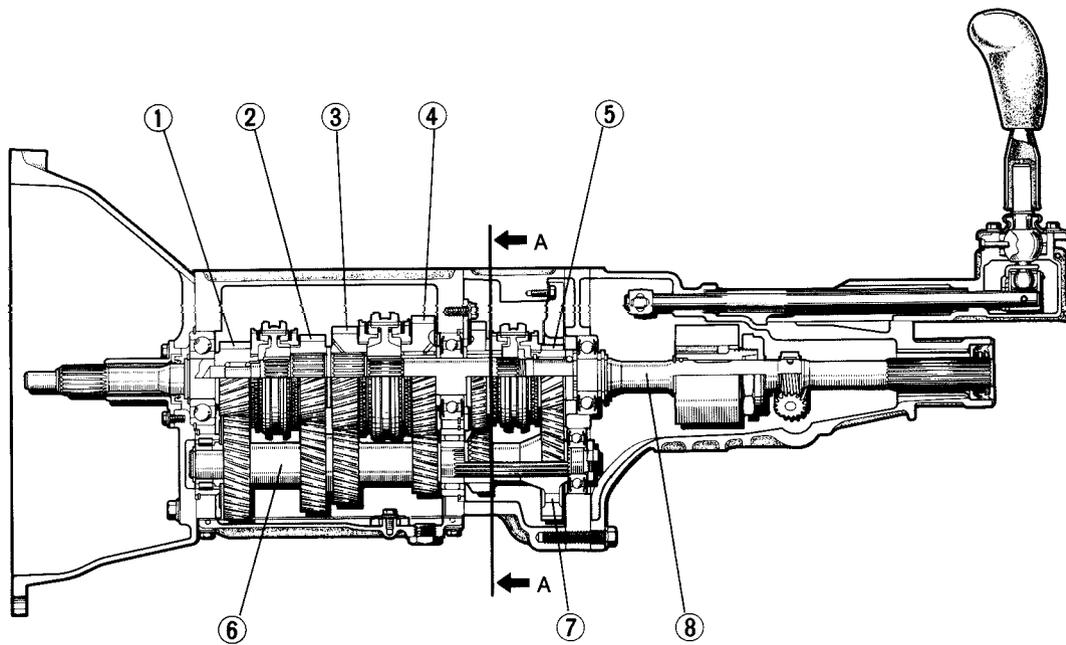
**SPECIFICATIONS**

Item		Transmission model	R-type
Synchronization mechanism			Forward: Synchromesh Reverse: Synchromesh
Shift type			5-speed, floor shift
Shift pattern			
Gear ratio	1st		3.483
	2nd		2.015
	3rd		1.391
	4th		1.000
	5th		0.719
	Reverse		3.288
Oil	Grade		API service GL-4 or GL-5
	Viscosity	All-season	SAE 75W-90
		Above 10°C (50°F)	SAE 80W-90
	Capacity	liters (US qts, Imp qts)	2.5 (2.6, 2.2)

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# J2 OUTLINE

## STRUCTURAL VIEW



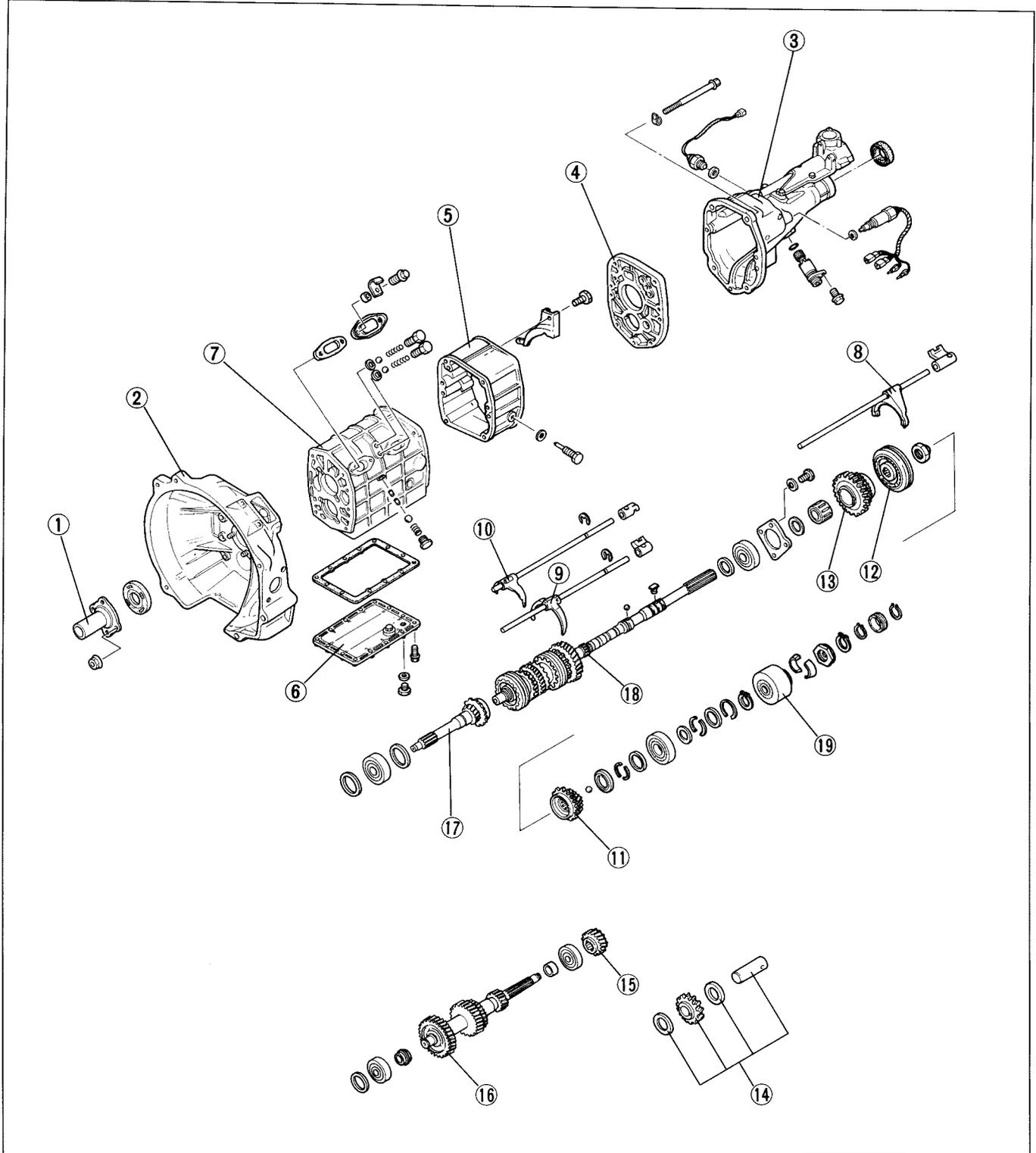
VIEW A—A

9MU0JX-004

1. Main drive gear (4th gear)
2. 3rd gear
3. 2nd gear
4. 1st gear
5. 5th gear
6. Countershaft

7. Counter 5th gear
8. Mainshaft
9. Reverse gear
10. Reverse idler gear
11. Counter reverse gear

## COMPONENTS

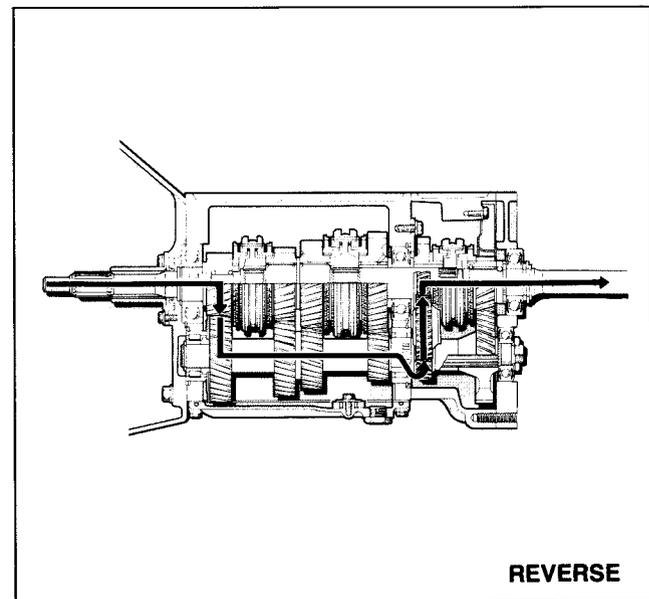
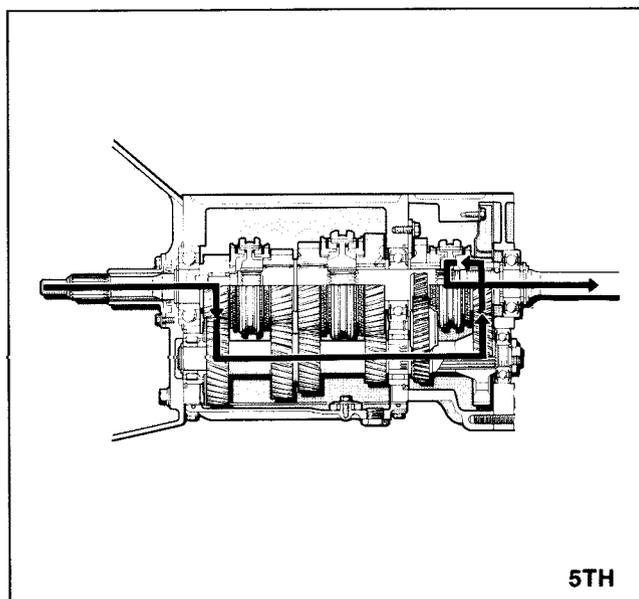
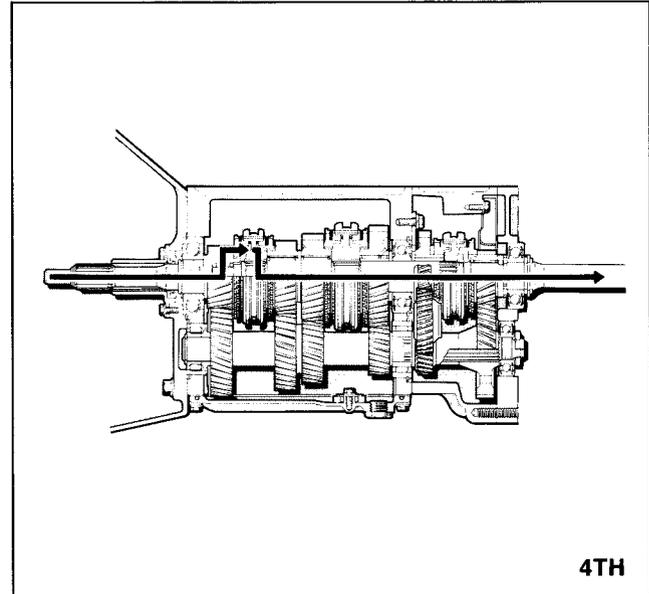
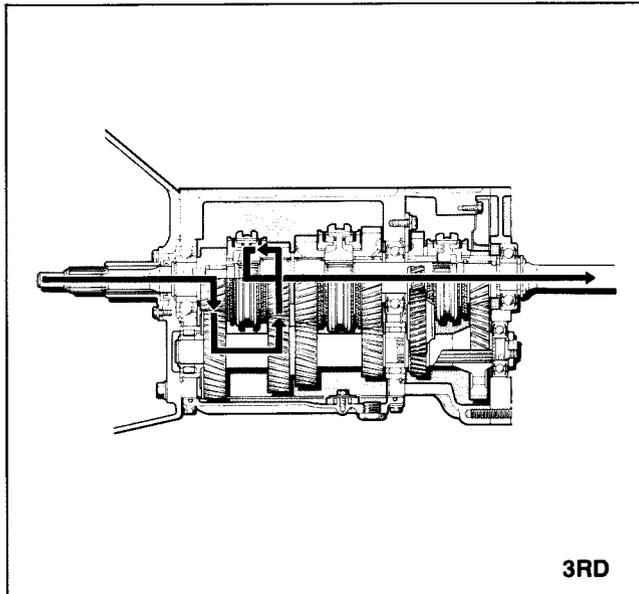
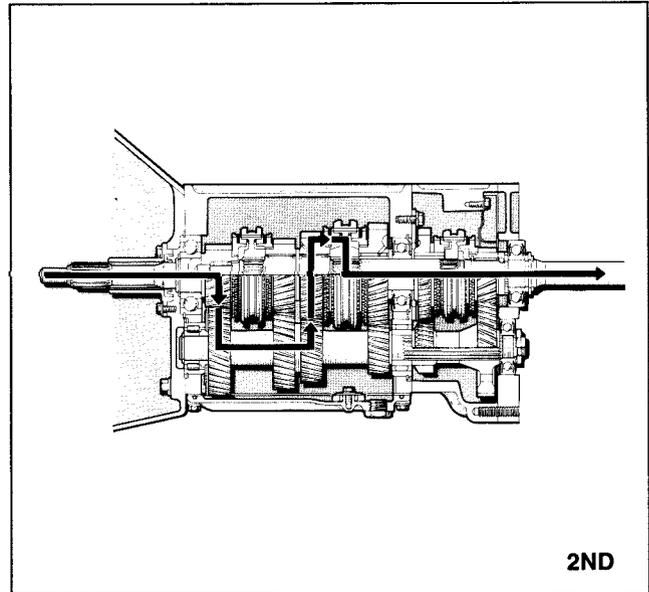
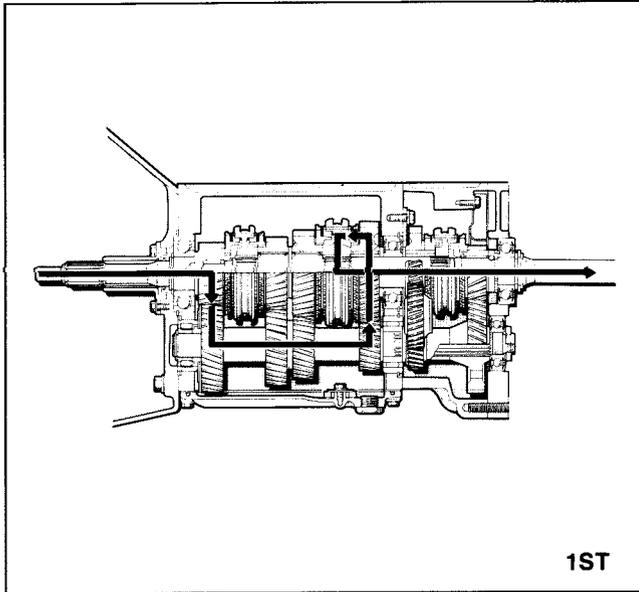


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- |  |  |   |
|--|--|---|
| 1. Front cover                         | 9. Shift fork and rod (1st/2nd)          | 16. Countershaft  |
| 2. Clutch housing                      | 10. Shift fork and rod (3rd/4th)         | 17. Main drive gear   |
| 3. Extension housing                   | 11. 5th gear                             | 18. Mainshaft assembly<br>(1st gear, clutch hub<br>assembly [1st/2nd], 2nd gear,<br>3rd gear, clutch hub<br>assembly [3rd/4th]) |
| 4. Bearing housing                     | 12. Clutch hub assembly<br>(5th/Reverse) | 19. Dynamic damper  |
| 5. Center housing                      | 13. Reverse gear                         |   |
| 6. Undercover                          | 14. Reverse idler gear assembly          |   |
| 7. Transmission case                   | 15. Counter reverse gear                 |   |
| 8. Shift fork and rod<br>(5th/Reverse) |  |   |

# J2 OUTLINE

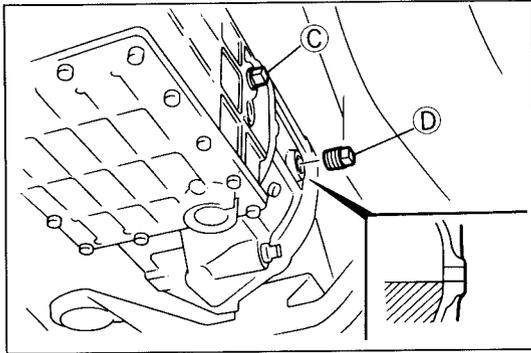
## POWERFLOW



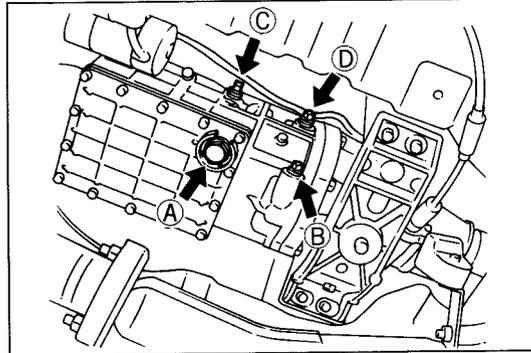
**TROUBLESHOOTING GUIDE**

<b>Problem</b>	<b>Possible Cause</b>	<b>Action</b>	<b>Page</b>
<b>Abnormal noise</b>	Insufficient oil	Add oil	J2- 8
	Deterioration of oil quality	Replace with specified oil	J2- 8
	Worn bearing	Replace	J2-24
	Worn contact surface of countershaft gear	Replace	J2-23
	Worn contact surface of gears	Replace	J2-23
	Excessive gear backlash	Replace	—
<b>Difficult to shift</b>	Damaged gear teeth	Replace	J2-23
	Insufficient oil	Add oil	J2- 8
	Deterioration of oil quality	Replace with specified oil	J2- 8
	Wear or play of control lever end or shift rod	Replace	J2-23
	Worn synchronizer ring	Replace	J2-24
	Worn synchronizer cone of gear	Replace	J2-24
	Poor contact of synchronizer ring and gear cone	Replace	J2-24
	Excessive longitudinal play of gears	Replace	J2-23
Worn bearing	Replace	J2-24	
Improper disengagement of clutch	Refer to Section H	—	
<b>Jumps out of gear</b>	Weak detent ball spring	Replace	J2-25
	Worn shift fork	Replace	J2-23
	Worn clutch hub	Replace	J2-24
	Worn clutch hub sleeve	Replace	J2-24
	Worn gears	Replace	J2-23
	Excessive gear backlash	Replace	—
	Worn bearing	Replace	J2-24
	Incorrect installation or loose engine mounts or transmission mounts	Tighten	J2-43

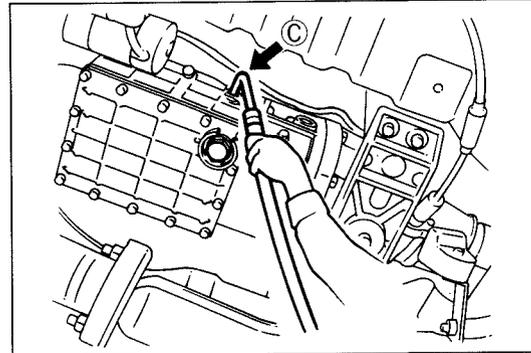
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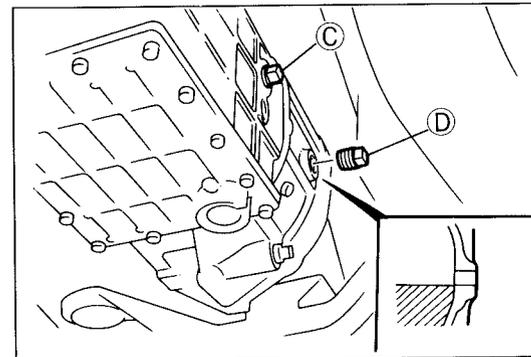
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9MU0JX-009



9MU0JX-010



9MU0JX-011

## TRANSMISSION OIL

### INSPECTION

1. Remove check plug **D**.
2. Verify that the oil is at the bottom of the check plug hole. If it is low, add the specified oil from fill plug **C**.
3. Apply sealant to the plug threads before installing.

### Tightening torque:

**C, D: 25—39 N·m (2.5—4.0 m·kg, 18—29 ft·lb)**

### REPLACEMENT

#### Note

Replace drain plug **A** washer with a new one whenever removed.

1. Remove the plugs (**A** with washer, **B**, **C**, and **D**).
2. Drain the oil into a suitable container.
3. Wipe all plugs clean.
4. Apply sealant to plug threads (**B**, **C** and **D**).
5. Install the drain plugs (**B** and **A** with new washer).

### Tightening torque:

**A: 39—59 N·m (4.0—6.0 m·kg, 29—43 ft·lb)**

**B: 31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)**

6. Add the specified oil from fill plug **C** port until the level reaches the bottom of check plug **D** hole.

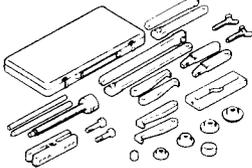
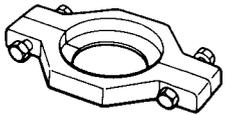
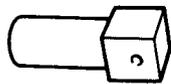
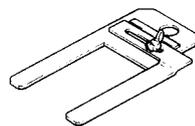
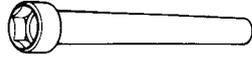
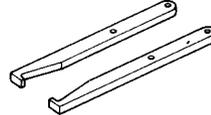
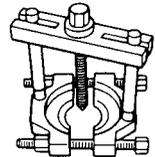
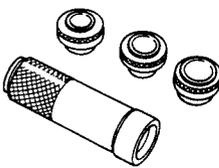
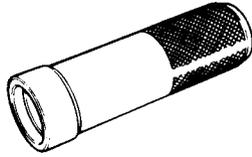
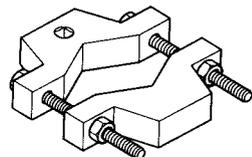
7. Install plugs **C** and **D**.

### Tightening torque:

**C, D: 25—39 N·m (2.5—4.0 m·kg, 18—29 ft·lb)**

## TRANSMISSION

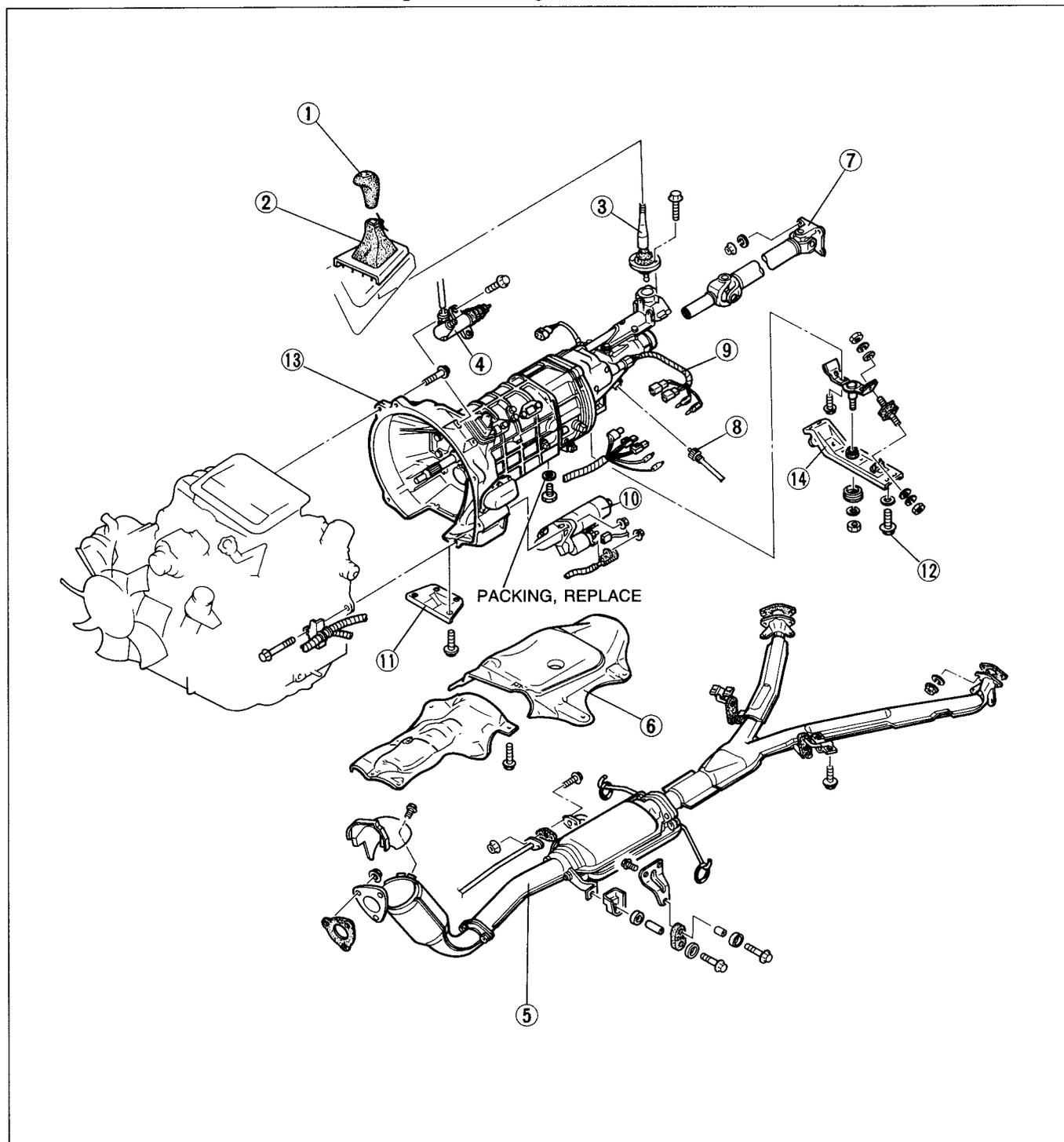
### PREPARATION SST

<p>49 0839 425C Puller set, bearing</p> 	<p>49 0500 330 Installer, transmission bearing</p> 	<p>49 0636 145 Puller, fan pulley boss</p> 
<p>49 S120 440 Holder, main-shaft</p> 	<p>49 F017 101 Holder, synchronizer ring</p> 	<p>49 0862 350 Guide, shift fork ass'y</p> 
<p>49 1243 465A Wrench, main-shaft locknut</p> 	<p>49 H017 101 Hook</p> 	<p>49 0710 520 Puller, bearing</p> 
<p>49 F401 330B Installer set, bearing</p> 	<p>49 F401 331 Body (Part of 49 F401 330B)</p> 	<p>49 F401 335A Attachment A (Part of 49 F401 330B)</p> 
<p>49 F401 337A Attachment C (Part of 49 F401 330B)</p> 	<p>49 F017 1A0 Wrench</p> 	<p style="text-align: right;">97U0J2-006</p>

# J2 TRANSMISSION

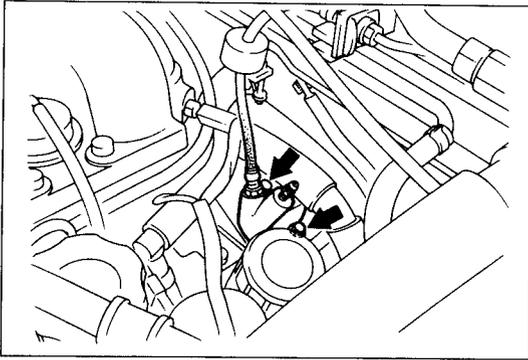
## REMOVAL

1. Disconnect the negative battery cable.
2. Raise the vehicle and support it with safety stands.
3. Drain the transmission oil into a suitable container.
4. Remove in the order shown in the figure, referring to **Removal Note**.



97U0J2-007

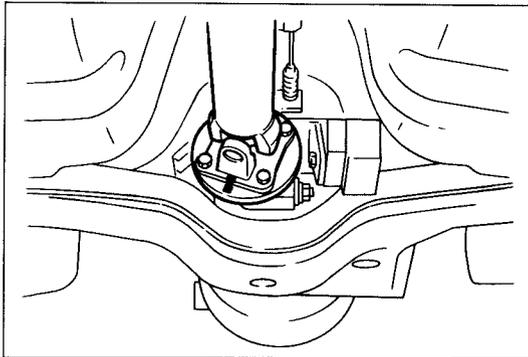
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|--|--|--|
| 1. Change lever knob                                   | 6. Heat insulator                              | 12. Transmission mounting bolts                |
| 2. Boot panel assembly and boot sheet                  | 7. Propeller shaft<br>Removal ..... page J2-11 | 13. Transmission<br>Disassembly ... page J2-12 |
| 3. Shift lever   | 8. Speedometer cable                           | Inspection ..... page J2-23                    |
| 4. Clutch release cylinder<br>Removal ..... page J2-11 | 9. Connectors                                  | Assembly ..... page J2-26                      |
| 5. Exhaust pipe  | 10. Starter                                    | 14. Transmission mount                         |
|  | 11. Undercover                                 |  |



97U0J2-008

## Removal Note Clutch release cylinder

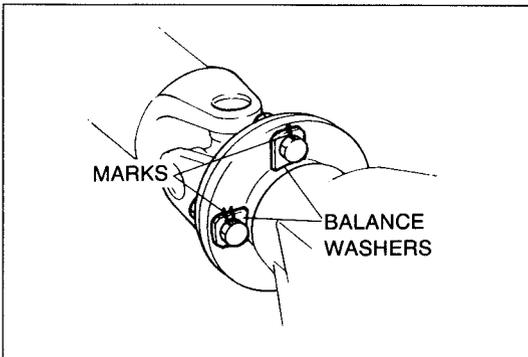
Remove the clutch release cylinder with the flexible hose still connected.



97U0J2-009

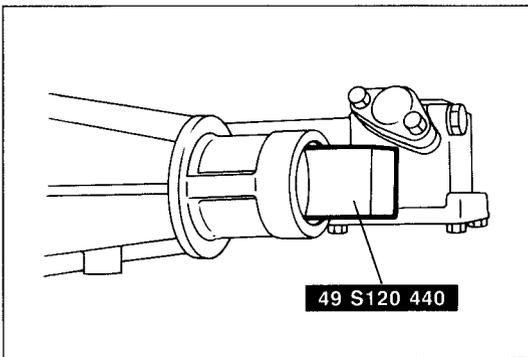
## Propeller shaft

1. Before removing the propeller shaft, mark the flanges for correct reassembly.



97U0J2-010

2. Mark the balance washers for correct reassembly.



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3. When the propeller shaft is removed from the extension housing, install the **SST** into the extension housing.

# J2 TRANSMISSION

## DISASSEMBLY

### Precaution

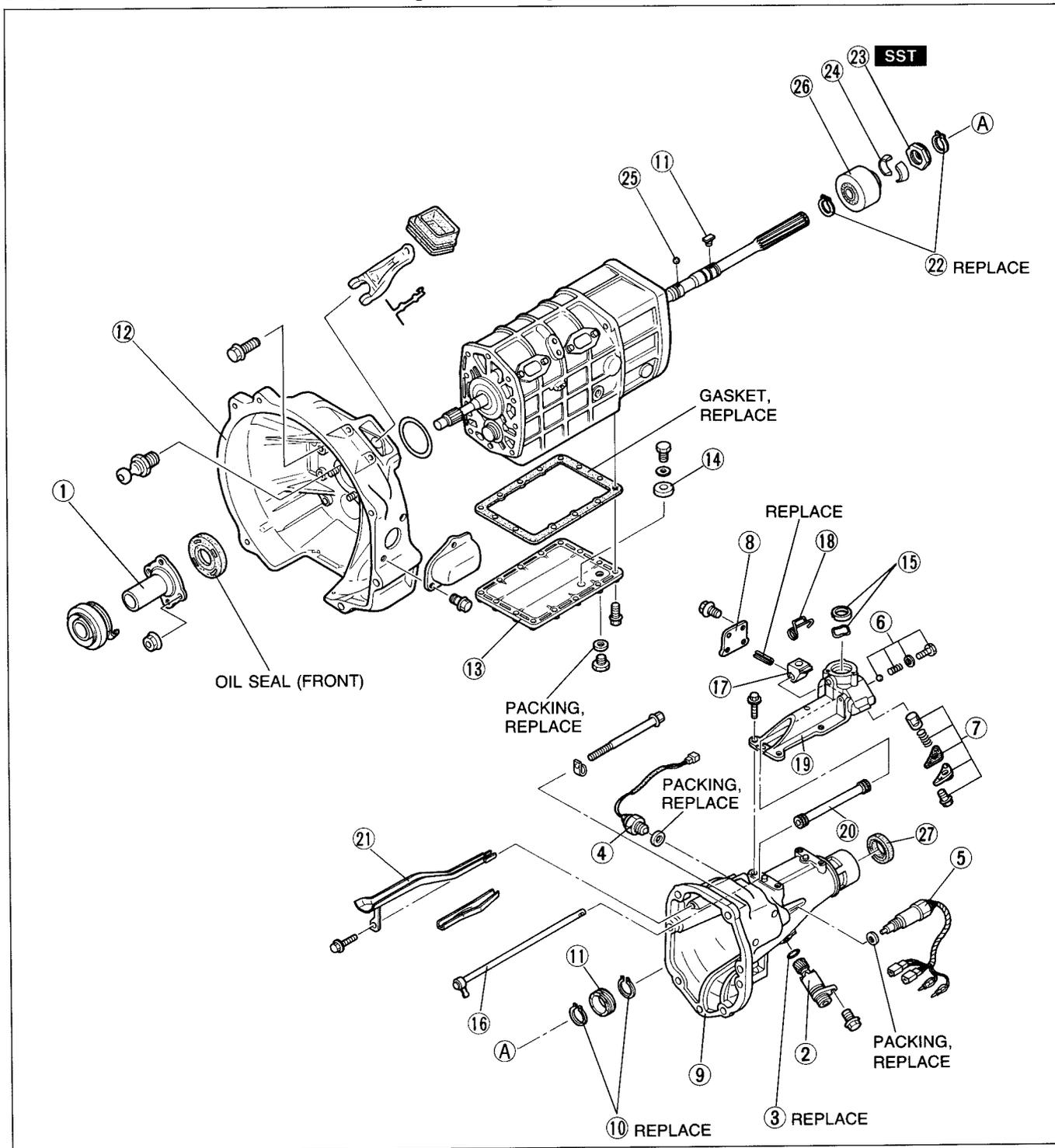
1. Clean the transmission exterior thoroughly with steam or cleaning solvents or both, before disassembly.
2. Clean the removed parts with cleaning solvent, and dry with compressed air. (Except sealed bearings.)  
Clean out all holes and passages with a compressed air, and check that there are no obstructions.
3. Wear eye protection when using compressed air to clean components.

### Housing Components

#### Note

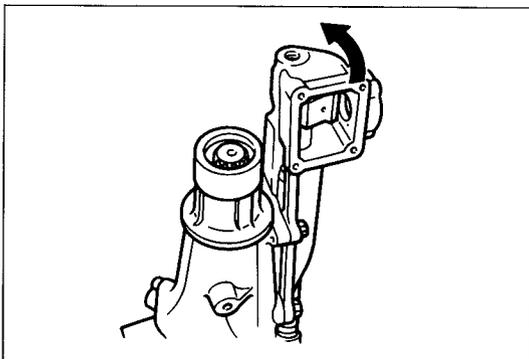
Do not remove the front and rear oil seals if not necessary.

Disassemble in the order shown in the figure, referring to **Disassembly Note**.

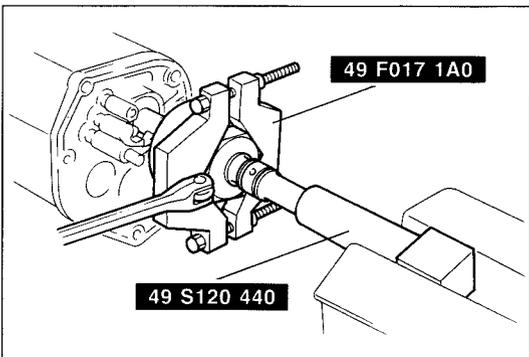


- |   |  |   |
|---|--|---|
| 1. Front cover<br>Installation..... page J2-39                                    | 11. Speedometer driven gear<br>and key                           | 20. Rod cover   |
| 2. Speedometer drive gear   | 12. Clutch housing<br>Inspect the oil seal (front)<br>for damage | 21. Oil passage assembly<br>Installation..... page J2-40  |
| 3. O-ring   | Installation..... page J2-39                                     | 22. Snap rings<br>Installation..... page J2-40  |
| 4. Neutral switch   | 13. Undercover<br>Installation..... page J2-42                   | 23. Locknut<br>Removal ..... page J2-13<br>Installation..... page J2-40                           |
| 5. Back-up light and 5th switch   | 14. Magnet   | 24. Taper cotter<br>Installation..... page J2-40  |
| 6. Steel ball, spring, and<br>spring cap<br>Installation..... page J2-41          | 15. Change bush and wave<br>washer                               | 25. Steel ball<br>Installation..... page J2-40  |
| 7. Select-lock spindle, spring,<br>and spring cap<br>Installation..... page J2-41 | 16. Control lever<br>Installation..... page J2-41                | 26. Dynamic damper<br>Installation..... page J2-40  |
| 8. Blind cover<br>Installation..... page J2-41                                    | 17. Control lever end<br>Installation..... page J2-41            | 27. Oil seal (rear)<br>Do not remove if not<br>necessary<br>Replace<br>(on vehicle)... page J2-13 |
| 9. Extension housing<br>Removal ..... page J2-13<br>Installation..... page J2-41  | 18. Select spring  |   |
| 10. Snap rings  | 19. Change control case<br>Installation..... page J2-40          |   |

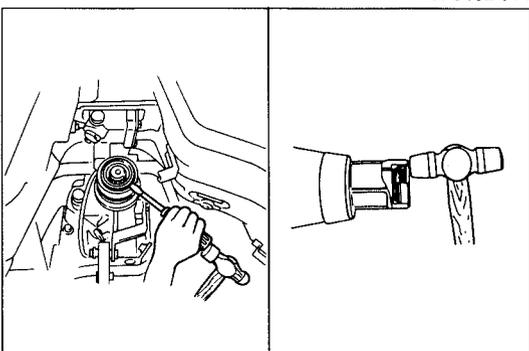
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97U0J2-013



97U0J2-014



97U0J2-015

## Disassembly note Extension housing

1. Move the control rod end to the neutral position.
2. Remove the extension housing attaching bolts.

### Note

**Do not remove the change control case.**

3. Turn the control rod in the direction of the arrow and remove the extension housing.

## Locknut

### Note

**Use pads in the vise to prevent damaging the SST.**

1. Connect the **SST** to the mainshaft and tighten it securely in a vise.
2. Remove the locknut with the **SST**.

## On-vehicle replacement Oil seal (rear)

### Caution

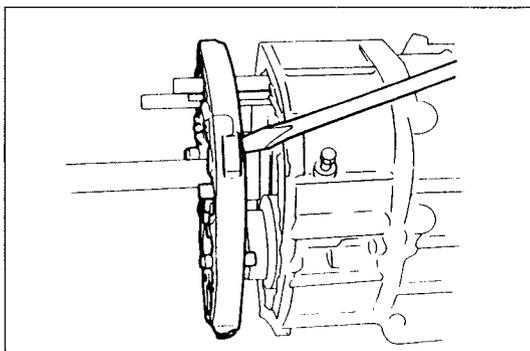
**Do not damage the mainshaft splines.**

1. Remove the exhaust pipe and heat insulator. (Refer to page J2-12.)
2. Remove the propeller shaft. (Refer to Section L.)
3. Remove the oil seal from the extension housing.
4. Apply transmission oil to outer periphery and lip surface.
5. Install the oil seal with a plastic hammer.
6. Install the propeller shaft. (Refer to Section L.)
7. Install the heat insulator and exhaust pipe. (Refer to page J2-43.)



- |   |   |   |
|---|---|---|
| 1. 5th/Reverse shift rod end<br>Inspection ..... page J2-23<br>Installation ..... page J2-37                              | 17. Center housing<br>Removal ..... page J2-16<br>Installation ..... page J2-35   | 32. 1st/2nd shift rod<br>Removal ..... page J2-17<br>Installation ..... page J2-34  |
| 2. 3rd/4th shift rod end<br>Inspection ..... page J2-23<br>Installation ..... page J2-37                                  | 18. Blind cover   | 33. Locknut<br>Removal ..... page J2-17<br>Installation ..... page J2-33  |
| 3. 1st/2nd shift rod end<br>Inspection ..... page J2-23<br>Installation ..... page J2-37                                  | 19. Cap plug, spring, and detent ball<br>Removal ..... page J2-16<br>Inspection ..... page J2-25<br>Installation ..... page J2-35 | 34. Clutch hub assembly (5th/Reverse)<br>Removal ..... page J2-17<br>Inspection ..... page J2-24<br>Installation ..... page J2-33 |
| 4. Bearing housing<br>Removal ..... page J2-15<br>Installation ..... page J2-37   | 20. Clip<br>Installation ..... page J2-35   | 35. Synchronizer ring (Reverse)<br>Removal ..... page J2-17<br>Inspection ..... page J2-24  |
| 5. Snap ring  | 21. Thrust lock washer<br>Installation ..... page J2-34   | 36. Reverse gear<br>Inspection ..... page J2-23<br>Installation ..... page J2-33  |
| 6. Thrust washer  | 22. Steel ball<br>Installation ..... page J2-34   | 37. Bearing<br>Inspection ..... page J2-24<br>Installation ..... page J2-33   |
| 7. C-washer<br>Removal ..... page J2-16<br>Installation ..... page J2-37  | 23. Bearing<br>Inspection ..... page J2-34  | 38. Inner race<br>Installation ..... page J2-33   |
| 8. Retaining ring   | 24. 5th gear<br>Inspection ..... page J2-23<br>Installation ..... page J2-33  | 39. Thrust washer<br>Installation ..... page J2-33  |
| 9. Mainshaft rear bearing<br>Removal ..... page J2-16<br>Inspection ..... page J2-24<br>Installation ..... page J2-36     | 25. Retaining ring<br>Installation ..... page J2-33   | 40. Bearing cover<br>Removal ..... page J2-17<br>Installation ..... page J2-30  |
| 10. C-washer and retaining ring<br>Installation ..... page J2-34  | 26. Synchronizer ring (5th)<br>Inspection ..... page J2-24  | 41. Thrust washer<br>Installation ..... page J2-33  |
| 11. Locknut<br>Removal ..... page J2-16<br>Installation ..... page J2-36  | 27. 5th/Reverse shift rod<br>Removal ..... page J2-16<br>Installation ..... page J2-34  | 42. Reverse idler gear shaft<br>Inspection ..... page J2-25<br>Installation ..... page J2-33                                      |
| 12. Countershaft rear bearing<br>Removal ..... page J2-16<br>Inspection ..... page J2-34<br>Installation ..... page J2-36 | 28. 5th/Reverse shift fork<br>Removal ..... page J2-17<br>Inspection ..... page J2-24<br>Installation ..... page J2-35            | 43. Reverse idler gear<br>Inspection ..... page J2-25<br>Installation ..... page J2-33  |
| 13. Counter 5th gear<br>Inspection ..... page J2-23<br>Installation ..... page J2-36                                      | 29. Interlock pin<br>Removal ..... page J2-17<br>Installation ..... page J2-34  | 44. Thrust washer<br>Installation ..... page J2-33  |
| 14. Spacer<br>Installation ..... page J2-36   | 30. 3rd/4th shift rod<br>Removal ..... page J2-17<br>Installation ..... page J2-35  | 45. Counter reverse gear<br>Inspection ..... page J2-25<br>Installation ..... page J2-33  |
| 15. Oil guide<br>Installation ..... page J2-35  | 31. Interlock pin<br>Removal ..... page J2-17<br>Installation ..... page J2-34  |   |
| 16. Set bolt and washer<br>Installation ..... page J2-35  |   |   |

97U0J2-016

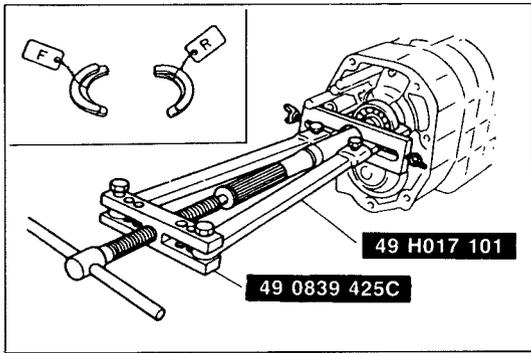


9MU0JX-025

## Disassembly note

### Bearing housing

Carefully pry the bearing housing away from the transmission case with a screwdriver, being careful not to damage the housing or case. Slide the bearing housing off the mainshaft.



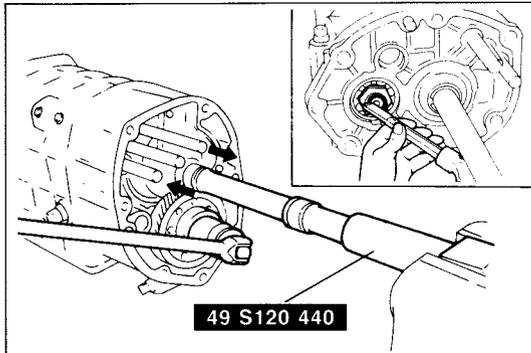
9MU0JX-026

## Mainshaft rear bearing

### Note

The front and rear C-washers may have different thicknesses.

1. Remove the snap ring, washer, retaining ring, and C-washers.
2. For proper reassembly, identify the front and rear C-washers.
3. Remove the mainshaft rear bearing with the **SST**.



9MU0JX-027

## Countershaft rear bearing

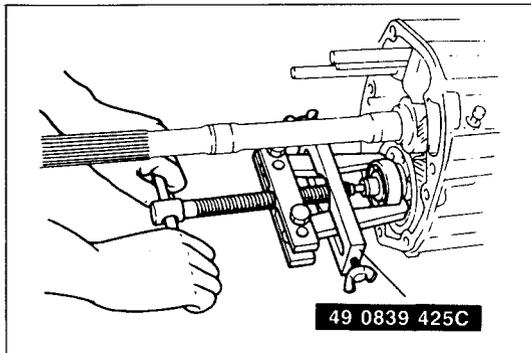
### Caution

Do not reuse the locknut.

1. Uncrimp the tab of the locknut.
2. Shift the clutch hub sleeves to first gear and reverse gear to put the gears in a double-engaged condition.

### Note

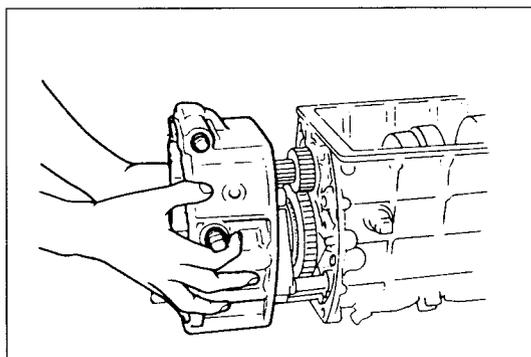
Use the protective plates to prevent damage to the **SST**.



9MU0JX-028

3. Hold the mainshaft with the **SST** and a vise.
4. Remove the locknut.

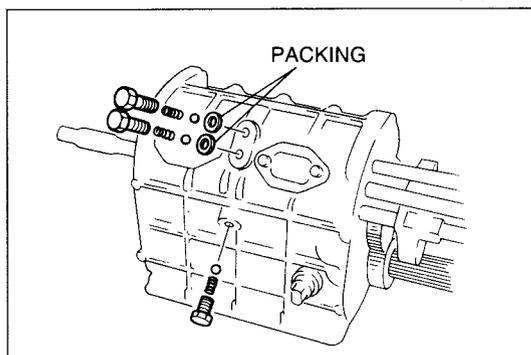
5. Remove the countershaft rear bearing with the **SST**.



9MU0JX-029

## Center housing

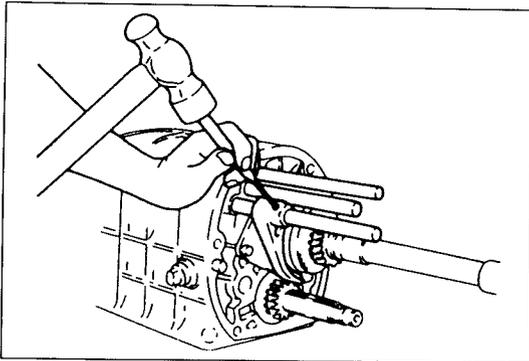
1. Remove the cap screws from the center housing.
2. Remove the center housing. If necessary, tap the housing with a plastic hammer.



9MU0JX-030

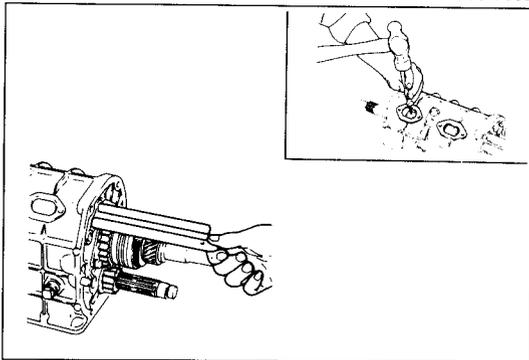
## 5th/reverse shift rod

1. Remove the packing and three cap plugs, then the detent balls and springs.



9MU0JX-032

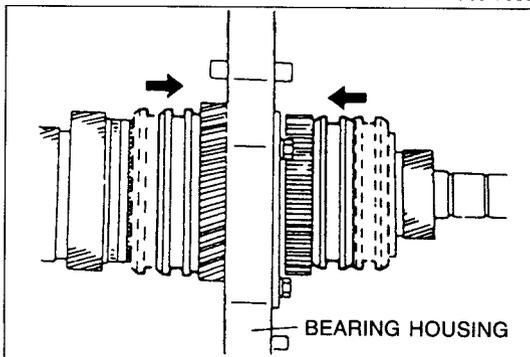
2. Drive the roll pin from the 5th/Reverse shift fork. Slide the 5th/reverse shift rod out of the transmission case.



9MU0JX-033

### 1st/2nd, and 3rd/4th shift rods

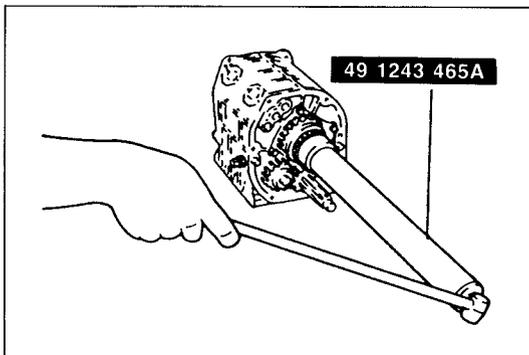
1. Remove the blind covers, gaskets, and clips.
2. Shift the transmission into 4th gear.  
This will provide adequate space to drive out the roll pin. Drive the roll pin from the 3rd/4th shift fork.
3. Slide the 3rd/4th shift rod out from the rear of the transmission case.
4. Drive the roll pin from the 1st/2nd shift fork.  
Slide the 1st/2nd shift rod out from the rear of the transmission case.
5. Remove the interlock pins.



9MU0JX-034

### 5th/Reverse clutch hub assembly

1. Uncrimp the tab of the locknut.
2. Shift into 1st gear and reverse gear to lock the rotation of the mainshaft.

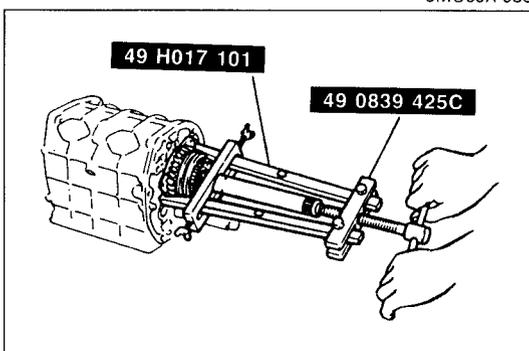


9MU0JX-035

### Caution

**Do not reuse the locknut.**

3. Remove the locknut with the **SST**.



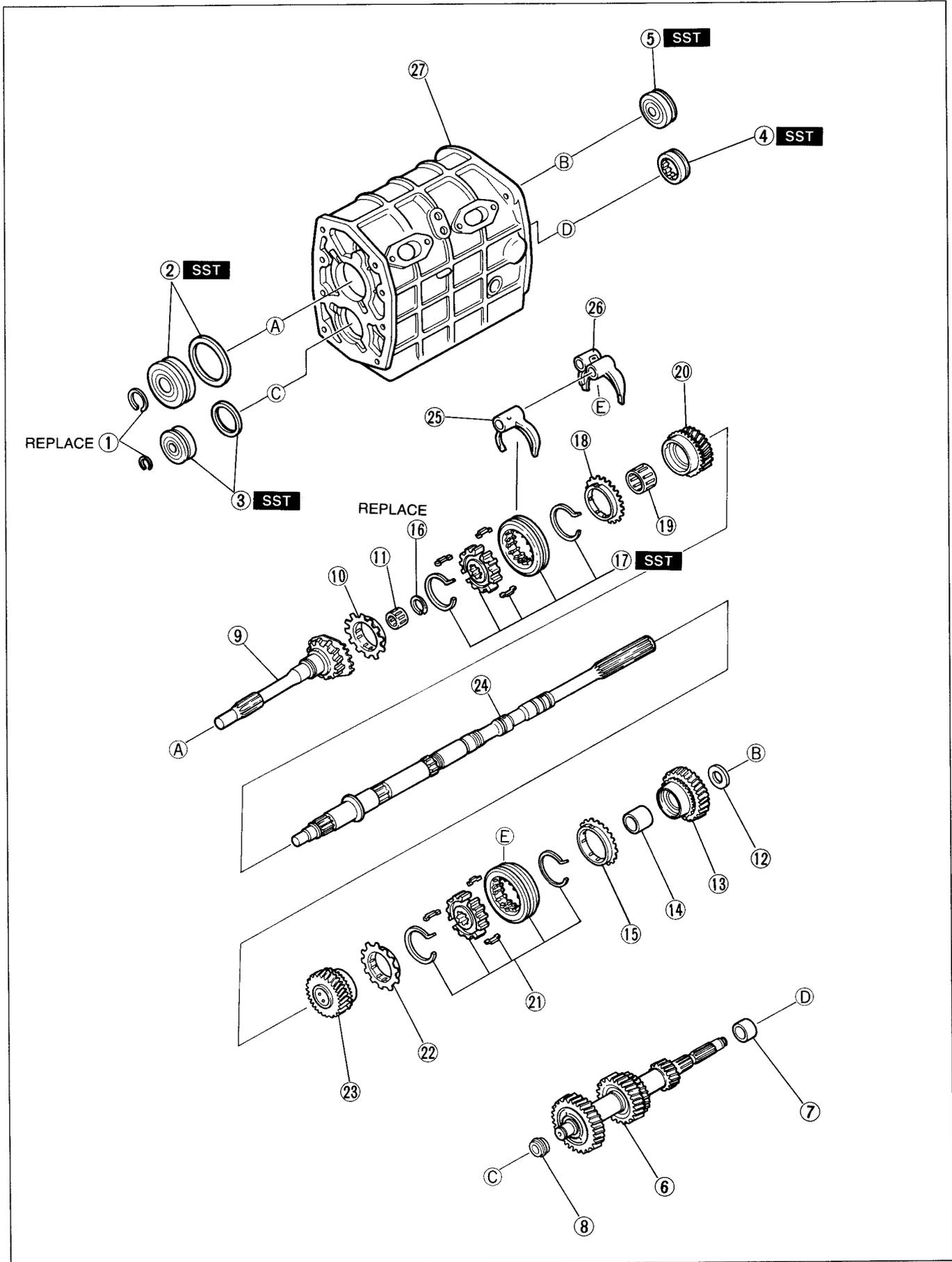
9MU0JX-036

4. Remove the bearing cover installation bolts.
5. Attach the **SST** to the bearing cover and remove the assembly, which consists of the following parts:
  - 5th/Reverse clutch hub assembly
  - Synchronizer ring
  - Needle bearing
  - Inner race
  - Reverse gear
  - Thrust washer
6. Remove the thrust washers, reverse idler gear shaft, and reverse idler gear.

# J2 TRANSMISSION

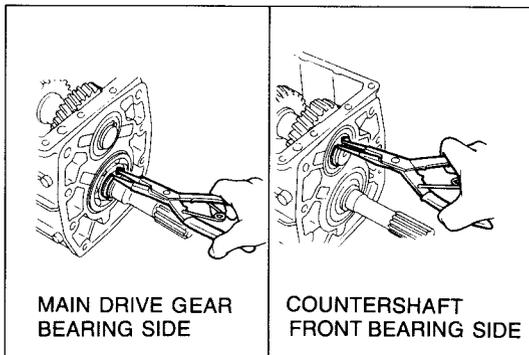
## Mainshaft

Disassemble in the order shown in the figure, referring to **Disassembly Note**.

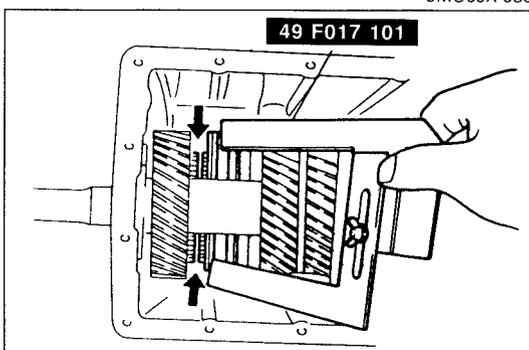


- |  |   |   |
|--|---|---|
| <p>1. Snap ring<br/>Removal ..... page J2-19<br/>Installation..... page J2-31</p> <p>2. Main drive gear bearing and adjustment shim<br/>Removal ..... page J2-19<br/>Inspection ..... page J2-24<br/>Installation..... page J2-31</p> <p>3. Countershaft front bearing and adjustment shim<br/>Removal ..... page J2-20<br/>Inspection ..... page J2-24<br/>Installation..... page J2-31</p> <p>4. Countershaft center bearing<br/>Removal ..... page J2-21<br/>Inspection..... page J2-24<br/>Installation..... page J2-30</p> <p>5. Mainshaft front bearing<br/>Removal ..... page J2-20<br/>Inspection ..... page J2-24<br/>Installation..... page J2-30</p> <p>6. Countershaft<br/>Removal ..... page J2-21<br/>Inspection..... page J2-23<br/>Installation..... page J2-30</p> <p>7. Countershaft center bearing inner race<br/>Removal ..... page J2-22<br/>Installation..... page J2-28</p> <p>8. Countershaft front bearing spacer<br/>Removal ..... page J2-22<br/>Installation..... page J2-29</p> | <p>9. Main drive gear<br/>Removal ..... page J2-21<br/>Inspection..... page J2-23<br/>Installation..... page J2-30</p> <p>10. Synchronizer ring (4th)<br/>Inspection ..... page J2-24<br/>Installation..... page J2-30</p> <p>11. Bearing<br/>Inspection ..... page J2-24<br/>Installation..... page J2-30</p> <p>12. Thrust washer<br/>Installation..... page J2-28</p> <p>13. 1st gear<br/>Inspection ..... page J2-23<br/>Installation..... page J2-28</p> <p>14. Inner race<br/>Installation..... page J2-28</p> <p>15. Synchronizer ring (1st)<br/>Inspection ..... page J2-24<br/>Installation..... page J2-28</p> <p>16. Snap ring<br/>Removal ..... page J2-21<br/>Installation..... page J2-28</p> <p>17. Clutch hub assembly (3rd/4th)<br/>Removal ..... page J2-21<br/>Inspection..... page J2-24<br/>Installation..... page J2-28</p> <p>18. Synchronizer ring (3rd)<br/>Removal ..... page J2-22<br/>Inspection..... page J2-24<br/>Installation..... page J2-28</p> | <p>19. Bearing<br/>Removal ..... page J2-22<br/>Inspection..... page J2-24<br/>Installation..... page J2-28</p> <p>20. 3rd gear<br/>Removal ..... page J2-22<br/>Inspection ..... page J2-23<br/>Installation..... page J2-28</p> <p>21. Clutch hub assembly (1st/2nd)<br/>Removal ..... page J2-22<br/>Inspection ..... page J2-24<br/>Installation..... page J2-28</p> <p>22. Synchronizer ring (2nd)<br/>Removal ..... page J2-22<br/>Inspection ..... page J2-24<br/>Installation..... page J2-28</p> <p>23. 2nd gear<br/>Removal ..... page J2-22<br/>Inspection ..... page J2-23<br/>Installation..... page J2-28</p> <p>24. Mainshaft<br/>Inspection ..... page J2-23</p> <p>25. 3rd/4th shift fork<br/>Inspection ..... page J2-24</p> <p>26. 1st/2nd shift fork<br/>Inspection ..... page J2-24</p> <p>27. Transmission case</p> |
|--|---|---|

97U0J2-017



9MU0JX-039



9MU0JX-040

## Disassembly note Snap ring

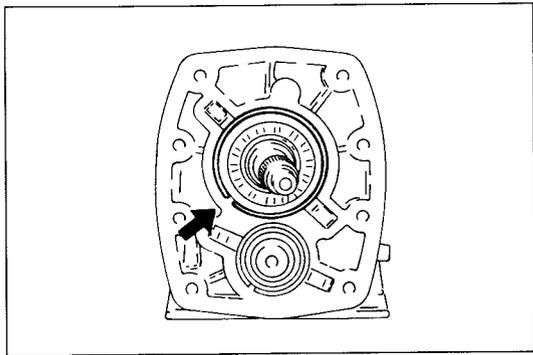
**Caution**  
**Do not reuse the snap ring.**

Remove the snap rings.

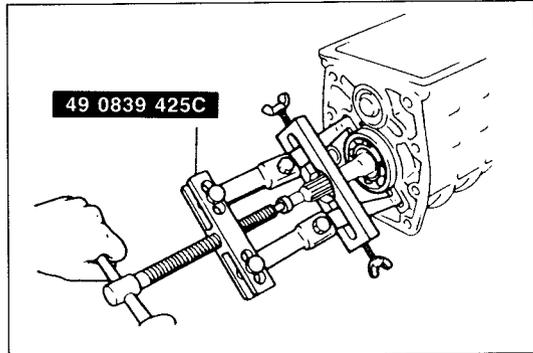
## Main drive gear bearing

1. Install the **SST** between the 4th gear synchronizer ring and synchromesh gear on the main drive gear.

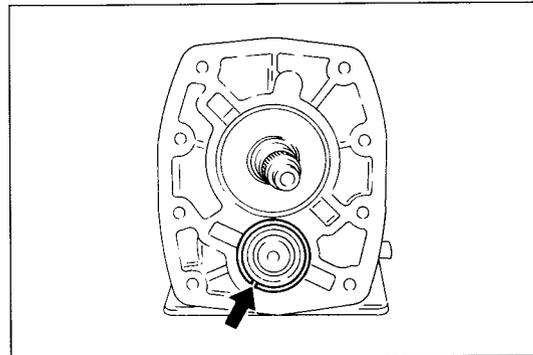
# J2 TRANSMISSION



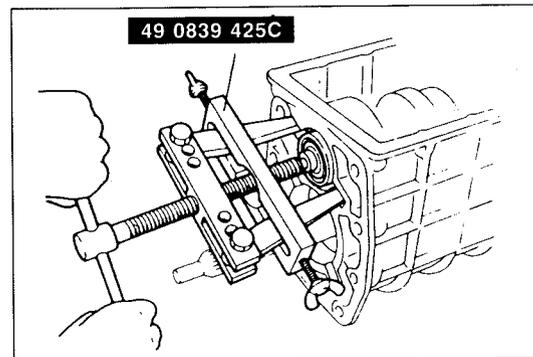
9MU0JX-041



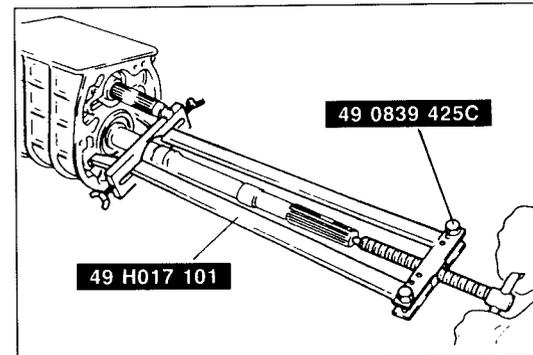
9MU0JX-042



9MU0JX-043



9MU0JX-044



9MU0JX-045

2. Turn the bearing snap rings so that the ends are **90°** to the case grooves.

3. Remove the main drive gear bearing with the **SST**.

## Countershaft front bearing

1. Turn the bearing snap rings so that the ends are **90°** to the case grooves.

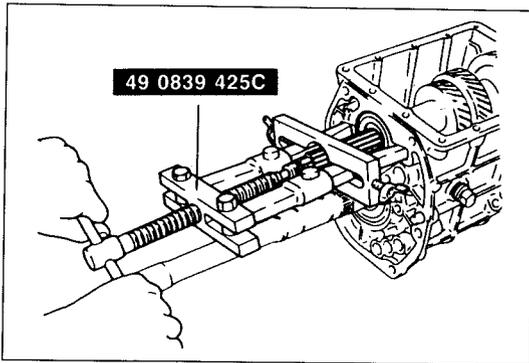
### Note

**Replace the countershaft front bearing and countershaft front spacer as one assembly.**

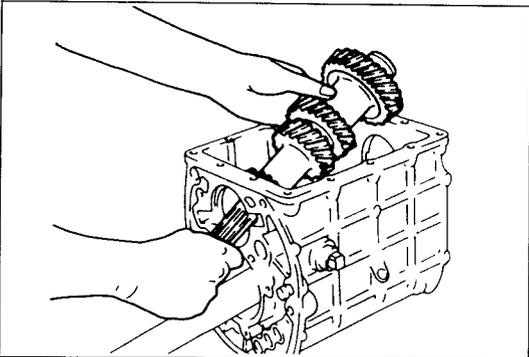
2. Remove the countershaft front bearing with the **SST**.

## Mainshaft front bearing

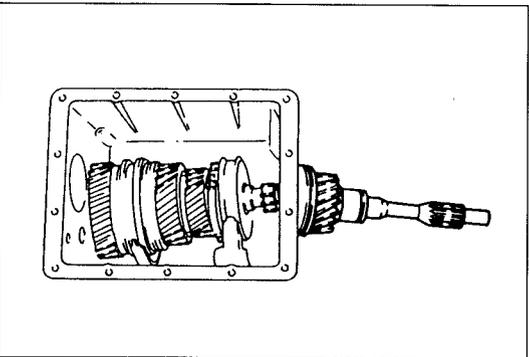
Remove the mainshaft front bearing with the **SST**.



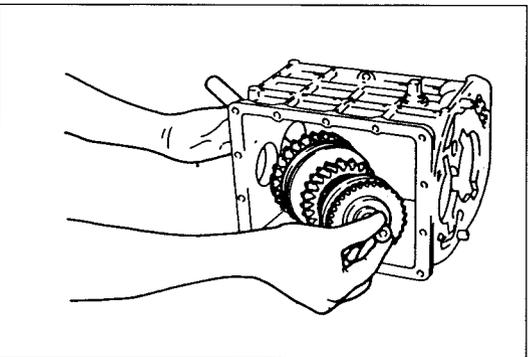
9MU0JX-046



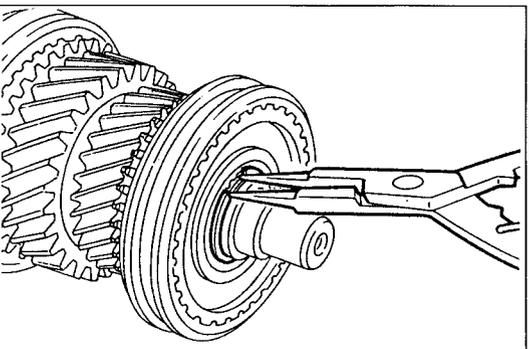
77U07A-037



9MU0JX-047



77U07A-039



9MU0JX-048

## Countershaft

1. Remove the countershaft center bearing with the **SST**.
2. Remove the countershaft.

## Mainshaft and gear assembly

1. Remove the main drive gear from the transmission case.
2. Remove the mainshaft and gear assembly from the transmission case.

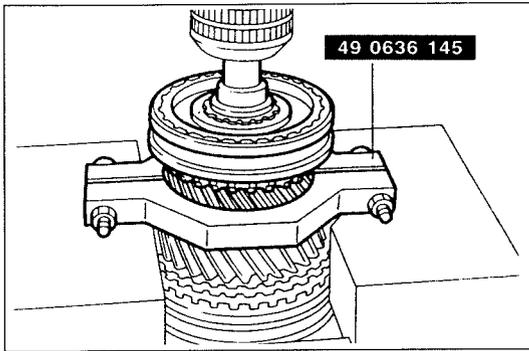
## 3rd/4th clutch hub assembly

### Caution

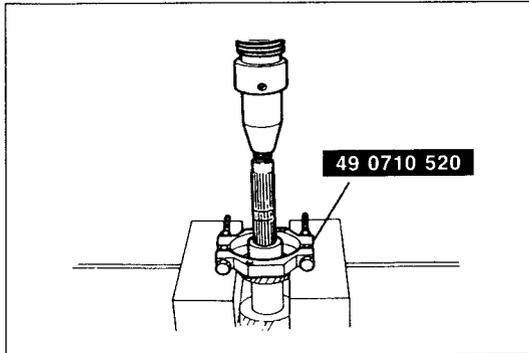
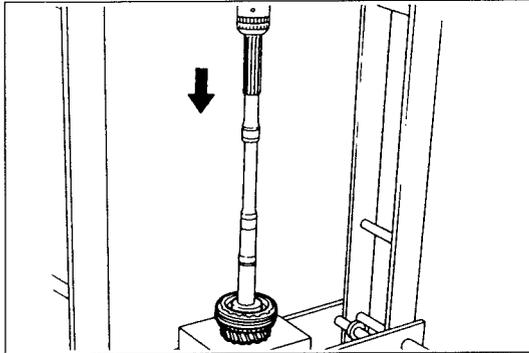
**Do not reuse the snap ring.**

1. Remove the snap ring from the front of the mainshaft.

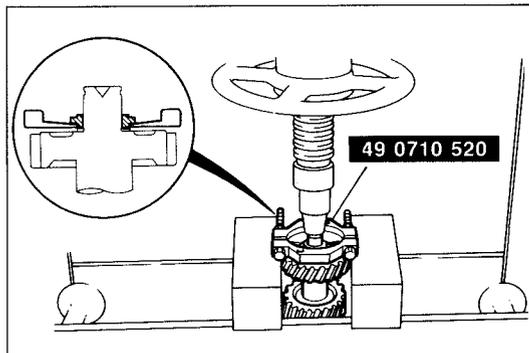
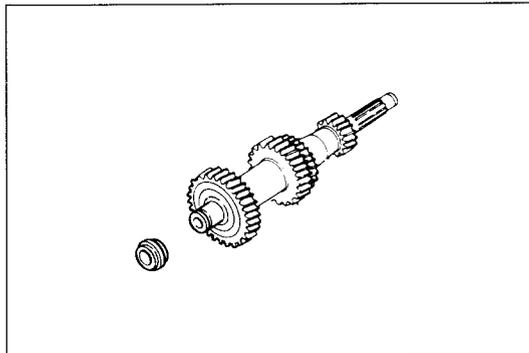
# J2 TRANSMISSION



9MU0JX-049



9BU0J2-018



9MU0JX-053

2. Position the **SST** between 2nd and 3rd gears.

### Caution

**Hold the mainshaft with one hand so that it does not fall.**

3. Press the mainshaft out of 3rd gear and 3rd/4th clutch hub assembly.

### 1st/2nd clutch hub assembly

### Caution

**Hold the mainshaft with one hand so that it does not fall.**

Press the 1st/2nd clutch hub assembly and 1st gear sleeve from the mainshaft.

### Countershaft center bearing inner race

### Caution

**Hold the countershaft with one hand so that it does not fall.**

### Note

**Replace the countershaft center bearing and countershaft center bearing inner race as one assembly.**

Remove the inner race of the countershaft center bearing from the countershaft with the **SST**.

### Countershaft front bearing spacer

### Note

**Replace the countershaft front bearing and countershaft front bearing spacer as one assembly.**

1. Position the **SST** between the countershaft front bearing spacer and countershaft.

### Caution

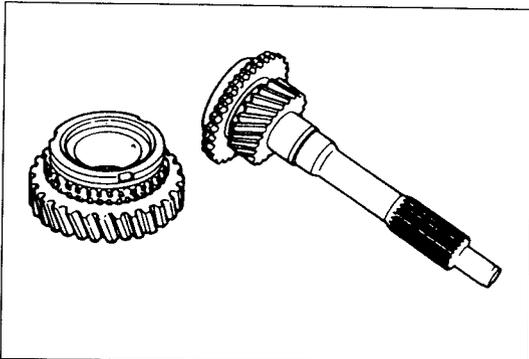
**Hold the countershaft with one hand so that it does not fall.**

2. Press the countershaft out front the countershaft front bearing spacer.

## INSPECTION

Inspect all parts, and repair or replace as necessary.

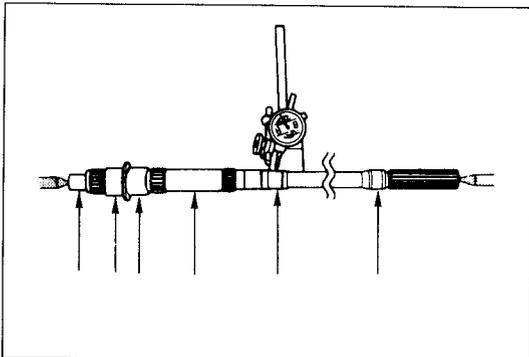
9MU0JX-054



9MU0JX-055

### Each gear and main drive gear

1. Inspect synchronizer cones for wear.
2. Inspect individual gear teeth for damage, wear, cracks.
3. Inspect synchronizer ring matching teeth for damage or wear.
4. Inspect main drive gear splines for damage or wear.



9MU0JX-056

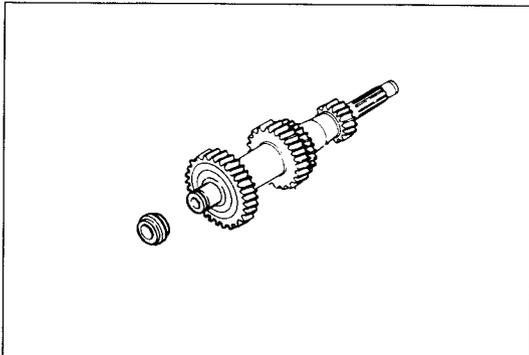
### Mainshaft

1. Measure the mainshaft runout.

**Maximum: 0.03mm (0.0012 in)**

2. Inspect splines for damage or wear.
3. Measure the clearance between mainshaft and gear (or bush).

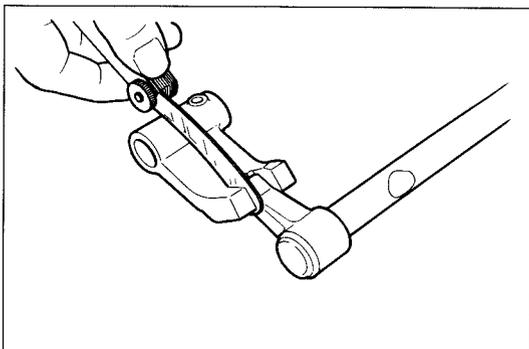
**Maximum: 0.15mm (0.006 in)**



9MU0JX-057

### Countershaft

1. Inspect gear teeth for damage, wear, cracks.
2. Inspect splines for damage or wear.

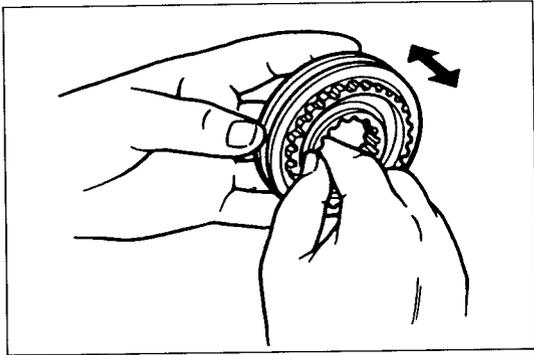


9BU0J2-050

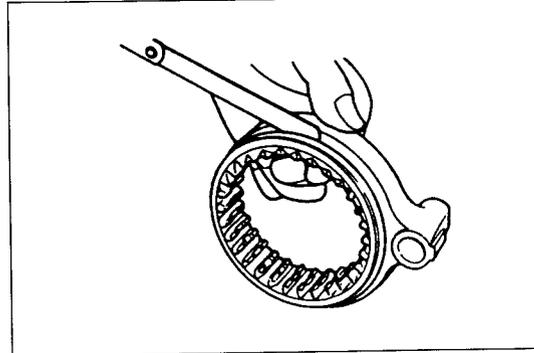
### Control lever and shift rod

Measure the clearance between the control lever and the gate of the shift rod.

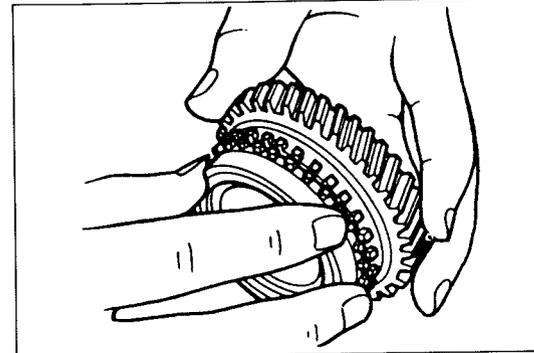
**Clearance: 0.8mm (0.031 in) max.**



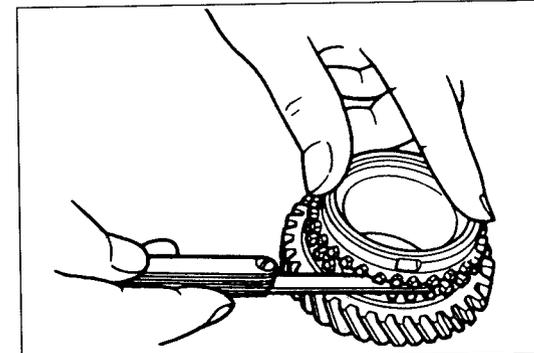
9MU0JX-059



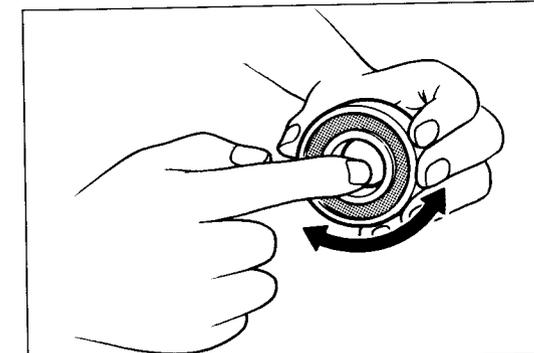
9MU0JX-060



9MU0JX-061



9MU0JX-062



9MU0JX-063

## Clutch hub assembly

1. Inspect for clutch hub sleeve and hub operation.
2. Inspect individual gear teeth for damage, wear, cracks.
3. Inspect synchronizer key for damage, wear, cracks.

4. Measure the clearance between hub sleeve and shift fork.

### Standard clearance:

**0.2—0.3mm (0.008—0.012 in)**

**Maximum: 0.5mm (0.020 in)**

## Synchronizer ring

1. Inspect individual synchronizer ring teeth for damage, wear, cracks.
2. Inspect taper surface for wear or cracks.

### Note

**Set the synchronizer ring squarely in the gear; then measure around the circumference.**

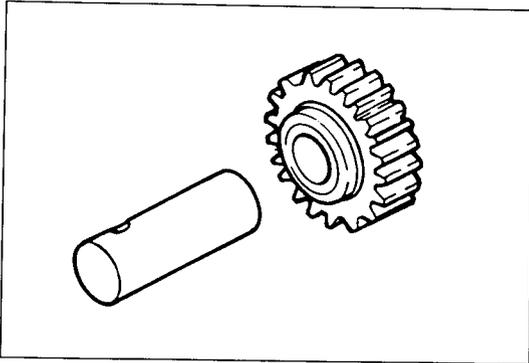
3. Measure the clearance between synchronizer ring and flank surface of gear.

**Standard clearance: 1.5mm (0.059 in)**

**Minimum: 0.8mm (0.031 in)**

## Bearing

Inspect for damage or rough rotation.



9MU0JX-064

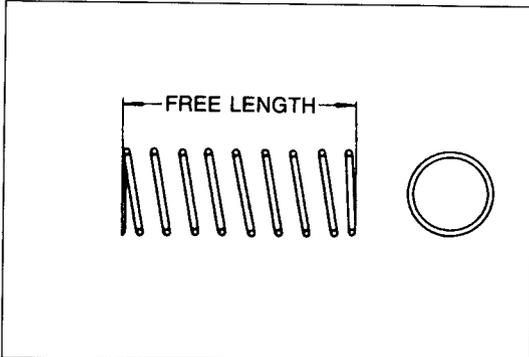
### Reverse idler gear and shaft

1. Inspect gear teeth for damage, wear, cracks.
2. Measure the clearance between reverse idle gear bush and shaft.

#### Standard clearance:

**0.02—0.05mm (0.0008—0.0020 in)**

**Maximum: 0.15mm (0.006 in)**



97U0J2-018

### Spring

Measure the free length of spring.

#### Standard free length

**Detent ball spring: 22.5mm (0.886 in)**

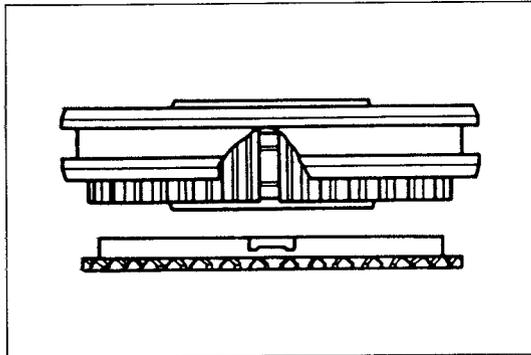
# J2 TRANSMISSION

## ASSEMBLY

### Precaution

1. All O-rings and gasket must be replaced with the new ones included in the overhaul kit.
2. Assemble the parts within 10 minutes after applying sealant. Allow all sealant to cure at least 30 minutes after assembly before filling the transmission with transmission oil.

9MU0JX-066

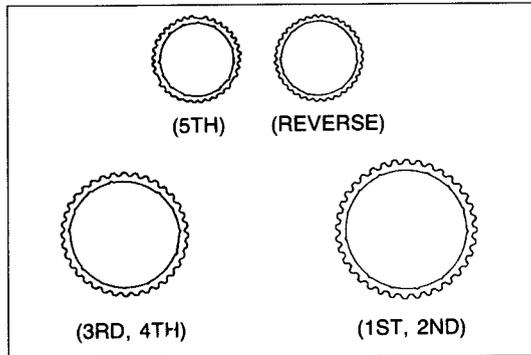


9MU0JX-067

### Clutch hub

#### Caution

Align the synchronizer ring grooves with the clutch hub keys during installation.

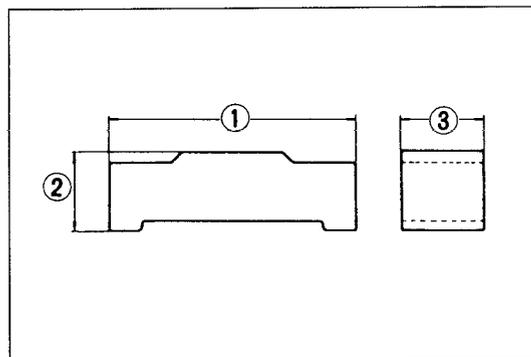


9MU0JX-068

#### Note

- The synchronizer rings all have the same basic shape. Carefully note these distinguishing features.
  - 5th and Reverse synchronizer rings are the smallest.
  - 5th has notches in the teeth.
  - 4th and 3rd are the next larger and are exactly the same.
  - 2nd and 1st are the biggest and are exactly the same.

- There are two types of synchronizer keys.

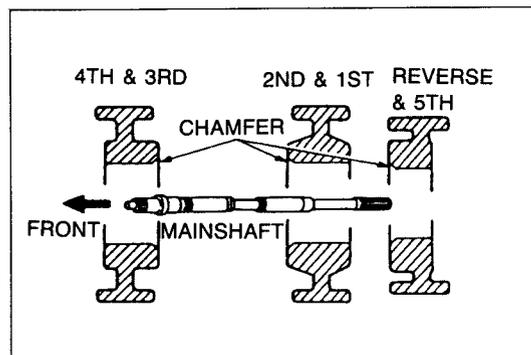


9MU0JX-069

Standard dimensions are as follows:

mm (in)

	①	②	③
1st and 2nd	18 (0.709)	5.45 (0.215)	6 (0.236)
3rd, 4th, 5th, and Rev.	17 (0.669)	4.25 (0.167)	5 (0.197)



9MU0JX-070

- Press each clutch hub assembly onto the mainshaft in the proper direction.

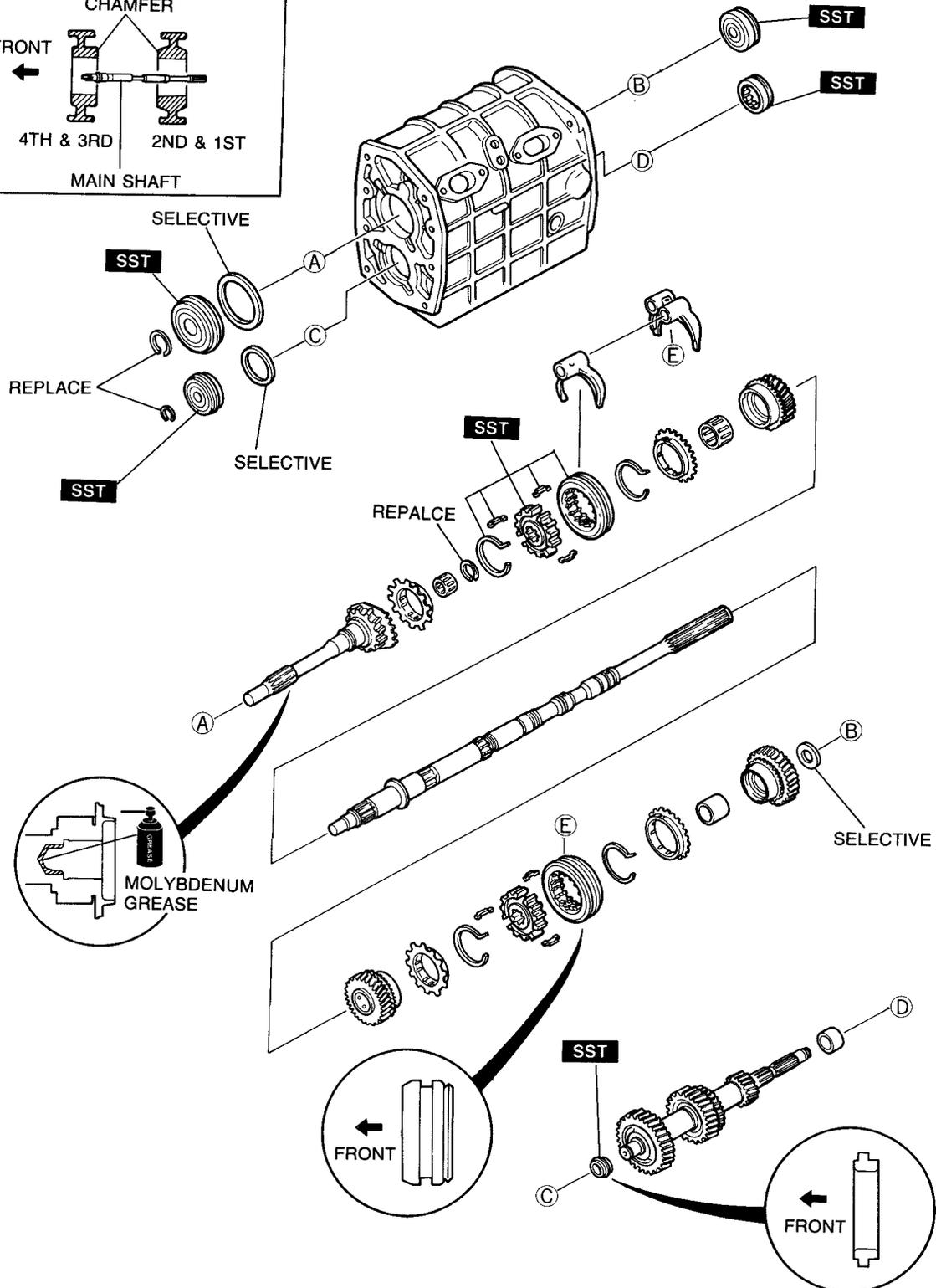
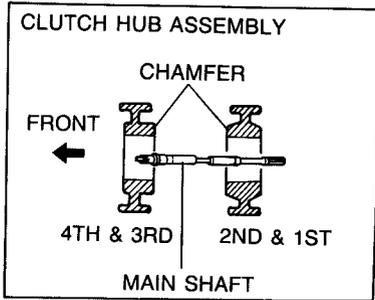
- Install the clutch hubs with the chamfers of the inner gear teeth as shown.

## Mainshaft

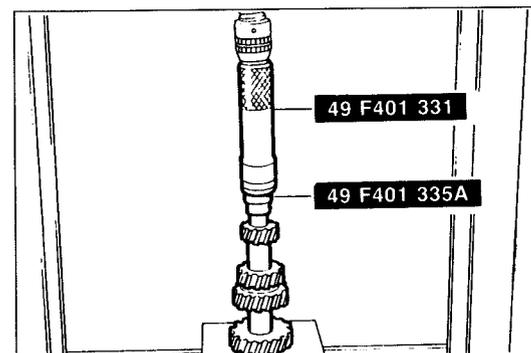
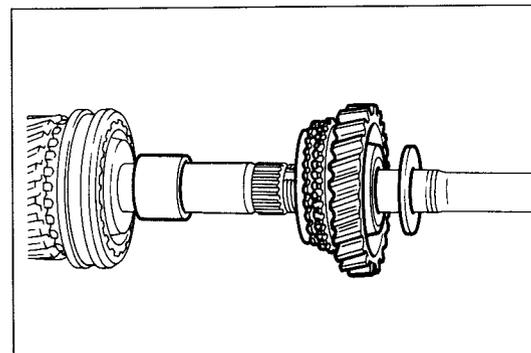
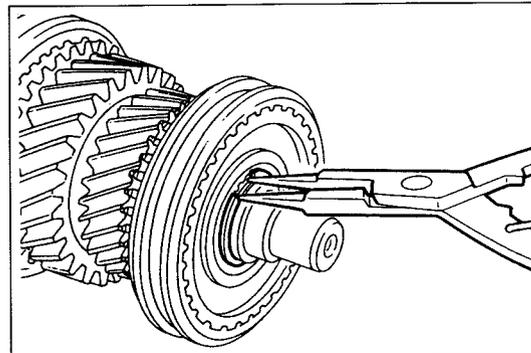
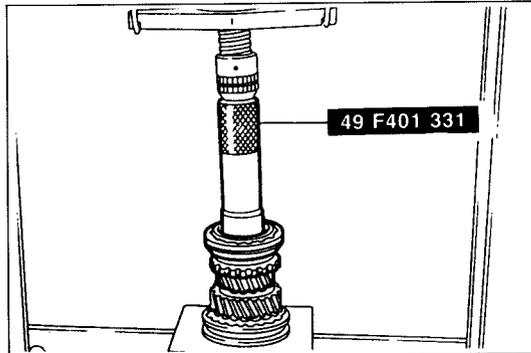
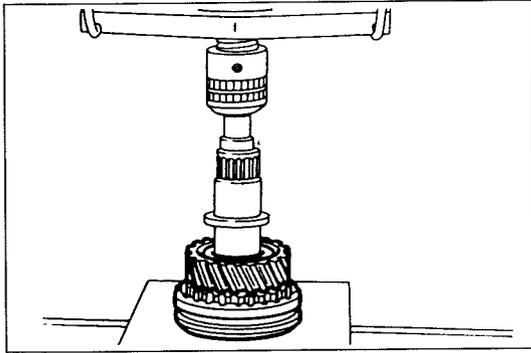
Assemble in the reverse order of disassembly, referring to the **Assembly Note**.



APPLY SPECIFIED OIL TO INDIVIDUAL PARTS



# J2 TRANSMISSION



## Assembly note

1. Set the 2nd gear and the 1st/2nd clutch hub assembly on the mainshaft, then press in the mainshaft.

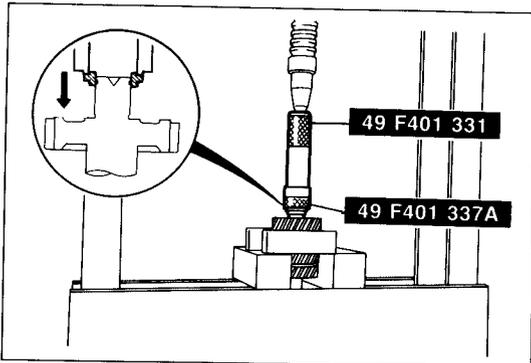
2. Set the 3rd gear, needle bearing, and 3rd/4th clutch hub assembly on the mainshaft, then press on the 3rd/4th clutch hub assembly with the **SST**.

3. Install a new snap ring on the front of the mainshaft.

4. Install the inner race, 1st gear, and thrust washer.

## Countershaft

Press the inner race of the countershaft rear bearing onto the countershaft with the **SST**.



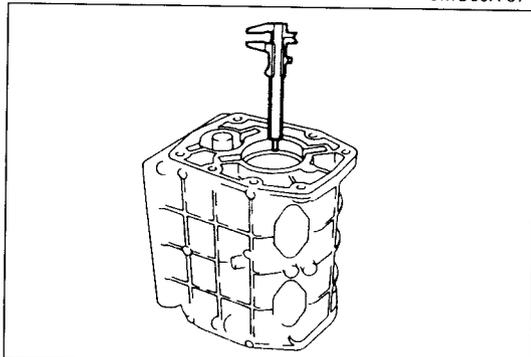
9MU0JX-074

## Countershaft front bearing spacer

### Note

Replace the countershaft front bearing and countershaft front bearing spacer as one assembly.

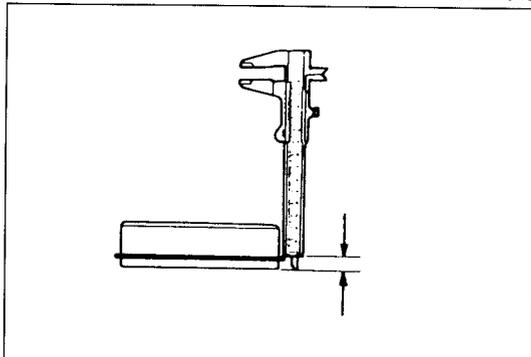
1. Install the friction gear, diaphragm spring, and countershaft front bearing spacer.
2. Press the countershaft front bearing spacer onto the countershaft with the **SST**.



77G07A-046

## Measurement of Bearing Thrust Play Mainshaft front bearing

1. Measure the depth of the mainshaft front bearing bore in the rear of the transmission case.



7EG07A-056

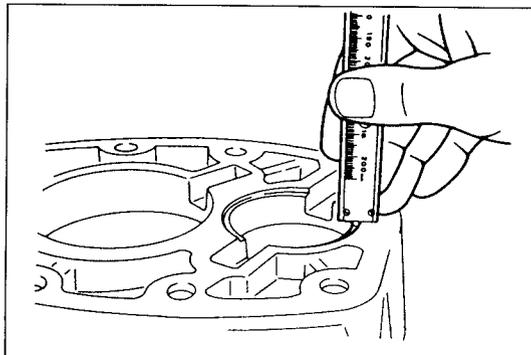
2. Measure the mainshaft front bearing height. The difference between the two measurements indicates the required thickness of the adjustment shim.

### Standard thrust play:

0—0.1mm (0—0.004 in)

### Adjustment shim thickness:

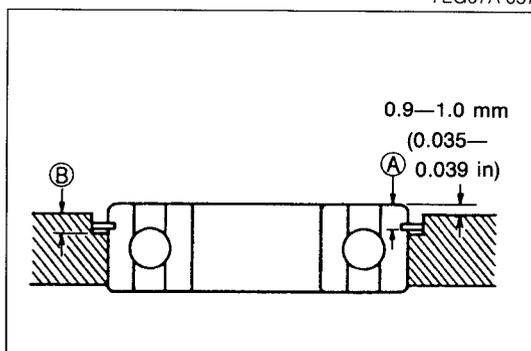
0.1mm (0.004 in), 0.3mm (0.012 in)



7EG07A-057

## Countershaft front bearing

1. Measure depth B of the countershaft front bearing bore in the transmission case.



7EG07A-058

2. Measure the countershaft front bearing snap ring height A.
3. Choose an adjustment shim that will allow the difference between the two measurements to be equal to the standard bearing height.

**A—B + Adjustment shim(s) = 0.9—1.0mm (0.035—0.039 in)**

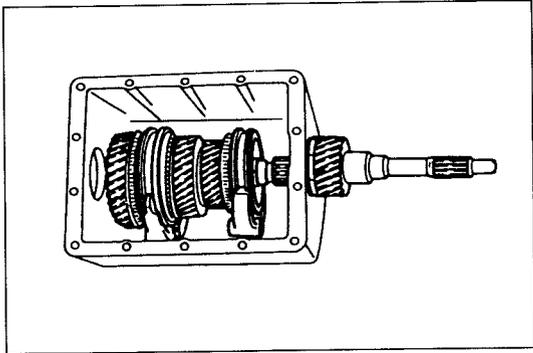
**Standard bearing height on installing:**

0.9—1.0mm (0.035—0.039 in)

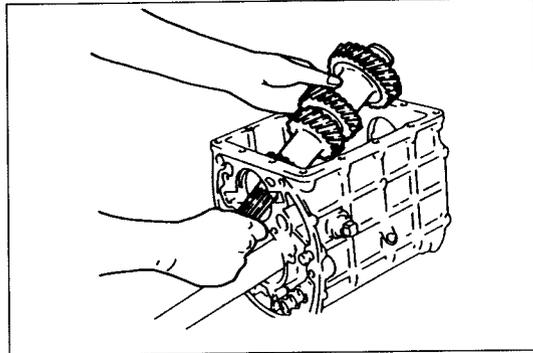
**Adjustment shim thickness:**

0.1mm (0.004 in), 0.3mm (0.012 in)

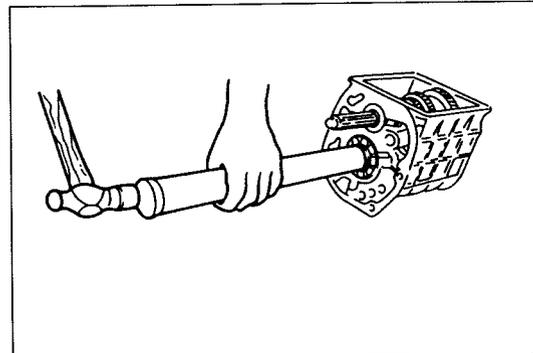
# J2 TRANSMISSION



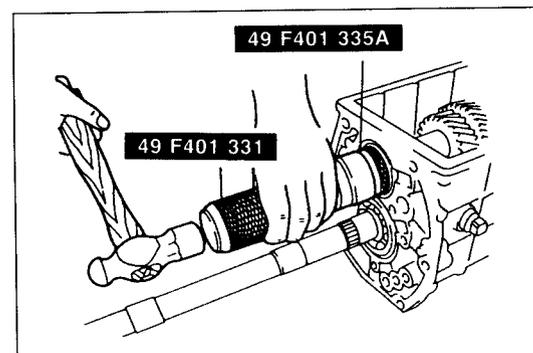
9MU0JX-075



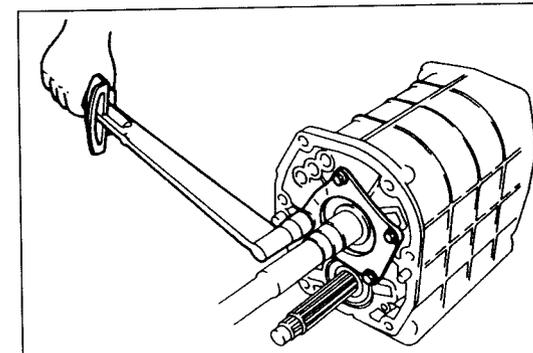
9MU0JX-076



7EG07A-061



77G07A-050



69G07A-117

## Transmission case

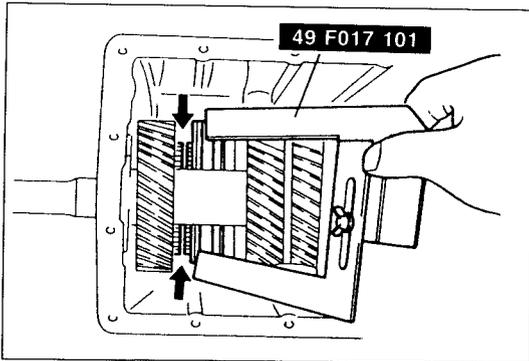
1. Position the 1st and 2nd shift forks and 3rd and 4th shift forks into the grooves of the clutch hub and sleeve assemblies.
2. Apply molybdenum grease to the needle bearing and install it in the main drive gear.
3. Install the main drive gear onto the front of the mainshaft.
4. Set the countershaft gear into the case, making sure that the countershaft gears engage each gear of the mainshaft assembly.

## Bearing for transmission case

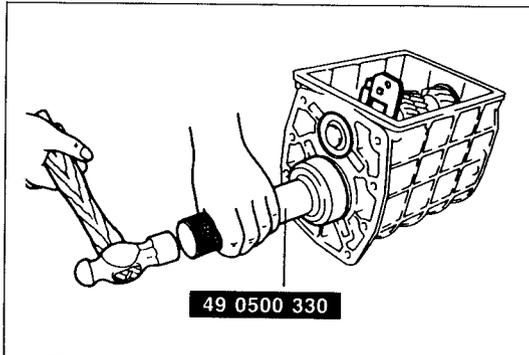
1. Install the correct shim onto the rear of the mainshaft as determined by "Measurement of Bearing Thrust Play".
2. Drive on the mainshaft front bearing with a suitable pipe.
3. Drive the countershaft center bearing onto the rear of the countershaft with the **SST**.
4. Install the bearing cover.

## Tightening torque:

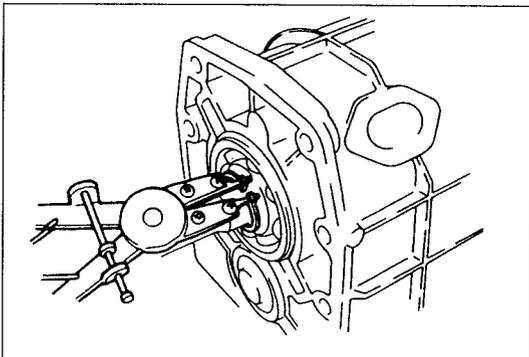
18—26 N·m (1.8—2.7 m·kg, 13—20 ft·lb)



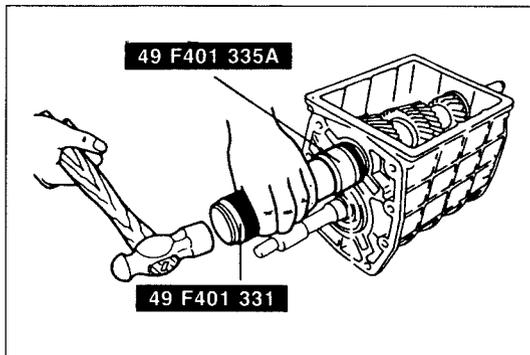
77G07A-051



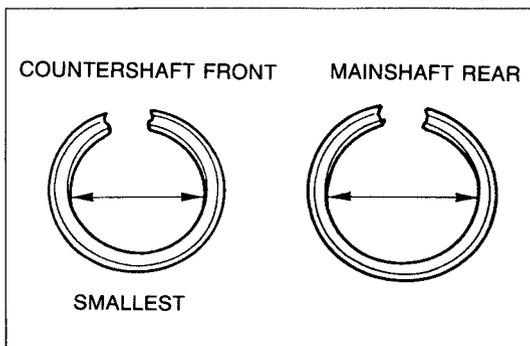
77G07A-052



9MU0JX-077



9MU0JX-078



9MU0JX-079

5. Install the **SST** between the 4th synchronizer ring and synchromesh gear on the main drive gear.

6. Drive on the main drive gear bearing with the **SST**.

7. Install a new snap ring to secure the main drive gear bearing.

**Note**

**Replace the countershaft front bearing and countershaft front bearing spacer as one assembly.**

8. Install the correct shim into the countershaft front bearing as determined by "Measurement of Bearing Thrust Play".

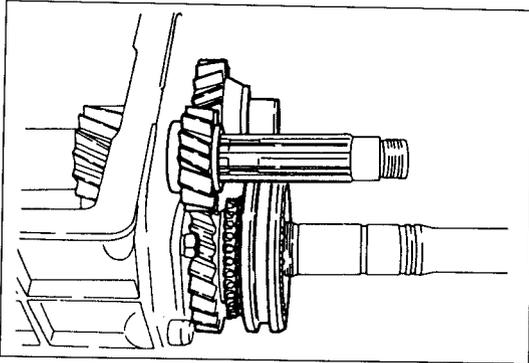
9. Drive on the countershaft front bearing with the **SST**.

**Note**

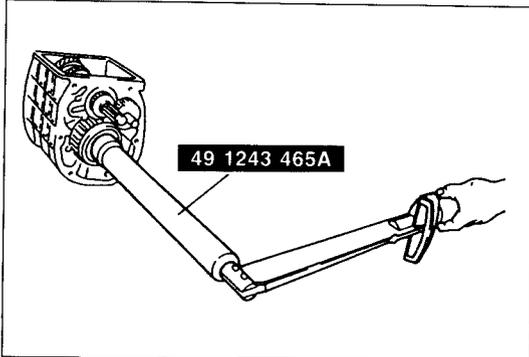
**Do not confuse the front and rear bearing snap rings. The countershaft front snap ring is smallest.**

10. Install a new snap ring to secure the countershaft front bearing.

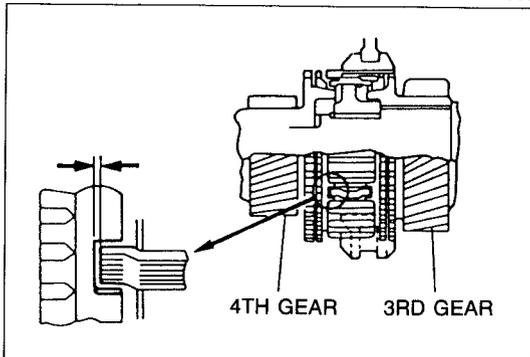




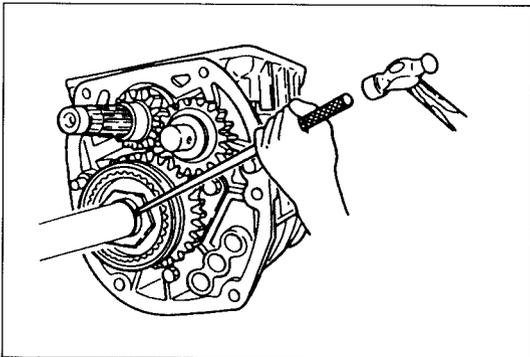
7EG07A-064



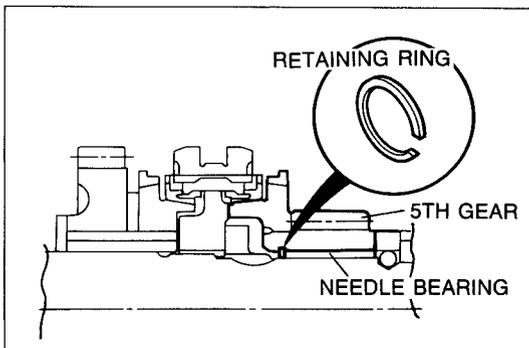
7EG07A-065



9MU0JX-081



69G07A-124



9MU0JX-082

## Assembly note

### Reverse gear

1. Install the reverse idler gear and shaft with a spacer on each side of the gear.
2. Install the counter reverse gear (chamfer side forward) and spacer.
3. Install the thrust washer, reverse gear, synchronizer ring, inner race, needle bearing, and clutch hub assembly.
4. Shift into 1st gear and reverse gear to lock the rotation of the mainshaft.
5. Install a new locknut and tighten it with the **SST**.

### Tightening torque:

**128—196 N·m (13—20 m·kg, 94—145 ft·lb)**

### Caution

**The total combined thickness of the front and rear thrust washers must equal 6.0mm (0.236 in).**

6. Check the clearance between the synchronizer key and the exposed edge of the synchronizer ring. If it is not as specified, adjust with the thrust washers on the front and rear of the mainshaft front bearing.

**Clearance: 2.0mm (0.079 in) max.**

### Available thrust washer thickness

**2.5mm (0.098 in), 3.0mm (0.118 in)**

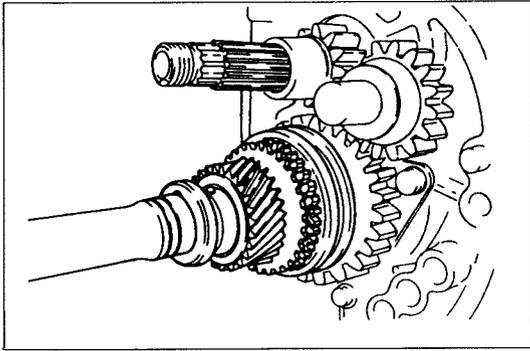
**3.5mm (0.138 in)**

7. Stake the locknut into the mainshaft groove.

### 5th gear

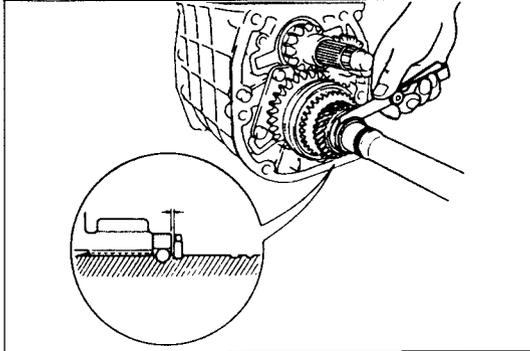
1. Install the retaining ring to the 5th gear.

# J2 TRANSMISSION



9MU0JX-083

2. Install the synchronizer ring, 5th gear, and needle bearing.
3. Install the steel ball and thrust lock washer.
4. Install the 3.0mm (0.118 in) C-washers and hold them with the retaining ring.



9MU0JX-084

5. Push the C washers toward 5th gear and measure the clearance between the C washers and thrust lock washer. If the clearance is not as specified, select the proper thrust lock washer.

**Standard: 0.1—0.2mm (0.004—0.008 in)**

**Available thrust lock washer thickness:**

6.2mm (0.244 in), 6.3mm (0.248 in)

6.4mm (0.252 in), 6.5mm (0.256 in)

6.6mm (0.260 in), 6.7mm (0.264 in)

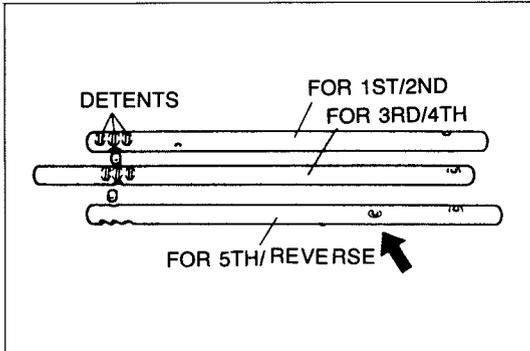
## Shift fork and rod

### Note

A simple way to identify the shift rods is as follows:

- The 3rd/4th shift rod is the longest.
- The 5th/Reverse shift rod has an extra hole for the shift fork at the rear of the rod.

When installing the shift rods, set the detents toward the ball side.

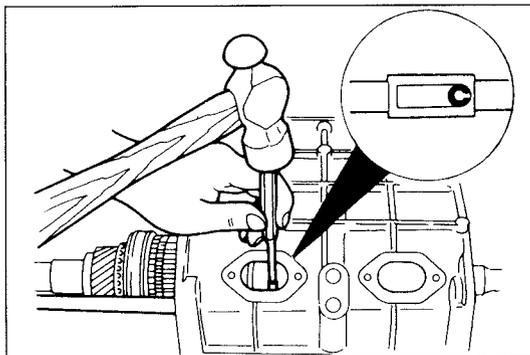


7EG07A-067

### Caution

The roll pin must be installed with the split as shown.

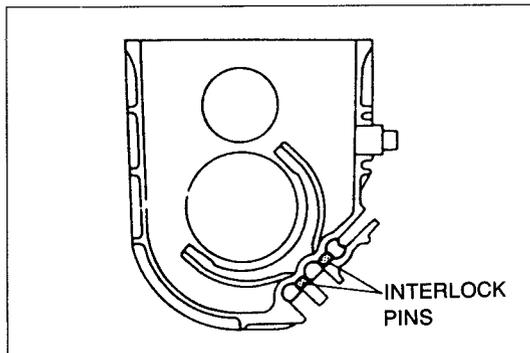
1. Slide the 1st/2nd shift rod into the case.
2. Secure the 1st/2nd shift fork to the rod with the new roll pin.



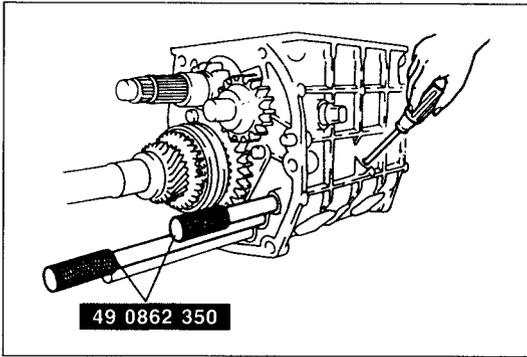
9MU0JX-085

### Note

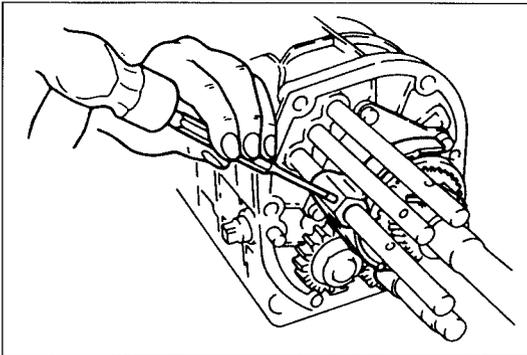
The interlock pins must be installed as shown.



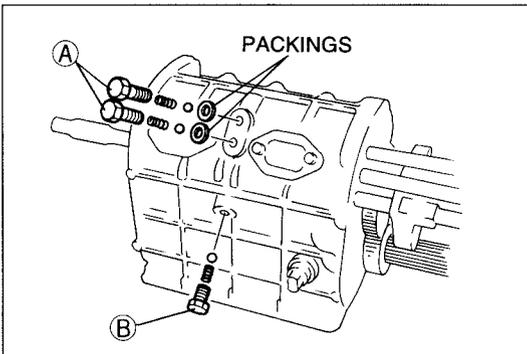
9MU0JX-086



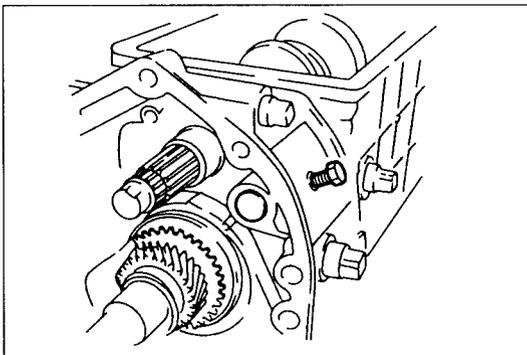
7EG07A-070



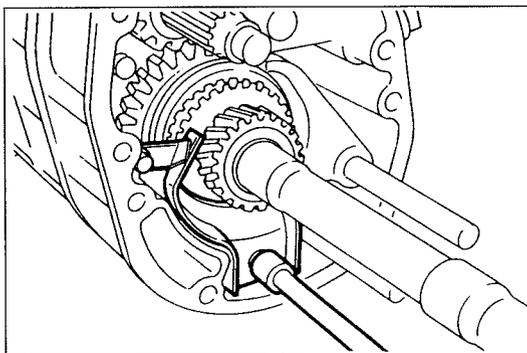
97U0J2-019



97U0J2-020



9MU0JX-089



9MU0JX-090

3. Slide the two **SST** into the transmission case to guide the interlock pins, and insert the first pin.
4. Remove the 3rd/4th shift fork guide from the case.
5. Slide the 3rd/4th shift rod into the case.
6. Secure the 3rd/4th shift rod onto the fork with the new roll pin.
7. Insert the remaining interlock pin and remove the **SST**.

8. Install the 5th/Reverse shift rod.
9. Secure the 5th/Reverse shift fork onto the shift rod with a new roll pin.
10. Install new clips onto the 1st/2nd shift rod and 3rd/4th shift rod.

11. Install the two blind covers and gaskets.

### Tightening torque:

**7.8—12 N·m (80—120 cm·kg, 69—104 in·lb)**

12. Install the packings, detent balls, springs, and cap bolts.

### Tightening torque:

**Ⓐ: 39—59 N·m (4.0—6.0 m·kg, 29—43 ft·lb)**

**Ⓑ: 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)**

### Center housing

1. Apply sealant to the contact surfaces of the transmission case and center housing.
2. Install the center housing.  
Align the reverse idler gear shaft with the set bolt hole; then install the set bolt and gasket.

### Tightening torque:

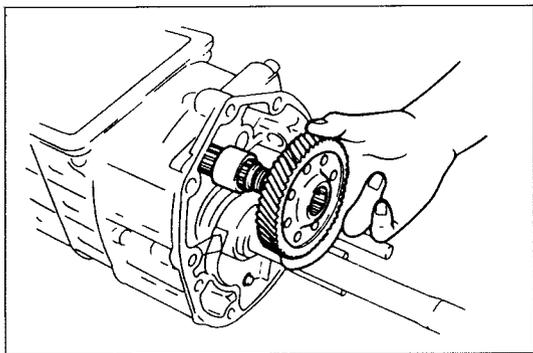
**19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)**

3. Install the oil guide.

### Tightening torque:

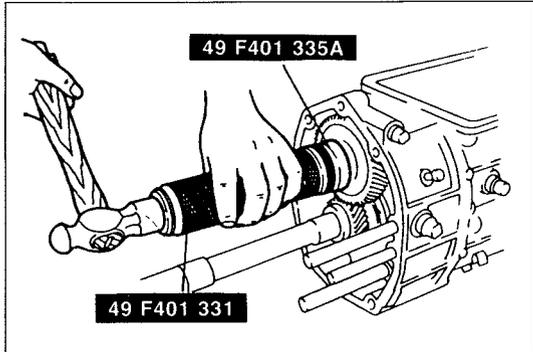
**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**

# J2 TRANSMISSION



9MU0JX-091

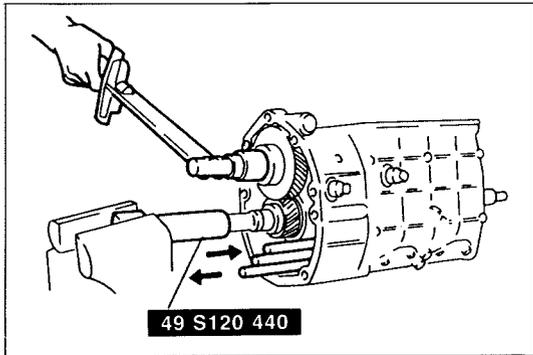
4. Install the spacer and counter 5th gear.



77G07A-061

## Rear Bearing

1. Drive on the countershaft rear bearing with the **SST**.



9MU0JX-092

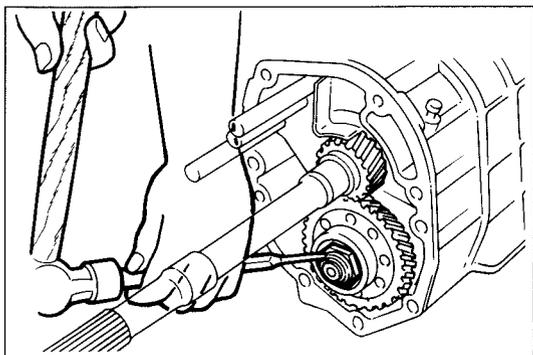
## Note

**Use the protective plates to prevent damage to the SST.**

2. Connect the **SST** to the mainshaft and mount it securely in a vise.
3. Shift into 1st gear and reverse gear to lock the countershaft.
4. Install the new countershaft locknut.

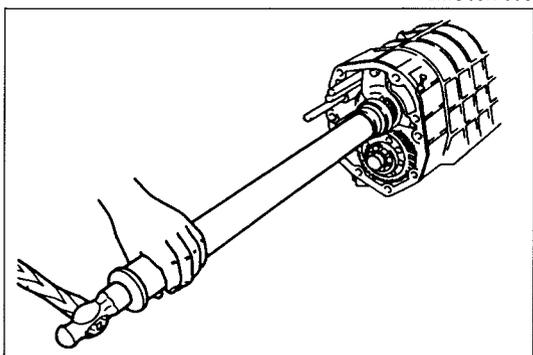
## Tightening torque:

**128—196 N·m (13—20 m·kg, 94—145 ft·lb)**



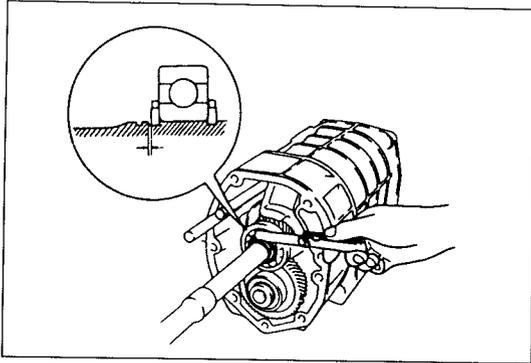
9MU0JX-093

5. Stake the locknut into the countershaft groove.



9MU0JX-094

6. Drive on the mainshaft rear bearing with a suitable pipe.



9MU0JX-095

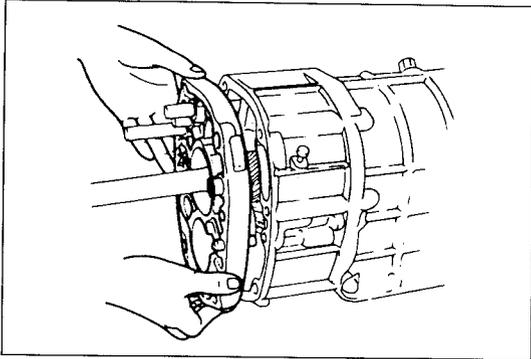
7. Install the C-washers and hold them in place with the retaining ring.
8. Measure the clearance between the C-washers and the groove.  
If the clearance is not as specified, select the proper C-washers.

**Standard: 0—0.1mm (0—0.004 in)**

**Available C-washer thicknesses:**

**2.9mm (0.114 in), 3.0mm (0.118 in)**

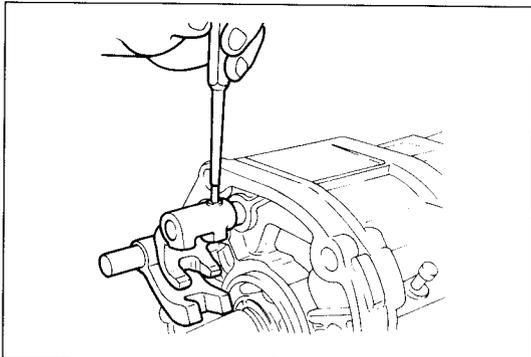
**3.1mm (0.122 in), 3.2mm (0.126 in)**



9MU0JX-096

**Bearing housing**

1. Apply sealant to the contact surfaces of the center housing and bearing housing.
2. Install the bearing housing onto the center housing.

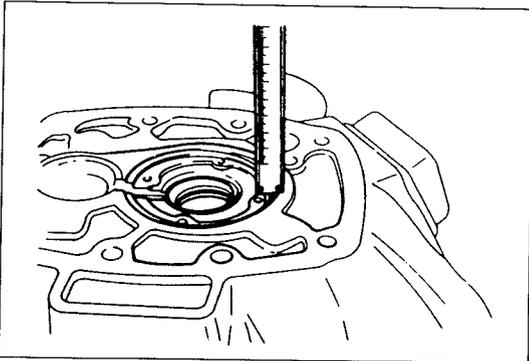


9BU0J2-020

**Shift rod end**

Install the shift rod ends onto the proper shift rods, and secure them with new roll pins.

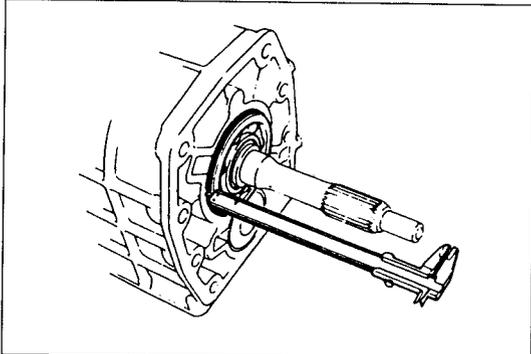




9MU0JX-100

## Assembly note Clutch housing

1. Measure the depth of the main drive gear bearing bore in the clutch housing with vernier calipers.



9MU0JX-101

### Note

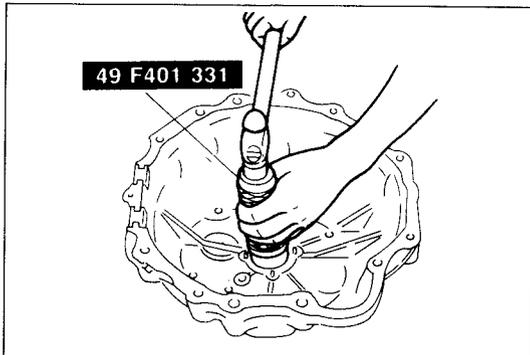
**Make this measurement after assembling the transmission case.**

2. Measure the main drive gear bearing height. The difference between the two measurements indicates the required thickness of the adjustment shim.

**Standard thrust play: 0—0.1mm (0—0.004 in)**

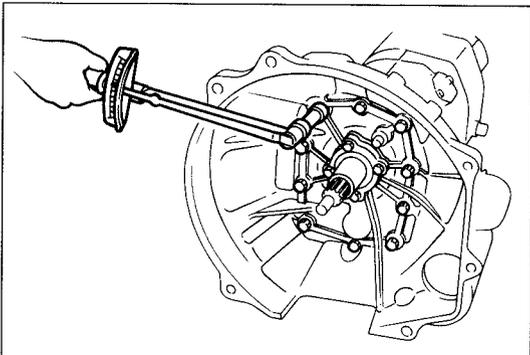
**Adjustment shim thickness:**

**0.3mm (0.012 in), 0.4mm (0.016 in),  
0.5mm (0.020 in), 0.6mm (0.024 in),  
0.7mm (0.028 in)**



89U07A-056

3. Apply oil to the oil seal lip, and install it to the clutch housing with the **SST**.

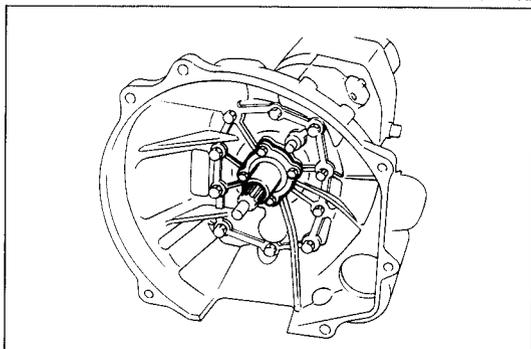


9MU0JX-102

4. Apply sealant to the contacting surfaces of the clutch housing and transmission case.
5. Install the correct adjustment shim on the main drive gear bearing.
6. Install the clutch housing.

**Tightening torque:**

**41—55 N·m (4.2—5.6 m·kg, 30—41 ft·lb)**



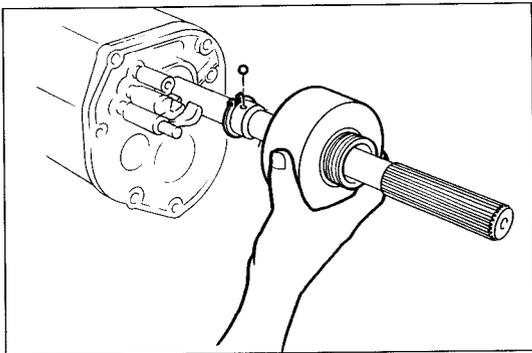
97U0J2-044

7. Install the front cover on the clutch housing.

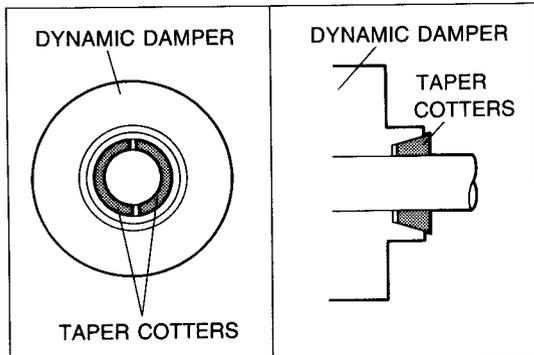
**Tightening torque:**

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**

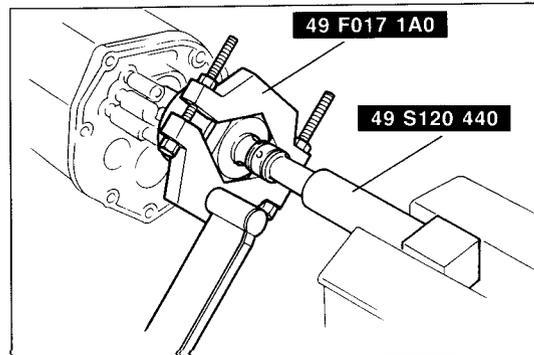
# J2 TRANSMISSION



97U0J2-021



97U0J2-022



97U0J2-023

## Locknut

1. Install a new snap ring, the steel ball, and the dynamic damper.

2. Set the taper cotters between the mainshaft and dynamic damper.

## Note

**Use pads in the vise to prevent damaging the SST.**

3. Connect the **SST** to the mainshaft and tighten it securely in a vise.

4. Install the locknut with the **SST**.

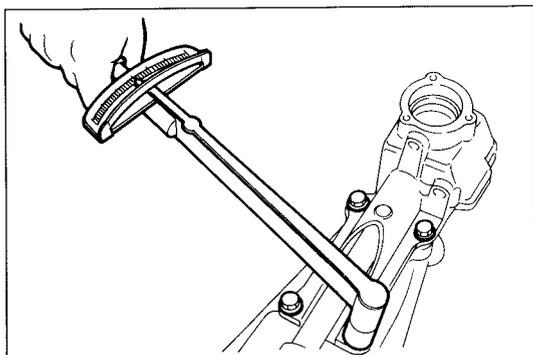
## Tightening torque (without SST):

**157—206 N·m (16—21 m·kg, 116—152 ft·lb)**

## Tightening torque (with SST):

Torque wrench length (in)	Tightening torque with SST (N·m, m·kg, ft·lb)
18 1/2	140—184, 14—19, 104—136
18 11/16	140—184, 14—19, 104—136
18 3/4	140—184, 14—19, 104—136
20 5/8	142—186, 15—19, 105—137
21 1/2	142—186, 15—19, 105—137
22	142—187, 15—19, 105—138
23	143—188, 15—19, 106—139
23 3/4	143—188, 15—19, 106—139

5. Install a new snap ring to secure the locknut.



97U0J2-024

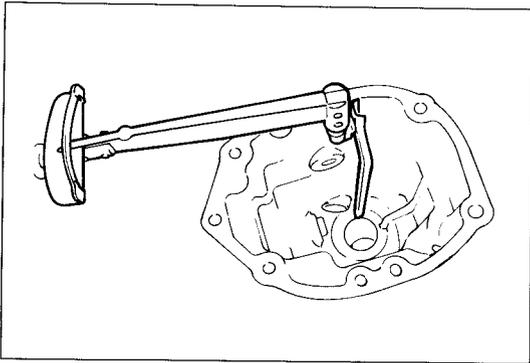
## Extension housing

1. Apply sealant to the contact surfaces of the extension housing and change control case.

2. Install the change control case.

## Tightening torque:

**22—30 N·m (2.2—3.1 m·kg, 16—22 ft·lb)**

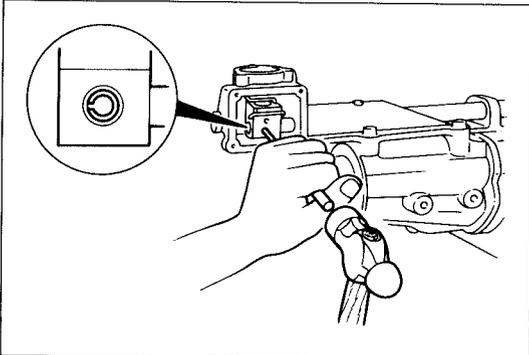


97U0J2-025

3. Install the oil passage.

**Tightening torque:**

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**



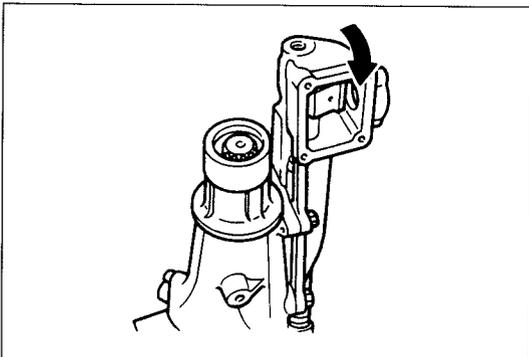
97U0J2-026

4. Install the control lever and control rod end.

**Caution**

**The roll pin should be installed so that the seam of the pin face as shown in the figure.**

5. Install a new roll pin into the control lever end.



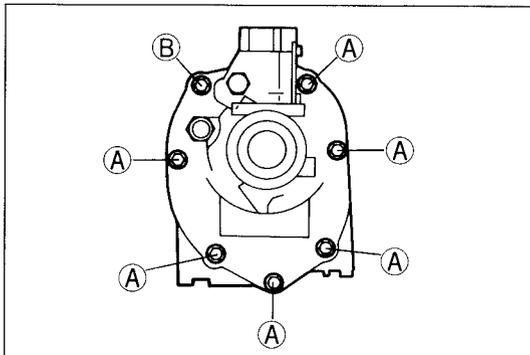
97U0J2-027

**Note**

**Align the inner shift lever and shift rod end groove.**

6. Apply sealant to the contact surfaces of the extension housing and bearing housing.

7. Turn the control rod in the direction of the arrow and install the extension housing.



97U0J2-028

8. Apply sealant to the bolt threads, then install the bolts.

**Tightening torque:**

**(A): 41—55 N·m (4.2—5.6 m·kg, 30—41 ft·lb)**

**(B): 31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)**

9. Install the select-lock spindle, spring, and spring cap.

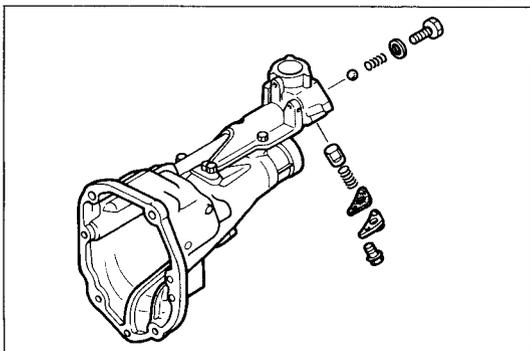
**Tightening torque:**

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**

10. Apply sealant to the spring cap threads.

**Note**

**If the select-lock spindle is not pushed down, the ball will not correctly engage it.**



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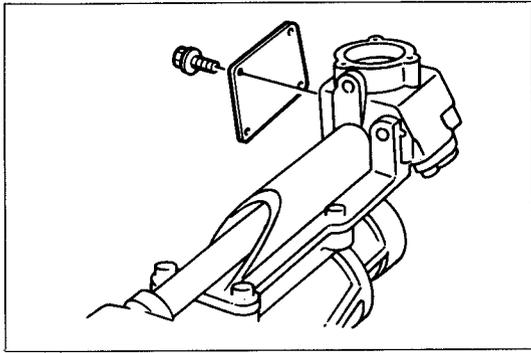
11. Push the select-lock spindle down by pushing on the control rod.

12. Insert the ball and spring, and install the spring cap.

**Tightening torque:**

**3.9—5.9 N·m (40—60 cm·kg, 35—52 in·lb)**

# J2 TRANSMISSION

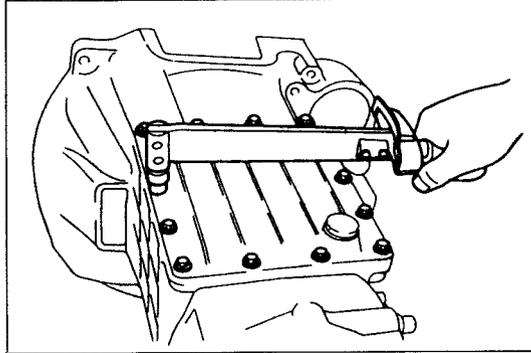


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13. Apply sealant to the contact surfaces of the change control case and blind cover.
14. Install the blind cover.

### Tightening torque:

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**



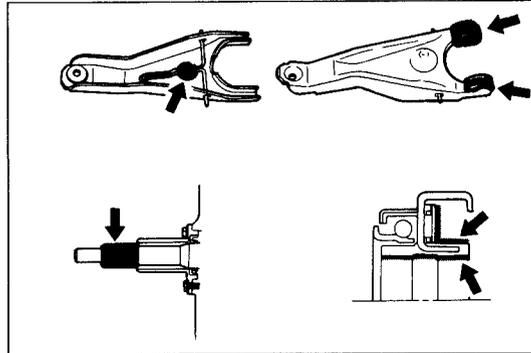
9MU0JX-108

### Undercover

Install the undercover and a new gasket.

### Tightening torque:

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**



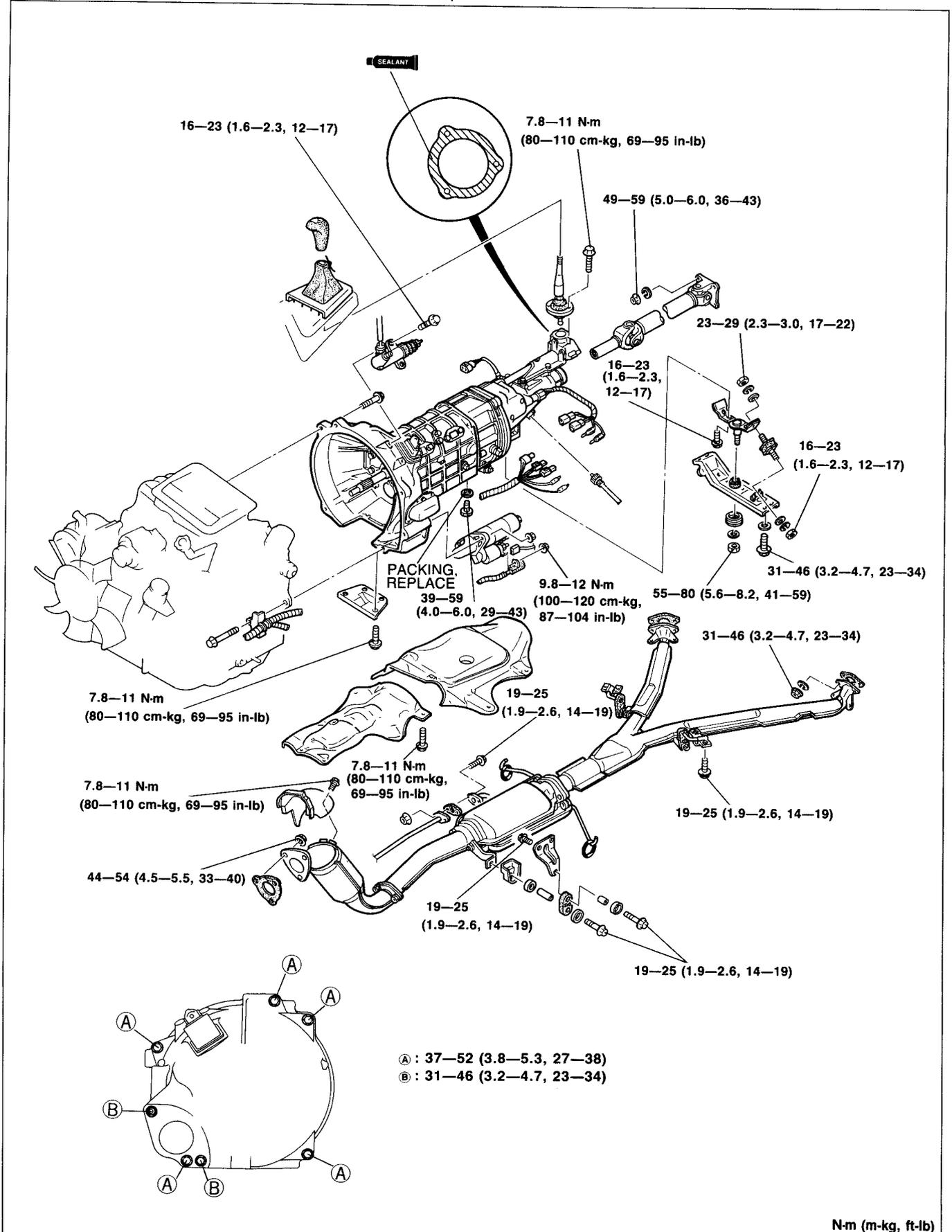
9MU0JX-109

### Release fork

1. Apply Mori white TA No.2 or equivalent organic molybdenum grease to the shaded areas of the release bearing and release fork.
2. Install the release bearing and release fork.

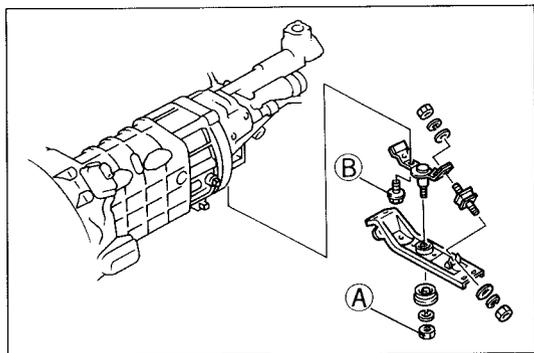
## INSTALLATION

1. Install in the reverse order of removal, referring to **Installation Note**.
2. After installation, fill the transmission with the specified oil.

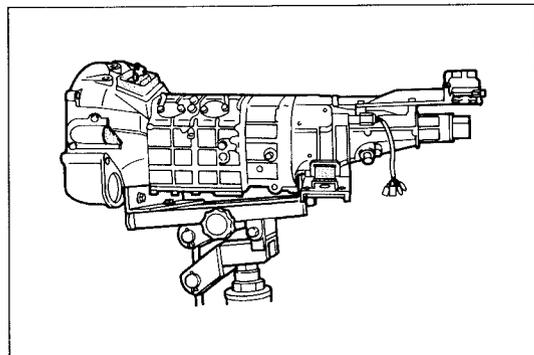


N-m (m-kg, ft-lb)

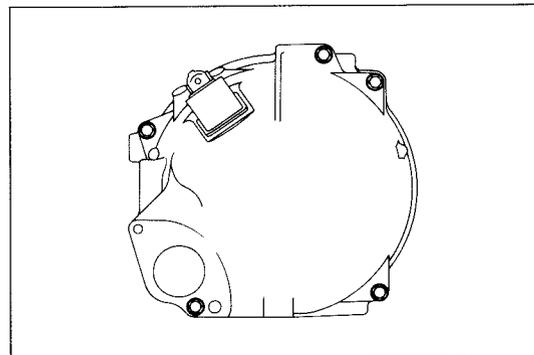
# J2 TRANSMISSION



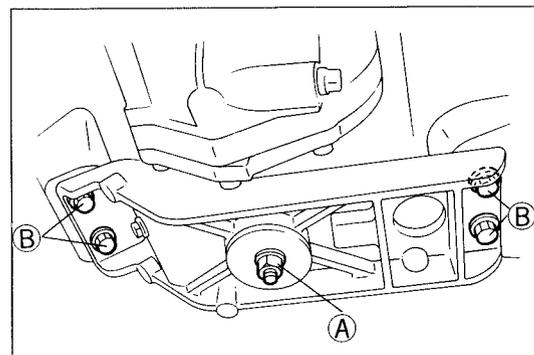
97U0J2-031



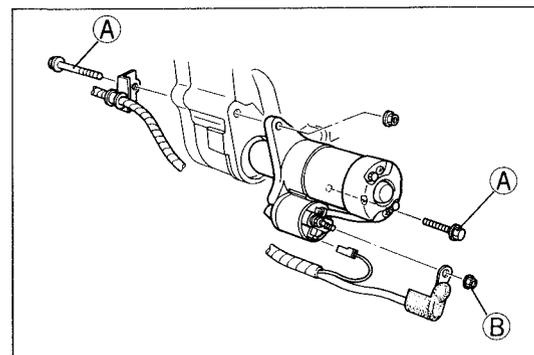
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97U0J2-033



97U0J2-034

## Installation note

1. Install the transmission mount rubber on the transmission.

## Tightening torque:

Ⓑ: 16—23 N·m (1.6—2.3 m·kg, 12—17 ft·lb)

2. Loosely tighten nut Ⓐ.

3. Set the transmission on a transmission jack.

4. Raise the transmission into place and install and tighten the installation bolts.

## Tightening torque:

37—52 N·m (3.8—5.3 m·kg, 27—38 ft·lb)

5. Tighten bolts Ⓑ.

## Tightening torque:

Ⓑ: 31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)

6. Tighten nut Ⓐ.

## Tightening torque:

Ⓐ: 55—80 N·m (5.6—8.2 m·kg, 41—59 ft·lb)

7. Install and tighten the starter to the specified torque.

## Tightening torque:

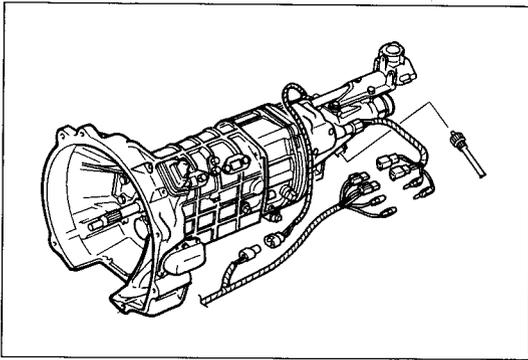
Ⓐ: 31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)

Ⓑ: 9.8—12 N·m (100—120 cm·kg, 87—104 in·lb)

8. Install the undercover.

## Tightening torque:

7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)

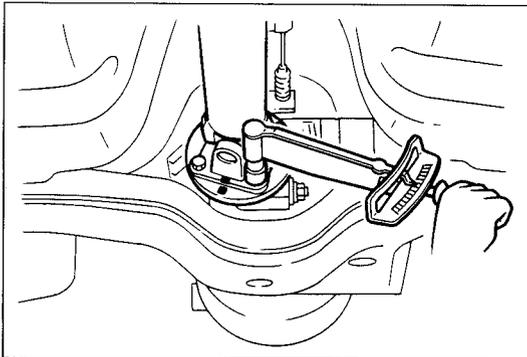


97U0J2-035

9. Connect the neutral switch, and back-up light and 5th switch connectors.
10. Install the speedometer cable.

**Note**

**Align the matching marks and install the propeller shaft.**



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11. Install the propeller shaft. (Refer to Section L.)

**Tightening torque:**

**49—59 N·m (5.0—6.0 m·kg, 36—43 ft·lb)**

12. Install the heat insulator and exhaust pipes.

**Tightening torque:**

**Heat insulator:**

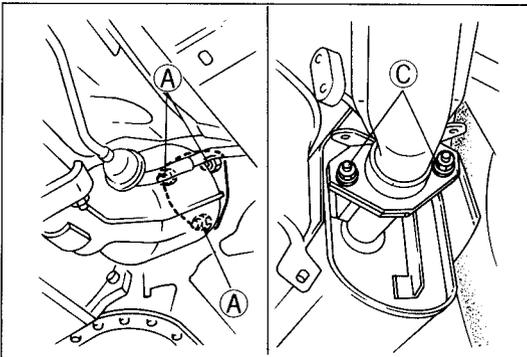
**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**

**Exhaust pipes:**

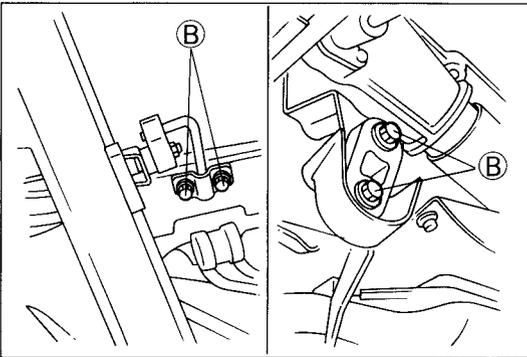
**Ⓐ: 44—54 N·m (4.5—5.5 m·kg, 33—40 ft·lb)**

**Ⓑ: 19—25 N·m (1.9—2.6 m·kg, 14—19 ft·lb)**

**Ⓒ: 31—46 N·m (3.2—4.7 m·kg, 23—34 ft·lb)**



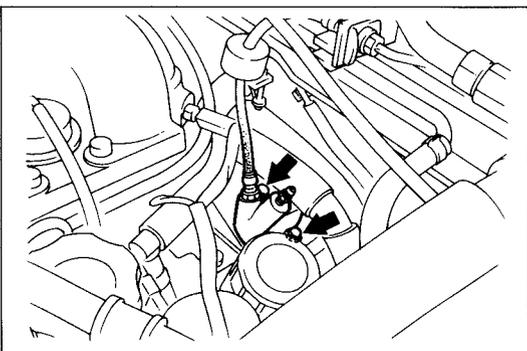
97U0J2-037



13. Install the clutch release cylinder.

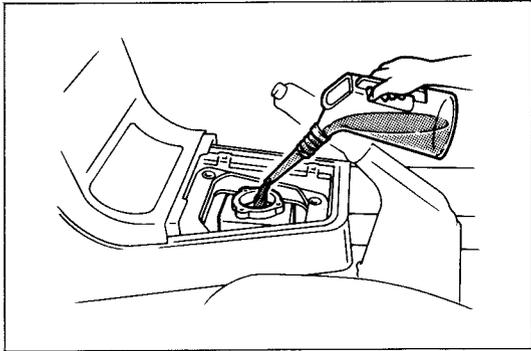
**Tightening torque:**

**16—23 N·m (1.6—2.3 m·kg, 12—17 ft·lb)**

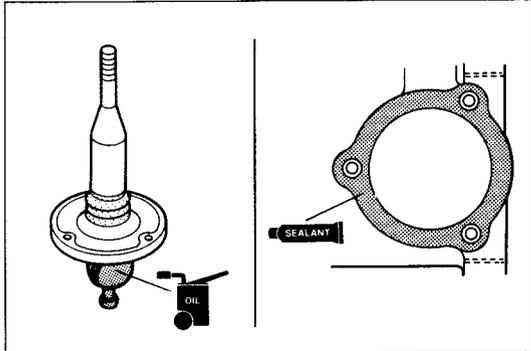


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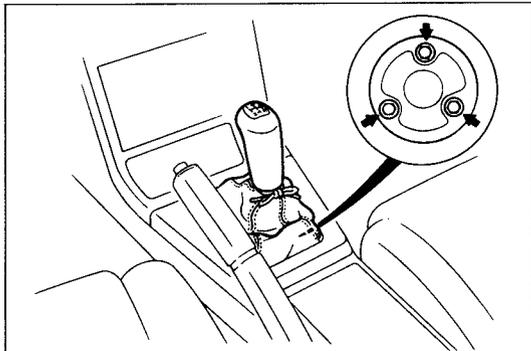
## J2 TRANSMISSION



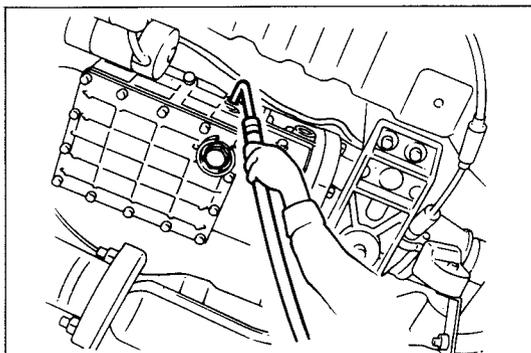
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97U0J2-041



97U0J2-042

14. Pour the specified amount of oil into the change control case.

### Note

**Add the specified oil whenever the extension housing has been removed.**

### Specified oil

**Grade: API service GL-4 or GL-5**

**All season: SAE 75W-90**

**Above 10°C (50°F): SAE 80W-90**

**Specified amount: 80—95 cc (4.9—5.8 cu in)**

15. Apply oil to the shift lever as shown.

16. Apply sealant to the contact surfaces of the boot panel and change control case.

17. Install the shift lever.

### Tightening torque:

**7.8—11 N·m (80—110 cm·kg, 69—95 in·lb)**

18. Install the boot panel assembly, boot sheet, and change lever knob.

19. Add the specified amount of specified transmission oil. (Refer to page J2-8.)

### Specified oil

**Grade: API service GL-4 or GL-5**

**All season: SAE 75W-90**

**Above 10°C (50°F): SAE 80W-90**

20. Warm up the engine and transmission oil to normal operating temperature. Check the following:

- 1) Oil leakage
- 2) Transmission operation

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